Papers on Anthropology

XV

PAPERS ON ANTHROPOLOGY
XV

UNIVERSITY OF TARTU
CENTRE FOR PHYSICAL ANTHROPOLOGY

PAPERS ON ANTHROPOLOGY

XV

TARTU 2006

Editor:
Helje Kaarma MD

The English text revised by
Mall Tamm and Ilmar Anvelt

The collection is indexed in BIOSIS, SPORTDiscus,
Anthropological Index Online,
EBSCO Publishing CABI International,
Index Copermicus, Estonian Database Ester.

The publication of the collection has been supported by:
Institute of Anatomy, University of Tartu
National Institute of Health Development

ISSN 1406–0140

Tartu University Press
www.tyk.ee
Order No 469

PREFACE

With the current collection we celebrate the 70^{th} jubilee of our honourable colleague Leiu Heapost.

Our previous collection presented an overview of teaching of anthropology at the University of Tartu throughout two centuries. In this issue we publish an article by Linda Kongo on the building where teaching of anthropology began – the present home of the Estonian Naturalists' Society. Today, however, the Centre for Physical Anthropology as well as the Collections of the Faculty of Medicine of the University of Tartu are situated in the Old Anatomical Theatre, which also accommodates an exhibition on its history of two hundred years.

Among the diverse research themes of anthropologists, European cooperation on dietetics, nutrition and prevention of chronic diseases has become one of the most topical. Emphasis is laid on application of body build data in nutritional research, although no common viewpoint has been reached which anthropometric data would be needed for possibly precise characterization of the constitutional morphotype and the type of metabolism. This research area will provide work for many anthropologists.

We thank the authors for their contribution to this collection and look forward to further cooperation with all of them.

Prof. Helje Kaarma

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LEIU HEAPOST 70

Mart Viikmaa

Leiu Heapost is the third great Estonian anthropologist besides and after Juhan Aul and Karin Mark. She is, however, the most versatile among our anthropologists. She has published studies on Estonians' and several other peoples' somatometric, age-related and palaeo-anthropology and population genetics. On the occasion of Leiu Heapost's recent jubilee, we should look back at her life, asking where she has come from and how she has become what she is today.

Leiu's childhood home was in Muhu Island. She was born in the family of a farmer-fisherman on Mihkli farm in Rootsivere village on 13 March 1936. The family was better off and more educated than the average for Muhu. Leiu speaks enthusiastically about the drawings in her father's diaries. Father was also known as a skilful blacksmith and cabinetmaker. Leiu's mother came from Tüü farm in Pallasma village, which was also the home of his two uncles who were schoolteachers (by the way, their surname was Pallas, like that of the famous Estonian art school). The family also had, as Leiu says, an "official" artist, a woman who had graduated from art school.

Leiu started her education at Piiri School in Muhu, but completed secondary school at Orissaare in Saaremaa (1956). After leaving school, she took a few gap years to think about her future. She worked as the head of Tamse village library. Father encouraged her to go and study medicine, but Leiu did not think the doctor's profession was close to her soul. She opted for biology.

Everything could have turned out differently. Leiu had a hand and an eye for art. This obviously ran in the family – her two sisters became artists. Luckily for Estonian anthropology, Leiu chose science.

In 1958, Leiu became a student of biology at the University of Tartu. Fascinated by the lectures of Prof. Juhan Aul, Head of the Chair of Zoology, she asked him to be her supervisor. J. Aul had recently started research on Estonian children's physical development. As a second-year student, Leiu started to accompany Prof. Aul on his research trips and carry out anthropometric measurements of school-children. Sometimes she also joined K. Mark's expeditions to the areas of Finno-Ugric peoples and their neighbours. So she acquired perfectly the diverse technique and methodology of physical anthropology and gathered material for her term papers and graduation thesis.

Neither did Leiu neglect her interest in art. In parallel with her studies in biology, she practised at the university art studio and attended Prof. Vaga's lectures on art history. She remembers these lectures and the accompanying demonstrations with great enthusiasm to the present.

Leiu graduated from the university in 1963 with a graduation thesis was about the anthropology of schoolchildren's physical development. So, the small community of Estonian anthropologists acquired a new, efficient member. Unfortunately, partly from ignorance, partly for political reasons, the leading science authorities of the Estonian SSR did not consider anthropology an essential branch of science to be developed in Estonia. No posts for researchers or lecturers in anthropology were avialable at the university or at the institutes of the Academy of Sciences.

As Prof. Aul did not want to lose a trained colleague, he applied for an additional senior office assistant's post for his Chair. Leiu filled this post until 1970. Besides participating in J. Aul's research expeditions, she performed statistical analysis of the collected data. Because of her abilities as an artist, she was also used as the illustrator of the textbooks written by the lecturers of the Chair (her name has not been even mentioned in them). Along with all that, Leiu found time for participating in research of Tallinn schoolchildren.

In 1970 the Estonian Academy of Sciences launched postgraduate studies in anthropology. Leiu applied and was admitted. She continued the research started in Tartu on the anthropology of schoolchildren of different ages and, in 1976, defended her Candidate's dissertation *Physical development of Tallinn Schoolchildren 1966–1969* (the materials of the dissertation were later published in the monograph *Tallinn Schoolchildren's Physical Anthropology*, Tallinn 1984). From 1974, Leiu Heapost has been on the staff of the Institute of History. She has held the posts from junior researcher to leading researcher. Now, being retired, she still works as a part-time senior researcher. As an active member of the academic community, she has participated in several scientific societies (Estonian Naturalists' Society, USSR Society of Geneticists and Selectionists, Estonian Society of Human Genetics, European Anthropological Association). She is a member of the international editorial board of the collection *Papers on Anthropology*.

Leiu has perhaps been the most inquisitive and versatile among Estonian anthropologists. She was the initiator of systematic population genetic research of Estonians and one of the first Estonian palaeoanthropologists dealing with craniology or osteology as a whole. As early as in 1966 she began, along with somatometric studies of schoolchildren, to collect genetic data on the frequency of the antigens of some blood group systems and a few physiological features (phenylthiocarbamide taste sensitivity and red-green colour blindness). In the 1970s–1980s she extended these studies to many samples (40 in total) all over Estonia. She established close cooperation with the geneticists of the Institute of General and Molecular Pathology at the University of Tartu to make use of their facilities and analytical potential.

Along with studying Estonians, Leiu, in cooperation with K. Mark and other Soviet and Finnish anthropologists, has participated in research expeditions to the Volga region, Vologda region, Western Siberia and Transcarpathia. She has also collected comparative population genetic data from Vepsians and Latvians.

Leiu has presented her research results at many international conferences of anthropologists; besides the Soviet Union and Estonia, her studies have been published in several foreign countries (Finland, Sweden, Poland, Germany, Hungary and Belgium). The list of her publications includes almost a hundred items. Along with the aforementioned monograph, her most substantial publication is the chapter *Population Genetic Features of Estonians* in the book *Estonians' anthropology in relation to problems of ethnogenesis* (Tallinn, 1994) written in cooperation with K. Mark and G. Sarap. At present, she is revising and preparing for print the manuscript *Physical Anthropology of Finno-Ugric Peoples* by her deceased colleague K. Mark.

The Estonians are one of the European nations who have been studied most diversely and thoroughly from the anthropological viewpoint, Leiu has made a remarkable contribution to that.

Leiu's population-genetic analysis has mostly confirmed physical anthropologists' conclusions on Estonians' biological variability. She has found that, throughout Estonia, differences are spread mostly in the west-east direction. Based on the greatest differences, four main groups of Estonians can be distinguished: the inhabitants of the Western Islands, mainland West Estonia, North-East Estonia and South-East Estonia. The Setu ethnic group is very similar in their genetic structure to other South-East Estonian samples. Some samples from the western part of Võru County in South-East Estonia, however, differ clearly from their neighbours, and the inhabitants of Muhu Island differ essentially from those of Saaremaa (being closer to North-Eastern Estonians).

Leiu's research results have led her to a critical appraisal of K. Mark's Mongoloidness index and the Mongoloid component in Finno-Ugric people's genetic structure. Leiu considers these components to be remnants of peculiarities of the initial Finno-Ugric population, where the Mongoloid and Europoid features could have existed together in an original combination.

These viewpoints contain a call for further research and theoretical analysis. The scientist who has posed such questions in her studies has followed the right path in her research.

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THE BUILDING WHERE TEACHING OF ANTHROPOLOGY BEGAN

Linda Kongo

When Tartu University was reopened in 1802, the university did not have its own premises as yet. Teaching took place both in the apartments of professors and rented rooms. The first Rector Georg Friedrich Parrot found a suitable man for constructing buildings necessary for the university – Johann Wilhelm Krause who was the husband of his wife`s sister. Krause like Parrot had come to Livonia as a teacher for aristocratic families. In 1803 Krause occupied the post of an architect, a professor of architecture, economics, agriculture and technology at Tartu University. After his designs the Anatomical Theatre, university hospitals, the main building of the of the university, the Observatory and other buildings were erected in the years 1803–1810 [1]. In 1803 Krause bought a house for himself in District 2, alotment No 19 at 6/8, Riia Street where he lived until his death in 1828.

Before the completion of the buildings Magnus Johann von Bock, a state counsellor, gave the first floor of his house to the university for the use during five years free of charge (at present 16, Ülikooli Street). In addition to that, the university bought a house at the corner of Rüütli (Knight) Street and Suurturg (Market) (at present 6, Town Hall Square where the outpatient clinic of stomatology works) from the Baron of Ulila, the Land Marshal Christian Friedrich von Ungern-Sternberg [5]. In this building each faculty had one lecture room. As the newly opened university had four faculties and one of them – the Faculty of Medicine – had four chairs, there was not enough space for teaching. Consequently, new rooms had to be rented.

Martin Ernst Styx (1739–1829), a professor of dietetics, pharmacology, history and literature of medicine, submitted an application to the University Council on 6 June 1803 with a request that 2–3 rooms together with a kitchen and basement should be rented for practical teaching of anatomy. In the same year Professor Heinrich Friedrich Isenflamm, who was invited from Erlangen University to become the

Head of the Chair of Anatomy, Physiology and Forensic Medicine at Tartu University, arrived. On 11 August 1806 he submitted a proposal for renting rooms for the temporary Anatomical Theatre. He had found a suitable building at 1, Tähe Street, alotment No 26 (at present 2, Struve Street). The owner of the building Johann Georg Drewing, who made wigs, signed the rent contract with the university on 20 August 1803. The first Anatomical Theatre of the University – Theatrum anatomicum Universitatis Tartuensis – was opened. To have a larger lecture room, the house was reconstructed. The garden and an outhouse were used by Drewing who became the guard of the university rooms and continued to bear the responsibilities even when the construction of the new Anatomical Theatre was completed [6].

All the members of the academic teaching staff of the Faculty of Medicine lectured at 2, Struve Street. Professor Isenflamm taught anatomy, physiology and forensic medicine. Pathology professor Daniel Georg Balk delivered lectures on pathology and also conducted a course of physiological-philosophical anthropology. His lectures were based on the textbook "Medizinisch-Philosophische Antropologie für Aerzte und Nichtaerzte" published in 1790 in Leipzig by Johann Daniel Metzger, a professor of Königsberg University, a personal physician and counsellor of the King of Prussia [3]. In the basement of the house practical studies of anatomy with making preparations of corpses took place. Instruction was conducted by lecturers from particular clinics. Isenflamm had brought along a sufficient number of preparations for teaching physiology, comparative anatomy and pathological anatomy. Later on preparations were made in Tartu. Isenflamm wrote about the studies in the building in his booklet of 26 pages titled "Tagebuch des anatomischen Theaters der Kaiserlichen Universität Dorpat" (The Diary of the Anatomical Theatre of the Imperial University of Tartu) [2].

Professor Balk started to deliver his course in the same building but already at the end of the year 1803 he announced that he had reached the point in his course when he needed a clinic for teaching practical skills to his students. For this purpose he offered eight rooms in his flat for the annual rent of 500 roubles. His house was located at alotments No 25 and 27 in Tähe Street (later alotments were cut into smaller pieces).

Professor Balk`s lectures aroused Karl Ernst von Baer`s (studied at Tartu University in 1810–1814) interest in anthropology. Professor Balk supervised his doctoral thesis "Endemic diseases of Estonians" which was completed in 1814. The thesis, however, contains mainly the data about the ethnography of Estonians which in Baer`s interpretation can be considered anthropological.

According to the contract the house at 2, Struve Street was used by the university until the central part of the Anatomical Theatre (the domed rotunda) was completed in 1805. The wings to the Anatomical Theatre were built in the years 1826–1827 [7].

ABOUT THE HOUSE AT 2, STRUVE STREET

At present the house belongs to the Estonian Naturalists' Society. It is one of the oldest wooden houses in Tartu – a dwelling house of a citizen. In 1758 it belonged as a private house to the widow of Liiva Peedo. In 1788 it was inherited by Peedo Hans, a coachman. Two year later the wig-maker Johann Georg Drewing bought it. After Drewing`s death in 1826 the house was bought by the Baron of Luunja Georg Johann Friedrich Freiherr von Nolcken. In 1829 the son of the first Rector Georg Friedrich Parrot – Johann Jakob Wilhelm Friedrich Parrot, a Medical Doctor and a professor of physis who was also Rector of Tartu University in the years 1831–1834 – began to live in it and three years later bought the house. His wife was Henriette, a daughter of the university architect Johann Wilhelm Krause, who remained to live in this house after the death of F. Parrot in the year 1841.

In 1849 F. Parrot`s widow sold the house to Ch. von Gavel whose family owned it until the year 1876. Then it was bought by Johann August von Roth, the grandson of the owner of the Veriora (Paulenhof) estate, the pastor of Kanepi Johann Philipp von Roth. Later the house and outhouses were bought with the rental rights by Friedrich Otto Eduard Samson von Himmelstierna.

In 1907 the house was bought by H. von Cossart. By the year 1920, when the house was bought by A. Ruuben, several parts had been added to it and restructuring of space had taken place. On the ground floor of Ruuben`s house the office of the water supply and waste water company "Akra" worked. In 1939 A. Ruuben went to Germany, returned in 1942 and became a member of the Town Council until the year 1944 when he again left for Germany.

In 1940 the house was expropriated and a kindergarten was opened there. When Ruuben came back from Germany and he was given back his house, he did not take it away from the kindergarten which was finally liquidated in 1981.

From 1981 the building housed the Narcology Department of the Psycho-neurology Hospital of Tartu having importance in the whole of Estonia. When a new building for the Psycho-neurology Hospital was erected, the house at 2, Struve Street was handed over to the Zoology and Botany Institute of the Academy of Sciences of the Estonian S.S.R on the basis of the respective joint application of Tartu State University and the Academy of Sciences of the Estonian S.S.R., the house was given to the Estonian Naturalists' Society for partial use together with some other establishments.

On 16 February 1994 the house was fully given to the Estonian Naturalists' Society because on that day the act of the transfer of the buildings and the land at 2, Struve Street was signed between the Institute of Zoology and Botany of the Academy Sciences and the Estonian Naturalists' Society. Although in the house at 2, Struve Street anthropology was not dealt with during 190 years, the house has culturally outstanding history. In the years 1828–1829 Carl Christoph Traugott Friedemann Goebel, a professor of chemistry and pharmacy, lived in it. In the year 1829, when F. Parrot began to live in the house, the famous naturalist Alexander von Humboldt stayed for some time there. After conquering the peak of Ararat together with J.J.W.F. Parrot, Hatsatur Abovjan, Parrot`s companion at the mountain expedition, lived in it during his studies at Tartu University. Later Abovjan became a famous Armenian writer.

In the years 1927–1930 the linguist Johannes Aavik lived in the house. In the years 1941–1946 a well- known teacher and researcher of local lore Johan Karma lived in the house together with his family. His wife was the director of the kindergarten housed in the same building. Thanks to the Karmas the house survived during the war.

From it very start the Estonian Naturalists' Society has been dealing with anthropological research. In addition to K. E von Baer anthropological research papers, articles have been printed in the Society`s publications by Constantin Grewingk, Richard Weinberg, Eber Avraam Landau, Richard Willems and many others. Until the beginning of Juhan Aul`s activities the research had been irregular. Since 1928, when J. Aul started an active research, the work had a definite goal. J. Aul published several papers on anthropology. In 1939 on J. Aul`s initiative an anthropology section was established in the Estonian Naturalists' Society. The sections`s task was to promote anthropological research, to excite interest in anthropology among wider circles of researchers dealing with anthropology or the neighbouring fields, to unite all the people interested in anthropology dealing with it as amateurs. In 1994, on the initiative of Helje Kaarma, the Centre for Physical Anthropology at the University of Tartu joined the research in anthropology. Since that time activities in the field of anthropology are consistent and systematic. In 1994 a joint international conference titled “Somatotypes of children II” was held. Together an anthropological seminar “Anthropological study of the head and the scull” was also carried out together. From the year 1995 an annual scientific conference began to be held to mark J. Aul`s birth anniversary. In the same year a series of anthropological collections of articles “Papers on Anthropology” in English was published (earlier the collection appeared in the series of the transactions of the University of Tartu as “Anthropological Papers”). “Papers on Anthropology” – XIV is the last issue.

Since 1998 the Yearbook of the Estonian Anthropometric Register has been published. Until 2002 five volumes have appeared. Detailed information about the anthropological activities of the Estonian Naturalists’ Society until 2003 can be found in L. Kongo`s monography [4].

When the Estonian Naturalists’ Society began to work in the house at 2, Struve Street, anthropological activities were renewed in it after a long period.

REFERENCES

1. Eringson, L., Müürsepp, P. (1967) G. F. Parrot ja Tartu Ülikool. G. F. Parroti 200. sünni-aastapäevale pühendatud teadusliku konverentsi materjale. Tartu, 9–35.
2. Isenflamm, H. Fr. (1805) Tagebuch des anatomischen Theaters der Kaiserlichen Universität Dorpat vom Jahre 1803 und 1804. Dorpat.
3. Kasmel, J., Kasmel, T. (1998) Dorpati (Tartu) Ülikooli esimesest antropoloogialektorist prof. Daniel Georg Balkist. Eesti antropomeetriaregistri Aastaraamat 1998, 128–132.
4. Kongo, L. (2003) Eesti Looduseuurijate Seltsi 150 tegevusaastat 1853–2003. Tallinn, 471.
5. Kudu, E. (1977) Tartu Ülikoolile üüritud õpperuumide asukohti. Tartu Ülikooli ajaloo küsimusi. 3–9.
6. Käer-Kingisesepp, E. (1985) Theatrum anatomicum Universitatis Tartuensis. Lehekülgi Tartu Ülikooli arsiteaduskonna õppetööst XIX sajandi algusaastail. Nõukogude Eesti Tervishoid, 2, 118–122.
7. Toomsalu, M., (2001) Vana Anatoomikumi sünd ja professor H. F. Isenflamm. Eesti Antropomeetriaregistri aastaraamat. 2001, 234–243.

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GENDER DIFFERENTIATION OF MORPHOLOGICAL TRAITS AT THE ENTERING OF PUBERTY

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ABSTRACT

Researching the factors influencing the patterns of morphological development has been carried out for years, but not so many surveys were concerned with the period of pubescence, though. The aim of the study was to examine gender differences in selected morphological traits in boys and girls aged 13 from the highly urbanized area of the city of Poznań. There were 224 boys and 227 girls examined for the evaluation of the Tanner's stage of development and morphological variables such as: body height, body mass, sum of skinfolds, WHR index and in girls for the occurrence of the first menarche. The body composition components were estimated with the bio-impedance method. Pupils from the accelerated group were characterized by the highest body size and the body mass and in boys differences between groups were observed in all the morphological traits, while in girls the differences were indicated only in the body height and the body mass. The results of the research partially confirm the findings of other authors, though the limited size of the accelerated and retarded groups, as well as homogeneity of the examined group, did not allow the author to make any broader generalization of the findings, which would require more in-depth analysis.

Key words: sexual dimorphism, puberty, body composition, youth

INTRODUCTION

Dimorphism is one of the characteristic morphological traits distinguishing female from male individuals. The origins of gender differentiation are often discussed and researched. At the turn of the pre- and pubertal period intensive internal (endocrine, psychological) and external (morphological, motor fitness) changes occur. Eliakim et al. (1996) [4] but also other researchers (Theintz 1994, Łaska-Mierzejewska 2002) [12,7] suggest that the increase in activity of gonadal and growth hormones, combined with the gain of the minimum body weight in girls necessary to initiate the onset of the first menarche, mark the beginning of a rapid morphological differentiation process. Burdukiewicz (2004) [1] fount that the onset of puberty is associated with decreasing sturdiness and the increase in fat deposition, which in case of girls was manifested in the increase of endomorphy, while in boys in mesomorphy. Saczuk et al. (1999) [10] in their research established that for girls the age of 12–13 and for boys 13–14 were characteristic of the widest differentiation in the stages of biological maturity. The level of sexual maturity had a great impact on motor fitness achievements. According to Półtorak (2004) [9] the kind of social environment (town-village) also influences the rate of reaching maturity, it influenced the level of motor fitness as well as, with urban boys and girls more advanced than their rural counterparts.

The aim of this study was to analyze the correlation between morphological traits and the stages of pubertal development among school pupils from the highly urbanized area.

MATERIAL AND METHODS

A sample of a total of 224 boys and 227 girls living in the urban area of Poznań was examined. The average calendar age of the examined boys was 13.3 (±0.3) and the girls 13.2 (±0.2). The assessment of the pubertal status was carried out by a qualified physician with the use of the Biological Maturity Rate on the basis of the puberty stages of Tanner (Malinowski, Bożilow 1997) [8]. The group was divided into three developmental stages: accelerated, normal, retarded. Among boys 13% represented the accelerated stage, 79.9% normal and 7.1% retarded. In girls the proportions were respectively: 8.8%, 82.4% and 8.8%. The level of subcutaneous fat was measured by the sum of five skinfolds (triceps, biceps, subscapular, suprailiac, calf) with the use of a Lange caliper (Heyward, Stolarczyk 1996) [5]. The assessment of the body composition was undertaken with the use of bioelectrical impedance analysis (BIA) with "Bodystat 1500" (Wieliński 2000) [13]. The analysis of correlation was testified by one-way ANOVA and The Smallest Difference Test and the level of significance was set at * p≤0.05 and ** p≤0.01.

RESULTS

Table 1. One-way ANOVA analysis of morphological traits and the Tanner's developmental stage in 13-year-old boys

Tanner's stage of development	Body height [cm]	SD	Body mass [kg]	SD	Sum of skin-folds [mm]	SD	WHR Index	SD
Accelerated	164.3	11.08	53.9	19.33	63.3	27.09	0.91	0.11
Normal	161.7	7.20	48.7	9.03	51.5	18.13	0.84	0.09
Retarded	153.3	8.62	40.3	7.56	42.3	15.32	0.87	0.07
F value level of p	**F=10.4721 p=0.000****		**F=8.1492 p=0.000****		**F=7.0783 P=0.001****		**F=4.8569 p=0.008****	

Table 1 presents a comparison of the mean values in three Tanner's developmental stages, which indicated statistically significant differences in the body height, the body mass, the sum of skinfolds as well as the ratio of waist to hip circumferences (WHR) at the level of p<0.01. In the case of height the difference between the accelerated and the retarded group was almost 10 cm and in the body mass almost 14 kilograms, but the range of the standard deviation was the broadest in the accelerated group. More detailed statistical analysis based on the Smallest Difference Test for all four morphological traits is presented in Tables 2 and 3. The body height of boys from the normal group equalled 161.7 cm and the body mass was 48.7 kg and the difference with the retarded group was around 8 cm in the height and over 8 kg in the body mass

Table 2. Results of the Smallest Difference Test analysis between the body height and the mass and the Tanner's developmental stage in 13-year- old boys

Tanner's stage of development	Body height [cm]			Body mass [kg]		
	M=164.3	M=161.7	M=153.3	M=53.9	M=48.7	M=40.3
Accelerated		0.097718	0.000012		0.0178820	0.000076
Normal	0.097718		0.000068	0.017820		0.003188
Retarded	0.000012	0.000068		0.000076	0.003188	

Table 3. Results of the Smallest Difference Test analysis between the sum of skinfolds and the WHR index and the Tanner's developmental stage in 13-year old boys

Tanner's stage of development	Sum of five skinfolds [mm]			Waist to Hip Ratio (WHR)		
	M=63.4	M=51.5	M=42.3	M=0.91	M=0.84	M=0.86
Accelerated		0.002396	0.000544		0.002268	0.174737
Normal	0.002396		0.068313	0.002268		0.457323
Retarded	0.000544	0.068313		0.174737	0.457323	

The analysis of the body composition elements' correlation with the Tanner's stages of developments in 13-year-old boys showed that there were statistically significant differences between the three stages, most of them at the level of $p<0.01$. Interestingly, in absolute and relative figures the fat mass of the normal group appeared to be the smallest, while in the case of the lean body mass and the muscle mass it was the one of the retarded group. The difference in the muscle mass in absolute values between the accelerated and the normal group was 2.5 kilograms but it was higher in the accelerated group, while in relative figures the highest percentage of the muscle mass was found in the normal group and equaled 54.6%. None of the groups had the mean BMI value higher than 21 – table 4.

Table 4. One-way ANOVA analysis of Tanner's stages of development and body composition in absolute [kg] and relative [%] figures in 13-year old boys

Tanner's stage of development	Fat Mass [kg]	SD	Lean Body Mass [kg]	SD	Muscle Mass [kg]	SD	Fat Mass [%]	SD	Lean Body Mass [%]	SD	Muscle Mass [%]	SD	BMI	SD
Accelerated	13.6	11.7	43.5	12.4	28.6	8.6	20.7	10.6	79.3	10.6	51.9	7.2	20.8	6.4
Normal	8.7	4.0	39.0	7.7	26.1	5.4	17.9	6.3	82.1	6.4	54.6	5.2	18.2	2.7
Retarded	11.3	4.1	33.3	7.5	22.1	5.1	25.1	6.7	74.9	6.8	49.6	6.1	19.0	2.9
F value level of p	**F=6.7359 p=0.001****		**F=4.507 p=0.012 ***		**F=3.6873 p=0.027 ***		**F=5.3746 p=0.005 ****		**F=5.4076 p=0.005 ****		**F=4.6835 p=0.028 ***		**F=4.9760 p=0.008 ****	

Table 5. One-way ANOVA analysis of four morphological traits and the Tanner's developmental stage in 13-year-old girls

Tanner's stage of development	Body height	SD	Body mass	SD	Sum of skinfolds	SD	WHR Index	SD	Date of the first menarche	SD
Accelerated	165.5	11.43	54.6	13.24	74.2	38.66	0.79	0.08	12.3	1.12
Normal	160.7	6.23	48.3	8.05	65.1	20.87	0.78	0.05	12.4	1.05
Retarded	159.9	10.04	46.4	13.28	66.9	44.14	0.79	0.06	12.7	1.03
F value level of p	**F=4.1576 P=0.016***		**F=5.0235 p=0.007****		F=1.2863 p=0.278		F=0.6718 p=0.511		F=0.7931 P=0.453	

Table 5 illustrates the correlation of variables in 13-year-old girls, where only the body height and the body mass proved statistically significant differences with the Tanner's stages of development. In body height the difference ranged 6 cm and the level of significance was $p<0.05$. In the body mass there was almost 8 kilograms difference between the accelerated and the retarded group at the level of $p<0.01$. The broadest range of standard deviations was observed also in the accelerated and the retarded groups. No differences were found in subcutaneous fat in such variables like: the sum of skinfolds, the WHR index and the date of the first menarche, where the average age of the onset of the first menarche in the examined girls ranged from 12.3 to 12.7 years. More detailed data analysis for the two morphological traits identified as statistically significant for girls is presented in Table 6. The highest girls were identified in the accelerated group with 165.5 cm height, but there was a 11.4 cm standard deviation value. The girls classified as belonging to the normal group were 160.7 cm tall and they had the weight 48.3 kg of the body mass.

Table 6. Results of the Smallest Difference Test analysis between the body height and the mass and the Tanner's developmental stage in 13-year-old girls

Tanner's stage of development	Body height			Body mass		
	M=165.4	M=160.7	M=159.9	M=54.6	M=48.3	M=46.3
Accelerated		0.005633	0.017085		0.003693	0.004637
Normal	0.005633		0.664484	0.003693		0.363702
Retarded	0.017085	0.664484		0.004637	0.363702	

No statistically significant correlation was found between the selected body composition components and the Tanner's stages of development in 13-year-old girls and the results of one-way ANOVA analysis are presented in Table 7. However, it is worth mentioning that the correlation between the Tanner's stage of development and the muscle mass was at the edge of statistical significance with $p=0.062$. Some tendencies to statistically valuable differences were also observed in the lean body mass where $p=0.091$. In both cases the differences tended to be statistically significant only in absolute figures [kg] and did not find its confirmation in relative figures [%]. In all the three stages of the Tanner's development BMI index of the examined girls did not exceed over the value of 19.

Table 7. One-way ANOVA analysis of the Tanner's stages of development and the body composition in absolute [kg] and relative [%] figures in 13-year-old girls

Tanner's stage of development	Fat Mass [kg]	SD	Lean Body Mass [kg]	SD	Muscle Mass [kg]	SD	Fat Mass [%]	SD	Lean Body Mass [%]	SD	Muscle Mass [%]	SD	BMI	SD
Accelerated	13.1	4.9	38.8	8.3	25.7	5.7	24.9	5.2	75.1	5.2	49.6	4.8	19.2	3.4
Normal	11.5	4.6	36.7	4.8	24.6	3.7	23.6	7.9	76.4	6.5	51.4	6.5	18.5	2.5
Retarded	11.3	6.5	34.1	6.6	21.7	4.8	23.3	7.8	76.7	7.8	48.8	6.5	18.2	3.8
F value level of p	F=0.8611 p=0.424		F=2.4423 p=*0.091*		F=2,8266 p=*0.062*		F=0,224 p=0.798		F=0,4953 p=0.610		F=1,1606 p=0.315		F=0,5836 p=0.583	

It is also worth mentioning that the average body height and the mass were higher in the examined girls than boys, but in both genders the highest mean values were observed in the accelerated groups. The examined 13-year-old girls had on average a higher total sum of five skinfolds than boys and in the case of the WHR index it was opposite. Girls had also a higher percentage of the fat mass and a lower level of the muscle mass than boys. In the case of the percentage of the lean body mass it was boys from accelerated and normal groups who had a higher level, approximately about 80% of the total body mass.

DISCUSSION

Szmodis et al (2002) [11] established that the children of obese parents more often develop a thicker layer of subcutaneous fat and the relationship was found to be the strongest between 10 and 13 years of age. In another research led by Kozieł (1999) [6] it was found that genetic heredity influences the level of subcutaneous fat most in boys between the years 11–12 and in girls between the years 10–11. This period, associated with social and psychological changes of the closest environment, has a stronger influence on more ecosensitive boys than girls (Charzewski and Piechaczek 2001) [2]. Chrzanowska (1992) [3] found that the level of subcutaneous fat in children increases until the age of 12 with similar patterns in boys and girls, and at entering the period of puberty it decreases in boys, especially at the limbs. While considering the body composition, according to Wieliński (2000) [13], the level of fat mass is gradually increasing from the age of 6 and by the age of 12 it is similar in both genders. It tends to decrease in boys after this age, as a result of height spurt and changes in the proportions of body parts. A similar situation has been observed in the case of the lean body mass level. However between the ages of 11–13 the level of the lean body mass is higher in boys (it is approximately 80% of the total body mass) as a result of the height spurt occurring in girls earlier (around the age of 11) than in boys.

In our research it was found that the level of biological development influences the morphological characteristic of 13-year-old boys more than girls. Significant differences between the three predetermined stages of biological development were noticed in somatotype characteristics: the body height, the body mass, the sum of skinfolds as well as in the WHR index. In the body composition differences were statistically significant in both relative and absolute values in: the fat mass, the lean body mass, the muscle mass. In girls there were no such marked differences in morphological traits. Statistically valuable differences were indicated only in the case of the body height and the body mass, but only in absolute mean values. The average height of girls from the accelerated group was five centimeters higher than in the two other groups, likewise in the body mass. Though there was no big difference in the level of subcutaneous fat between the groups, the comparison of body composition elements in girls showed some tendency to differentiation in the lean body mass and the muscle mass, but only in absolute figures. In our research the mean calendar age was 13.2–13.3 in both groups, so it is very likely that the girls have already been advanced in their height spurt, with the average age of the first menarche occurrence set at 12.3–12.7; while the boys have only been entering this stage of pubescent development (Chrzanowska 1992) [3]. The explanation of the results could come through the findings of the research led by Saczuk et al. (1999) [10], who found that the age of 12–13 years for girls and 13–14 years for boys are the age categories characterized by the broadest representation of various stages of sexual maturity. However in our research it was not proven through the statistical analysis, specifically in girls, probably due to the homogeneity of the girls' group, which did not allow for any remarkable differences between the stages of Tanner's development. Another possible explanation may be found in the limited number of the samples in both the accelerated and the retarded groups. The problem needs more in-depth extended longitudinal studies.

REFERENCES

1. Burdukiewicz A. (2004) Sex differentiation of morphological and motor features In children and youth. Human Movement, vol.5 (1), 27–34.
2. Charzewski J., Piechaczek H. (2001) Międzywarstowe różnice rozwoju somatycznego dzieci warszawskich. Wychowanie Fizyczne i Sport, 4, 441–431.
3. Chrzanowska M. (1992) Biologiczne i społeczno-ekonomiczne determinanty rozwoju podskórnej tkanki tłuszczowej u dzieci i młodzieży. Monografia nr 49, AWF Kraków.
4. Eliakim A., Brasel J. A., Mohan S., Barstow T. J, Berman N., Cooper D. M. (1996) Physical fitness, endurance training and the growth hormone-insuline-like growth factor I system in adolescent females.

Journal of Clinical Endocrinology and Metabolism, vol.81 (11), 3986–3992.
5. Heyward V. H., Stolarczyk Ł. M. (1996) Applied body composition assessment. Human Kinetics II.
6. Koziel S. (1999) Zmiany wpływu czynnika genetycznego na stopień otluszczenia ciala w późnym dzieciństwie i okresie pokwitania u dziewcząt i chłopców wroclawskich. Wychowanie Fizyczne i Sport, 3, 5–25.
7. Łaska-Mierzejewska T. (2002) Antropologiczne aspekty selekcji sportowej dzieci i mlodzieży. (In:) Zastosowanie metod naukowych na potrzeby sportu. Wydawnictow Estrella, tom XI, Warszawa, 71–93.
8. Malinowski A., Bożilow W. (1997) Podstawy antropometrii. Metody, techniki, normy. Wydawnictwo Naukowe PWN, Warszawa-Łódź.
9. Półtorak W. (2004) Biological age and assessment of motor ability in the period of puberty in urban and rural children. Human Movement, vol. 5 (2), 130–141.
10. Saczuk J., Poplawska H., Wilczewski A. (1999) Wiek biologiczny a poziom sprawności fizycznej dziewcząt i chłopców. Wychowanie Fizyczne i Sport, 1/2, 3–18.
11. Szmodis M., Bodzsar E., Szmodis I., Zsakai A. (2002) Parental body linearity and skinfolds in the offspring. Papers on Anthropology, IX, 297–312.
12. Theintz G. E. (1994) Endocrine adaptation to intensive physical training during growth. Clinical Endocrinology, 41, 267–272.
13. Wieliński D. (2000) Komponenty ciala czlowieka w aspekcie tradycyjnych i najnowszych metod badań. Monografia nr 338, AWF Poznań.

Papers on Anthropology XV, 2006, pp. 28–46

PHYSIQUE IN CHROMOSOMAL DISORDERS

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SUMMARY

The physiques of a relatively large sample of the Down's syndrome (DS) subjects and some with gonosomal disorders, such as 46Xq del., XXX, XXY, XYY syndromes were compared in this study. The proportionality profile and the somatotype were analysed in the subjects of the same age.

Some characteristic differences were observed in the proportionality profiles between the DS and the gonosome disorders although the differences are seldom significant.

The somatotype seems to be more variable in the gonosomal disorders than in the DS. Significant differences were found between the somatotype of the DS subjects and those with gonosomal disorders.

INTRODUCTION

The characteristics of the body build in different sex chromosomal disorders will be compared with those of the DS subjects in this paper. Our aim is to study the influences of the different chromosomal aberrations on growth and the body shape. There is already considerable information about the people with sex chromosomal disorders to be found in literature. Their proportionality profile and the somatotype were compared with the DS subjects of the same gender and age.

MATERIAL AND SUBJECTS

The majority of the subjects with the DS live in special institutions, boarding houses or social service institutions in Hungary. Some of them are living in social service institutions in Western Slovakia. The total number of the subjects is 740, aged from 4 years to adulthood.

Proportionality was evaluated by the method of the unisex human phantom model of Ross and Wilson (1974) [14]. The authors calculated a z-value on the basis of the measurements of a phantom, which is related to the measurements of the individuals or groups in question. This value is 0 if the ratio between the body measurement and the body height of the subject is identical to the model. Negative numbers denote a lower ratio, while positive numbers denote a higher one.

The evaluation of physique was based on the Heath-Carter anthropometric somatotype (Carter 1975) [5]. In the DS group, the calculated components were corrected on the basis of photographs – whenever necessary (Buday 1990) [4]. The somatotypes of the different groups were compared according to the SDI (somatotype dispersion index) values and I index of Ross et al. (1977) [15] and as well as by the SAM (somatotype attitudinal mean) and SASD (somatotype attitudinal standard deviation) values of Duquet and Hebbelinck (1977).

SURVEY OF THE PROBLEM

It must be mentioned that we know more about the effect of sex chromosomal aberrations on the body shape than their effect on growth. The reason is that most of these syndromes are recognized only at puberty [1].

Bősze et al. (1980) defined the effect of the X chromosome on the growth and the body shape as follows:

- both arms of the X chromosome are important in the development of normal body height;
- deletion of the short arm of the X chromosome results in a great weight/height ratio and therefore a proportionally great weight. This change of proportion can also be detected in the event of the deletion of the long arm;

- both arms are important in the development of the limb/trunk proportion. In the event of both X chromosomes being deleted the limbs will be shorter;
- the duplication of the long arm can not compensate for the absence of a short arm.

According to Varrela et al. (1984b) [25] the effects of X chromosomes do not have sufficient consequences. The second X chromosome causes most body measurements to be smaller but an excess of chromosomes does not cause the body measurements to grow. With the 47,XXY males the length of their limbs (and as a consequence their height) and the thickness of skinfold are increased, while the other parameters are definitely smaller. With the 47,XXX females the ratio of sitting height/lower extremity length is decreased, which means that their legs are longer compared to their height – just as with the 47,XXY males. A similar tendency with the 46,XX males can also be observed. It is possible that the decrease of the sitting height in these two syndromes is caused by hormonal absence. That would mean that the X chromosome also controls the height and the effect on the lower extremity length: it is possible that it contains special genes effecting the epiphysis and the spinal column as well. As the bone cortex decreases, the width measurements of the bones decrease. According to Tanner et al. (1959) the double occurrence of the X chromosome inhibits muscle development. However, according to Varrela et al. (1984b) [25] this is questionable because these measurements also depend on the development of bones and on the thickness of skinfolds.

Ross et al. (1983) [16] doubt that Lyon's hypothesis is valid. If it is, then it is hard to understand why the body shapes of females with 45,X0 and of 46,XX chromosome differ from each other, or what kind of abnormalities are connected to the extra X or Y chromosome in 47,XXY or 47,XXX syndromes. Examining the body proportions, they found that the body structure of subjects, having these chromosomal aberrations, differs according to gender. The aneuploidy of the X chromosome is directly connected to abnormal body structure. The possible solution is as Ferguson-Smith proposed: the short arm of X chromosome (Xp) is not inactivated. It is possible that the inhibitory effect of the extra chromosome or the delay of maturation results in a longer growing period and consequently greater body measurements.

According to Varrela and Alvesalo (1984) [23] the Y chromosome affects the parameters of the degree of growth but not the shape of the body. Its influence on growth seems to be additive: the subjects having the Y chromosome with a structural anomaly are shorter than others having the more normal Y chromosome. This additive effect is not limited to height but for the whole body. All these facts led them to conclude that the Y chromosome contains the genes which affect growth in general. This has an effect on some basic processes: for example, an influence on the cells' mitotic activity in a direct manner or by hormonal regulation. Taking into consideration the measurements of women with the 46,XY chromosome, this effect seems to be independent from the androgenes. That means that these women are not taller than the men, so in the development of normal male height not only the Y chromosome but the androgens also play a role.

Further, according to the proportion of the body measurements of different sex, chromosomal aberrations were compared with the DS subjects' ones. The number of body measurements for comparison is not the same because of the different anthropometric programmes. In some cases we have calculated the proportionality profile from the given body measurements. The details found in literature are often contradictory, which means that these syndromes are themselves variable.

1. COMPARISON OF THE PROPORTIONALITY PROFILE

1.1. 45,XO Turner Syndrome

This syndrome was described by Turner in 1938 [20]. The definition of the chromosomal aberration was provided by Ford et al. (1959) [10]. It was stated in the first anthropological work dealing with the syndrome (Shimaguchi et al 1961) [17] that their body proportions are similar to those of normal men. They have short legs, wide shoulders and narrow hips.

More detailed anthropological examinations were carried out by Park (1975, 1977) [12, 13]. Here we only discuss her statements on the body shape.

- Although there are apparently short females, there are other genetic factors affecting their growth. Park concluded that there is a positive correlation between their height and the average height of their parents, and also that the correlation with the mothers' body measurements is similar as is the case with normal daughter-mother pairs.

- The body measurements are reduced more in length than in width.
- Compared to their height, the Turner syndrome subjects are wide and heavy which gives a rectangular impression of their body shape.
- In adulthood the shortness of their legs is not so apparent and the proportion of biacromial and bi-iliocristal width is similar to that of the normal people.
- It is characteristic of their upper limbs that the reduction of parameters increases from the proximal to the distal direction: this tendency also occurs with the hands.

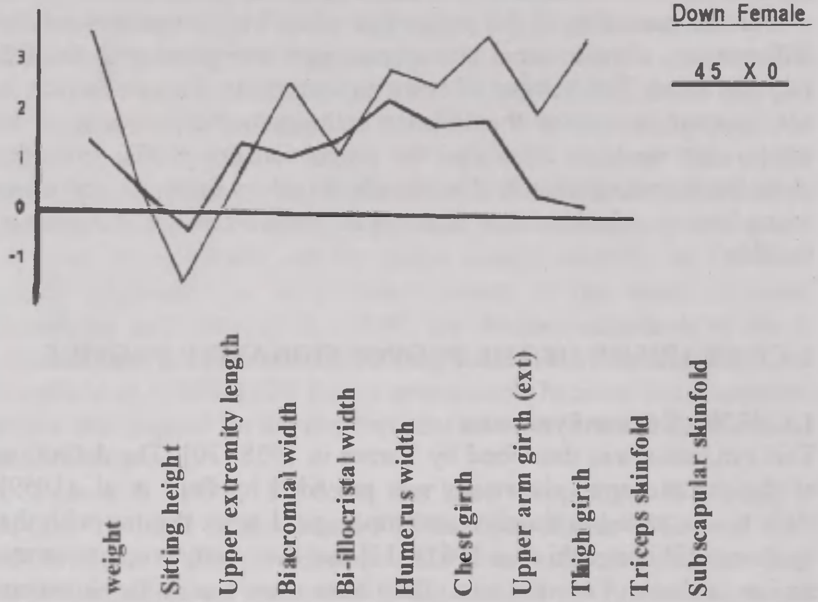

Figure 1. Proportionality profile of adult subjects with the Turner and with the Down syndrome (Varrela 1984) [23]

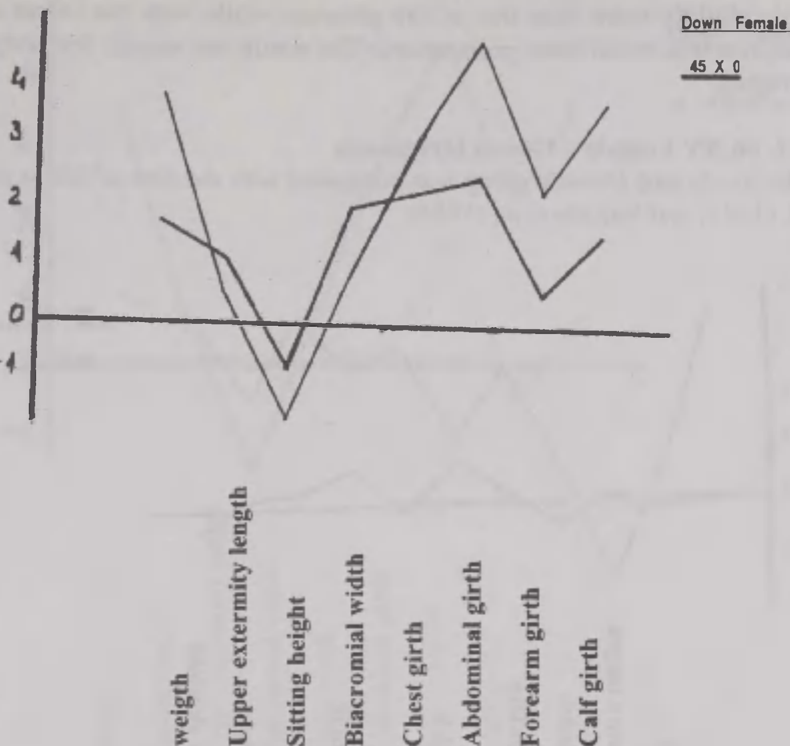

Figure 2. Proportionality profile of subjects with the Turner and with the Down syndrome (Bősze et al) [1]

The proportionality profiles of the Turner syndrome subjects were compared with the female DS subjects of 26–30 years of age using the data of Varrela et al. and Bősze et al. (1982) Bősze et al. (1982) (1984b, Figure 1. and Figure 2.). The trunks of the DS and Turner syndrome subjects are proportionally longer but the difference is slight. With the DS subjects the shoulders are proportionally narrower, the hips are wider; which is why the trunk seems to be more squat and widening downwards. This is supported by the fact that the chest girth is less but the abdominal girth is proportionally higher with the DS subjects.

The limbs in the DS are proportionally shorter: with the Turner syndrome the proportions compared to the length of limbs are nearer to those of the fertile women. At the same time the limbs are wider and their girths are proportionally greater. The subscapular skinfold is only slightly more than that of the phantom while with the Down's subjects it is much more pronounced. The results are similar for body weight.

1.2. 46,XY Female – Gonad Dysgenesis

The mentioned Down's group was compared with the data of Bősze et al. (1982) and Varrela et al. (1984).

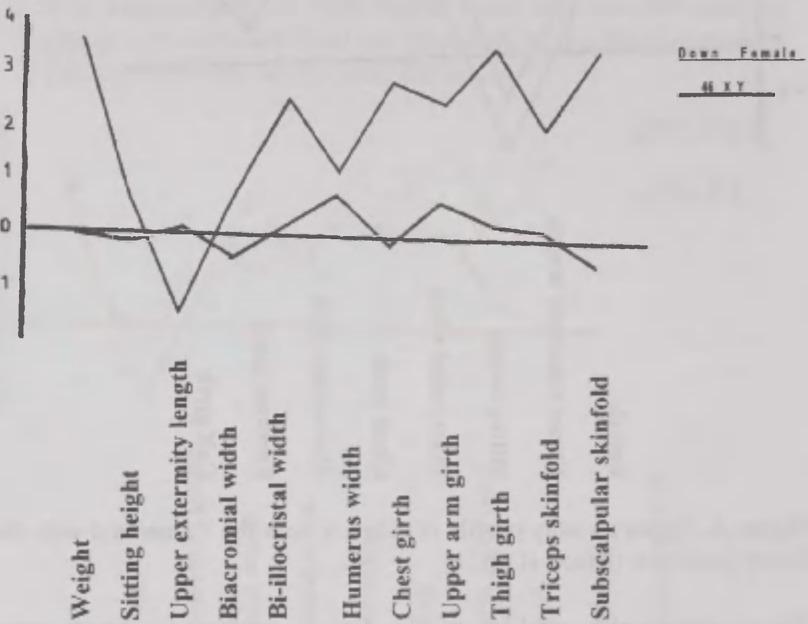

Figure 3. Proportionality profile of adult subjects with 46,XY female and with the Down syndrome (Bősze et al 1982) [23]

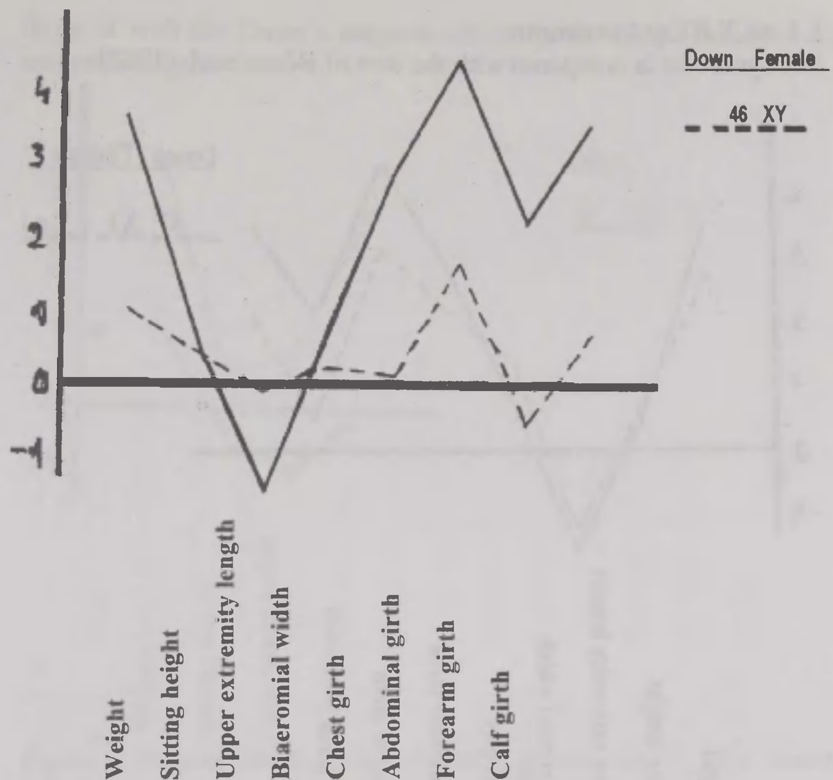

Figure 4. Proportionality profile of adult subjects with 46,XY female and with the Down syndrome (Varrela 1984)

On the basis of Figure 3 and 4 we have the impression that these individuals are similar to the reference model, except that the body weight, the abdominal girth and the proportionality profile of DS is quite different in these cases. The smallest differences we observed for the sitting height. The biacromial width and bi-epicondylar width of humerus and the upper limb is proportionally shorter and all the other examined measurements are much greater than the mentioned syndrome.

1.3. 46,X,i(Xq) Syndrome

The syndrome is compared with the data of Bősze et al. (1982).

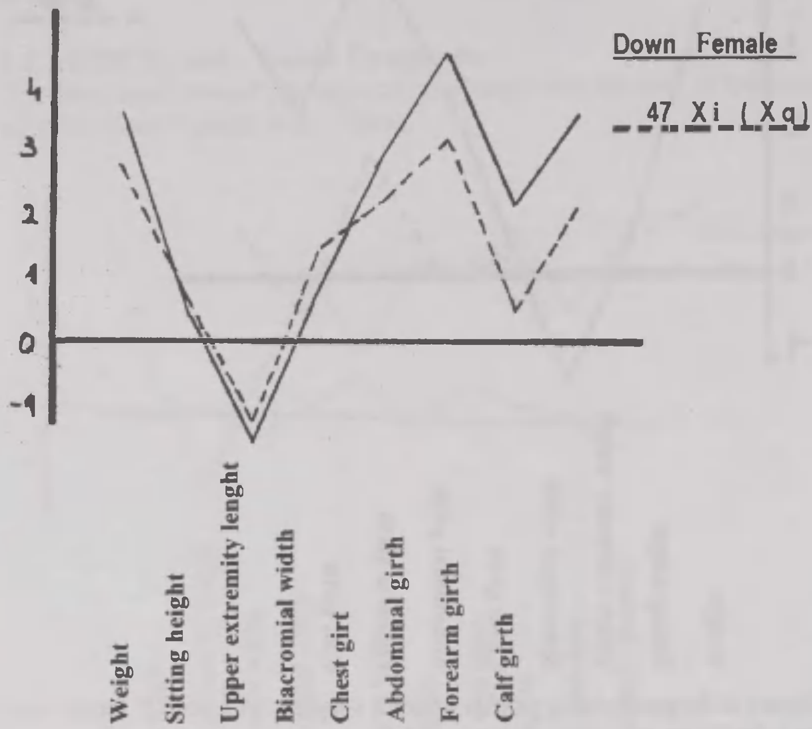

Figure 5. Proportionality profile of adult subjects with 46,Xi(Xq) female and with the Down syndrome (Bősze et al 1982)

According to Figure 5 this syndrome has the most similar proportions to those of the DS subjects. The trunk is similarly alike and the extremities are short. The shoulder is proportionally wider than for DS. With the Down's subjects the girths and the body weights are proportionally greater. In respect of the abdominal and limb girths the differences are greater than + 1z value. Their limbs are generally stockier and the lower part of their trunks is greater.

1.4. 47,XXX syndrome

We have a few data about this syndrome in adulthood but more for children of 7 years of age, both sets of which were published by Ross et al. (1983). In the adulthood their body weight, their sitting height and their shoulder and hip breadths are proportionally smaller than those of with the Down's subjects which means that their trunks are narrower (Figure 6).

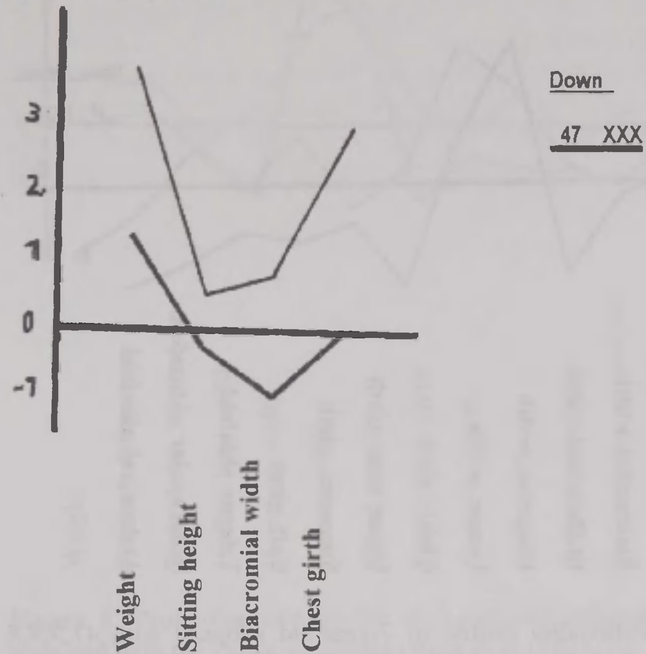

Figure 6. Proportionality profile of adult subjects with 47,XXX female and with the Down syndrome (Ross et al 1983) [16]

This picture is supported and completed by the comparison of proportionality profiles of 7-year-old children with the Down's girls of a similar age (Figure 7).

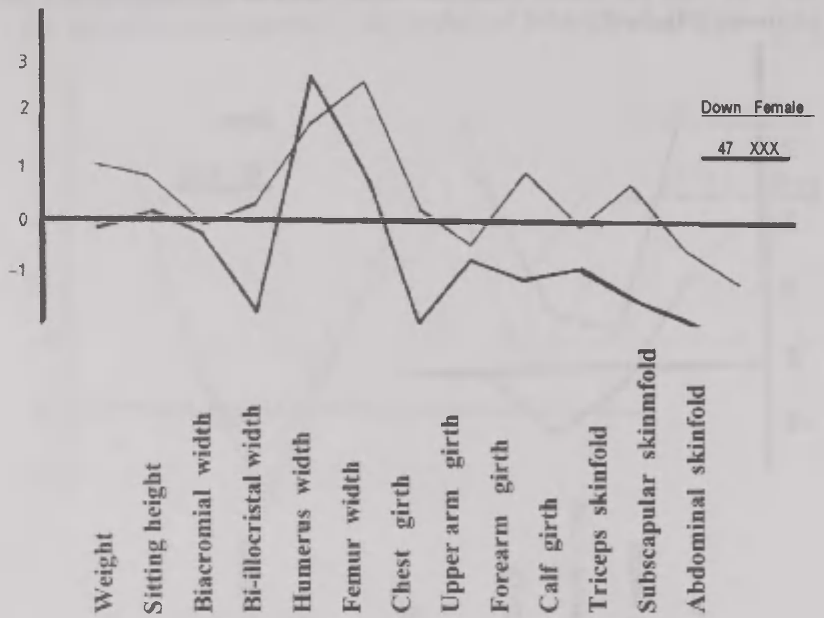

Figure 7. Proportionality profile of 7-year-old subjects with 47,XXX female and with the Down syndrome (Ross et al 1983) [16]

The trunks of the former are proportionally less wide and of smaller girth than those of the DS. The differences are especially great in the case of bi-iliocristal width, which means that their trunks narrow downwards. The humerus width is proportionally greater and the femur proportionally smaller, contrary to the DS. Their limbs, however, are proportionally longer and thinner and their girths are smaller than with the DS which cannot be seen in the figure. Their body weight and the examined skinfolds are also proportionally smaller.

1.5. 47 ,XXY Klinefelter syndrome

The chromosomal constitution of the syndrome was described by Jacobs and Strong in 1959. The anthropological publication is consistent with this describing tall and thin men with short trunks and long lower limbs. Ross et al. (1983) [16] published data about 7-year-old children with the Klinefelter Syndrome (Figure 8.).

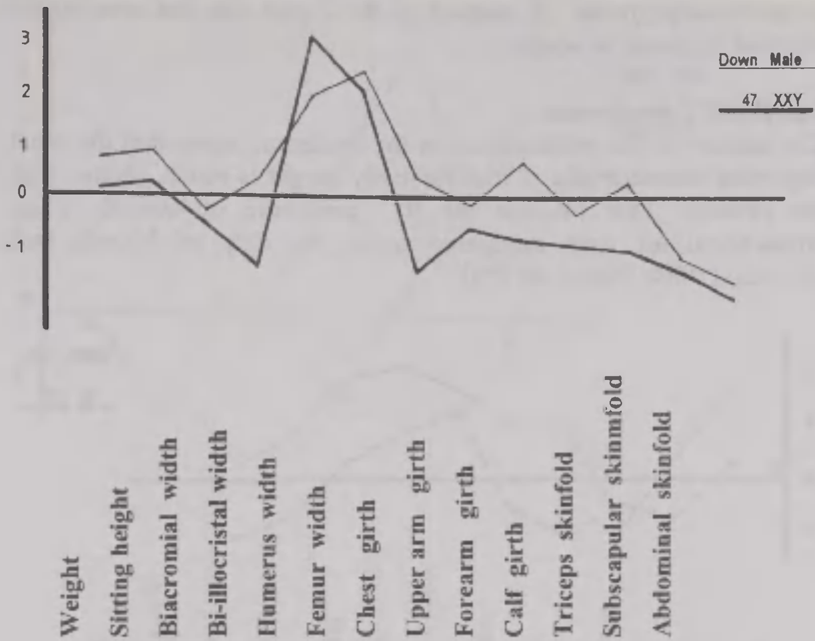

Figure 8. Proportionality profile of 7-year-old subjects with 47,XXY male and with the Down syndrome (Ross et al 1983) [16]

In the Klinefelter syndrome the trunk is proportionally shorter, the breadths of shoulders and hips are narrower and the chest girth is also narrower. The humerus width is proportionally greater than that of the femur, contrary to the DS subjects whose femur width is greater. The limbs are proportionally longer but thinner because of the girth measurements which is not shown in the figure. With the DS subjects the body weight and the triceps skinfold are proportionally greater but the differences of the two other examined skinfolds are not significant. At this age the greatest differences could be found in the “z” values of bi-iliocristal width and chest girth: the trunk of DS subjects is proportionally longer and wider than that of those with the Klinefelter syndrome.

The trunk is proportionally short and narrow with a relatively greater chest girth. The upper arm is proportionally longer than in DS but it cannot be taken for a long type: its proportion is similar to that of the reference model. The humerus width is proportionally smaller than for the DS which is in connection with the development of the cortex of bones. The perimeters of the Down subjects are proportionally greater. In contrast to the 7-year-olds the subscapular skinfold is greater in adults.

1.6. 47,XYY syndrome

The authors of the publications on the syndrome agree that the most important characteristic is that the body height is much greater than the average. This exceeds the 97th percentile of normal. Their proportionalities were compared using the data of Varrela and Alvesalo (1984; Figure 10) [23].

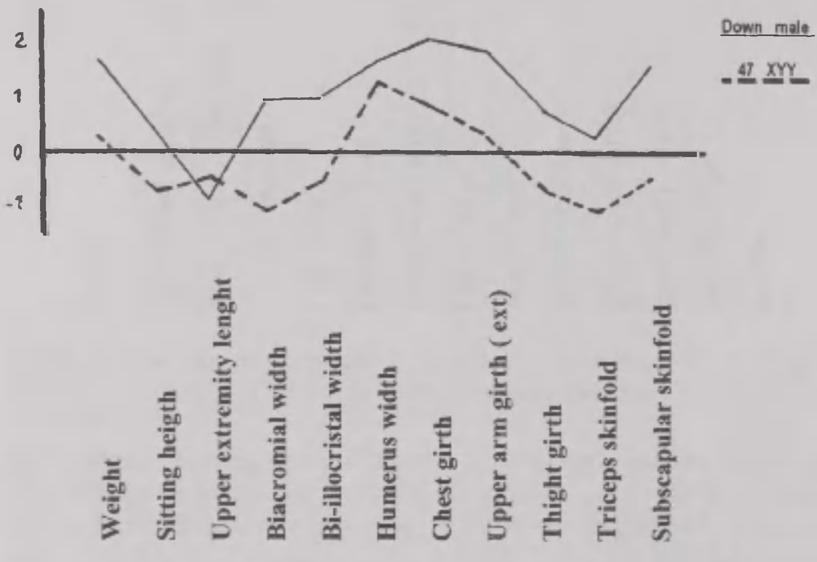

Figure 9. Proportionality profile of the adult subjects with 47,XYY male and with the Down syndrome (Varrela and Alvesalo 1984)

This syndrome is more similar proportionally to the Klinefelter syndrome. The trunk is short and narrow. The girths are proportionally greater but do not reach the values of Down subjects. The linearity is characteristic of the syndrome: this is also supported by the proportionally low values of bodyweight and skinfolds.

1.7. 46,XX Male – (Gonad dysgenesis)

The proportional characteristics of the syndrome were compared with the male adult Down subjects using the data of Bősze et al. (1982) and Varrela (1984b [22]; Figure 11 and 12).

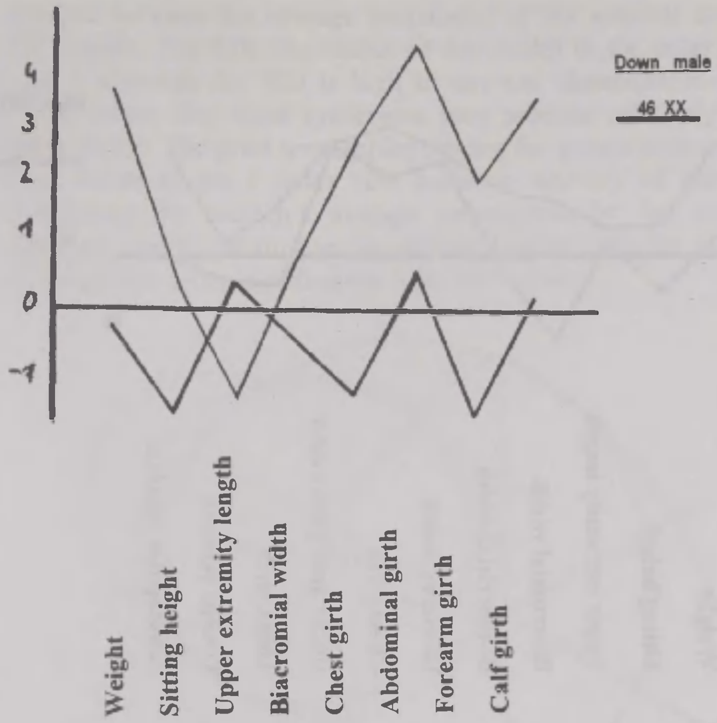

Figure 10. Proportionality profile of adult subjects with 46,XX male and with the Down syndrome (Bősze et al 1982)

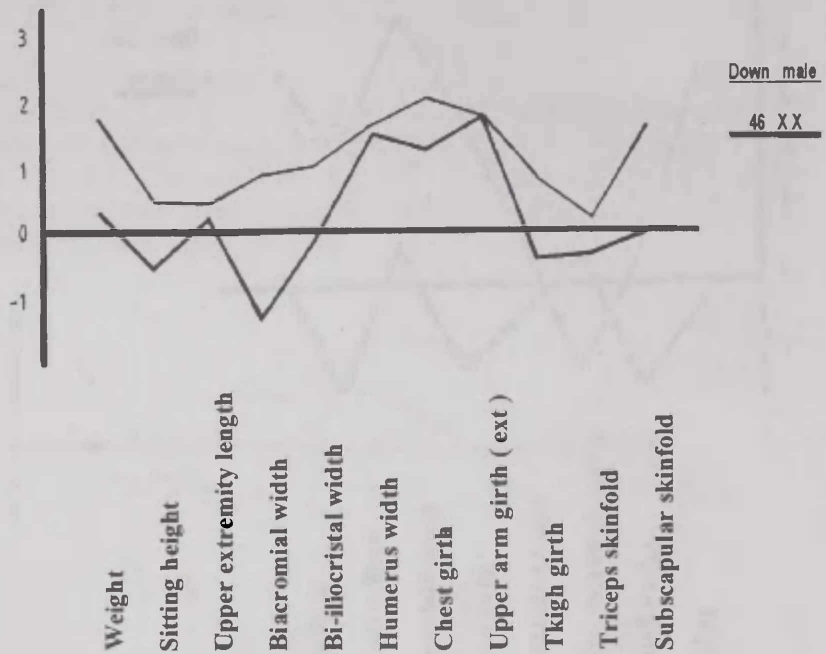

Figure 10. Proportionality profile of adult subjects with 46,XX male and with the Down syndrome (Bősze et al 1982)

Their height is "normal". The trunk is proportionally small but wider than that of the Klinefelter syndrome subjects. The chest girth is proportionally smaller, the abdominal girth is greater. The limb girths are proportionally smaller than in DS, except the girths of the upper arm. The skinfolds and the body weight are also lower.

2. COMPARISON OF THE SOMATOTYPES

We have only the data on the somatotype of subjects with some sex chromosome disorders of 45,XO, 46,Xi and 46,XY female and 46,XX male adults (Eiben et al. 1985) [9]. High and balanced endo- and mesomorpy are characteristic of the somatotype of DS subjects (Buday 1990, [4] Ruiz et al 2002). Comparing the female subjects in the DS group the SDI is the lowest. High endo- and mesomorphy are characteristic of the 46,Xi(Xq) group. The highest distance was detected between the average somatoplot of DS subjects and the 46 XY female. The SDI (the radius of the circle) in the latter group is higher, although the SDI is high in any sex chromosome disorders which means that these syndromes may produce relatively variable body shapes. The great overlapping among the groups is shown by the high value of the I index (the common territory of the circles). Comparing the women's average somatoplots by the analysis of variances, the F statistics are significant (Table 1) so the somatotype of the groups differ significantly from each other.

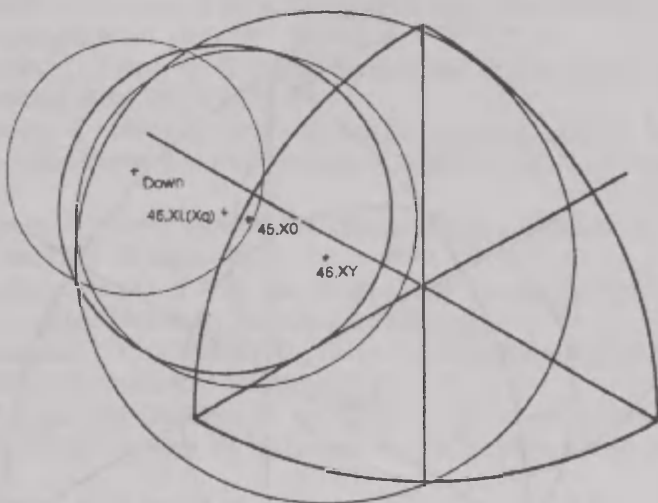

Figure 12. Comparison of the somatotype of adult female with the Down syndrome and different sex chromosomal disorders.

Table 1. Comparison of somatotype components in female patients

SAM	SAS D		I –	II	– III	SDI		I
1.88	1.25	Down	8.07 – 7.02 – 0.52			3.31		
2.18	1.25	45.XO	5.78 – 5.22 –1 .22			4.35	Down-45.XO	28.42
2.55	1.76	46.Xi	6.19 –5.59 – 1.09			4.11	Down-46.Xi	35.76
2.71	1.45	46XY	5.20– 4.75 –2.70			6.39	Down-46.XY	12.40

Analysis of Variance

Source of variance	Square deviation	D.F.	Variance
Inside groups	9.76	3	3.25
Within groups	85.80	168	1.26
Together	195.54	71	–

F (12;70) = 2.59+

Comparing the male subjects (Figure 16) we also see high endo- and mesomorphy in the DS group. The SDI is also higher in this group. The difference of somatotypes is also significant in the male subjects.

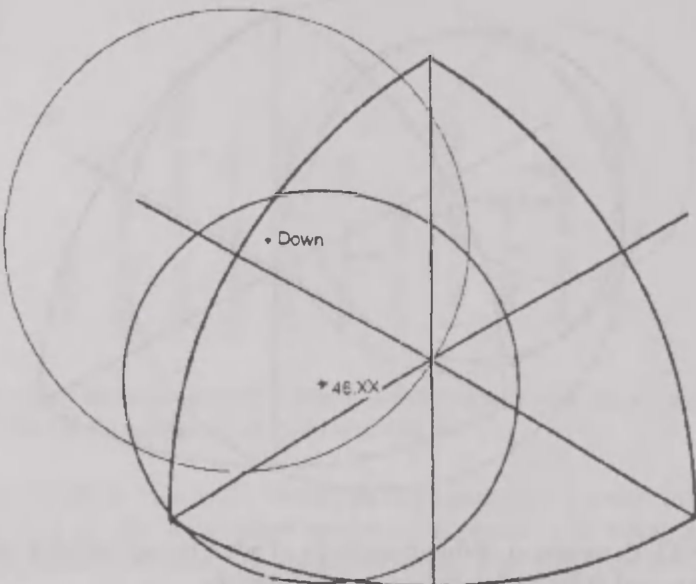

Figure 13. Comparison of the somatotype of adult male with the Down syndrome and with different sex chromosomal disorders.

Table 2. Comparison of somatotype components in male patients

SAM	SASD		I – II – III	SDI	I
2.75	1.21	Down	5.50 – 5.84 – 1.13	5.38	
					42.18
1.89 t=3.35	1.19	46,XX	5.32–3.67–2.89	4.31	

It is remarkable that the body shapes produced by trisomy 21 and sex chromsome aberrations are significantly different. On the basis of further investigations it can be expected that the characteristics of the figures and their measurements could serve alone in distinguishing different syndromes.

REFERENCES

1. Bősze, P., Eiben, O. G., Gaál, M., László, J. (1980) Body measurements of patients with streak gonads and their bearing upon the karyotype. Hum. Genet, 54. 355–360.
2. Buday, J., Eiben, O. G. (1982) Somatotype of adult Down's patiens. Anthrop. Közl, 26, 71–77.
3. Buday, J. (1984) Growth and proportionality in patients with DS. Human Growth and Development. Plenum Press, New York, 631–636.
4. Buday, J. (1990) Growth and physique in DS children and adults. Humanbiol. Budapest, 20.
5. Carter, J. E. L. (1975) The Heath-Carter somatotype method. San Diego State University. San Diego, California.
6. Chumela, T. C., Cronk, C. E. (1981) Overweight among children with trisomy 21. J. ment. Defic. Res, 25, 275–280.
7. Cronk, C. E., Chumela, T. C., Roche, A. F. (1985) Assessment of overweight children with trisomy 21. Am. J. Ment. Defic, 89, 433–436.
8. Down, I. L. M.(1866) Observation on an ethnic classification of idiots. Clim. Lect. Rep. London. Hosp. 1866, 3, 259–262.
9. Eiben, O. G., Bősze, P., László, J., Buday, J. (1985) Somatotype of patients with streak gonad syndrome. Humanbiol. Budapest, 16. 53–64.
10. Ford, C. E., Jones, K. W:, Polam, P. E., De Almeida, J. c., Briggs, J. H. (1959) A sex chromosome anomaly in a case of gonadal dysgenesis (Turner syndrome). Lancet, 1, 711–725.
11. Horváth, L., Buday, J. (1980) Examination of physical development of Down's patients in view of three body measurements. A follow up study. Anthrop. Közl, 24. 119–122.
12. Park, P. E. (1975) An anthropometric and radiographic study of the development of individuals with Turner's syndrome. Ph. D. Thesis, University of Toronto.
13. Park, P. E. (1977) Body shape in Turner's syndrome. Hum. Biol, 49, 215–223.

14. Ross, W. D., Wilson, N. C. (1974) A strategem for proportional growth assessment. Acta Paediatrica Belgica 28. Suppl. 169–182.
15. Ross, W. D., Carter, J. E. L., Roth, K, Willimczik, K (1977) Sexual dimorhpism in sport by a somatotype I index. Growth and Development; Physique. Symph. Biol. Hung, 20, 365–376.
16. Ross, W. D., Ward, R., Sigmon, B. A., Leany, R. M. (1983) Anthropometric concomitants of X chromosome aneuploidies. In: Cytogenetics of the Mammalian X chromosme. Part B: X chromosome anomalies and their clinical manifestations. Alan R. Liss, New York, 127–157.
17. Shimaguchi, S., Ashizawa, K, Endo, B., Sakura, H. (1961) An anthropometric approach to Turner's syndrome. A cytogenetical study of 57 patients. Zinruigaku Zassi, 72, 107–125.
18. Tanner, J. M. (1958) Growth and the prediction of abnormality. Dent. Pract. VIII, 220–229.
19. Tanner, J. M., Whitehouse, R. H. (1982) Atlas of children's growth. Academic Press, London.
20. Turner, H. H. (1938) A syndrome of infantilism congenital webbed neck and cubitus valgus. Endocrinology, 23, 566–578.
21. Varrela, J. (1984a) Body size and shape in 46,XX males. An anthropometric investigation. Effect of X and Y chromosomes on body size and shape. University of Turku, Turku II, 2–15.
22. Varrela, J. (1984b) Effects of X chromosome on size and shape of body. An athropometric investiqation in 47,XXY males. Effects of X and Y chromosomes on body size and shape. University of Turku, Turku IV, 2–23.
23. Varrela, J., Alvesalo, L. (1984) Y chromosome effects on body size and shape. Effects of X and Y chromosomes on body size and shape. University of Turku, Turku V, 2–16.
24. Varrela, J., Vinkka, H., Alvesalo, L. (1984.a.) The phenotype of 45,X females: an anthropometric quantification. Ann. Hum. Biol, 11, 53–66.
25. Varrela, J., Alvesalo, L., Vinkka H (1984.b.) Body shape in 46.XY females with complete testicular feminization. Effect of X and Y chromosomes on body size and shape. University of Turku. Turku III, 3–19.

Papers on Anthropology XV, 2006, pp. 47–54

SOME ANTHROPOMETRIC INDICES OF DEFINITIVE AGE ADOLESCENTS IN THE STUDY OF 2005/2006

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Physical development is a continuous and complex process of morphological and physiological changes taking place in the body. It is manifested by the increase of the human's height and the body mass, and also changes of sex matters. Body height, weight and chest circumference are anthropometrical parameters which are characterizing physical development of a child and a youth. We analysed anthropometrical data of boys, aged 17–20 years. We observed the definitive age of boys at the age of 18 years. All average parameters were stable at the age of 19 years. Comparing the findings of boys' physical development with data of other scientists, we found similar data. Acceleration of body height was not observed. The average BMI data had a normal range in all the age groups.

INTRODUCTION

The study of the process of the growth and physical development of the human body is very important for practical medicine, especially, in paediatrics, because the child's morphological development indices are the criteria of a child's health status. Using the current scientific achievements and by applying progressive research methods, one can evaluate the child's physical development in the population to define those criteria, which make the basis for morphological development of children and adolescents. Although the children's physical development has been studied, there are still investigations going on for finding the characteristic signs of the growth process. The characterristic parameters, typical of the physical development, are the anthropometric parameters, such as the height, the body mass and the perimeter of the chest. Riga schoolchildren's physical development in the pre-war period was studied by K. Ādamsons (1927) [2], Ā. Plūme (1931) [7], G. Fedders (1936)[3] and L. Jēruma (1936). In the fifties a wide-scale study of Riga schoolchildren's physical development was carried out by D. Buņimoviča (1954, 1969). In the post-war period, the standards for the Latvian children's physical development were worked out by R. Millere and K. Segleniece (1977). An individual's morphological sign specificities in the population are affected in the similar way either by the gene complex, or the environmental factors (the level of life of the society and the quality of the environment). The children's physical development is also one of the indicators of the state's welfare. To catch up with the developmental tendencies of these signs in the population, they must be regularly studied. The variations of social and economic factors call for the necessity to follow the changes of the forms of the human body and the changes of the functions, as well as to check whether there are changes in the physical development of Riga boys on the threshold of the new century. It is important because in the last ten years no indications for the boys' physical or sexual maturation have been defined.

THE AIM OF THE STUDY

To study the anthropometric indices of the 1st and 2nd year students of Riga Stradins University and the senior class students of Riga secondary schools, and to compare the data with those of the literature.

MATERIAL AND METHODS

In the study we have used the anthropometric measurements acquired in 2006 from the 1st and 2nd year students of RSU and the senior class students of Riga secondary schools. The anthropologic data of 236 boys, aged from 17 to 20 years, were analyzed. The boys, included in the study, were divided into 4 age groups (years). The following anthropometric indices were analyzed: body height, body mass, the perimeter of the chest and the body mass index (BMI).

BMI is calculated by the formula: BMI = body mass(kg)/ body height (m).

All the anthropometric measurements were made with the instruments of the Swiss company Silber-Hagner&Co. The study was carried out, taking into account R. Martin (1914; 1928), K. Seller (1957–1966) and J. Prīmanis (1937) methodological instructions.

The statistical analysis of the acquired data was carried out by using the computer statistical analysis programme SPSS.

RESULTS

In the work several anthropometric indices in boys, aged from 17 to 20 years – body height, body mass and the perimeter of the chest, as well as the BMI and its correlation to the body height were analyzed (Table 1):

1. **body height** – at the age of 17 years, the amplitude of the body height is from 150.7 cm to 192.0 cm, the mean body height is 178.11 cm; at the age of 18 years the mean body height is 180.66 cm, where the body height has increased by 2.55 cm; at the age of 19 years the mean body height is 179.50cm, where no increase in the body height is observed; at the age of 20 years the mean body height is 181.76 cm where a slight increase in the body height is observed;
2. **body mass** – at the age of 17 years the minimum body mass value is 41.50 kg, but the maximum value is 96.1 kg, the mean value is 66.84 kg; at the age of 18 years the mean body mass value is 71.30 kg, where the annual increase is 5.46 kg, but at the age of 19 years the mean value is practically unchanged, there is a tendency for the body mass stabilization; at the age of 20 years the mean value is 77.15 kg, the increase within the year is 4.87 kg;
3. **perimeter of body chest** – at the age of 17 years the chest amplitude varies from 73.80 cm to 86.19 cm, on average it is 86.19 cm; at the age of 18 years – the mean value is 88.93 cm, the annual increase is 2.74 cm, but at the age of 19 years the mean value is 88.90 cm where no increase in the mean value of the chest parameter is observed; at the age of 20 year the mean value is 91.85 cm.

BMI mean value in all groups studied increase from 21.03 to 23.29.
A significantly confident positive correlation was found ($p<0.01$) between the body height and the BMI.

Table 1. Anthropometric Indices of Definitive Age Adolescents in the study of 2005/2006

Age of the boys (years)	Anthropometrical parameters	N	Minimum	Maximum	Mean
17	Body height, cm	98	150.70	192.00	178.11
	Body mass, kg		41.50	96.10	66.84
	Chest perimeters, cm		73.80	108.20	86.19
18	Body height, cm	55	161.40	193.60	180.66
	Body mass, kg		54.00	100.50	72.30
	Chest perimeters, cm		76.50	105.00	88.93
19	Body height, cm	47	171.10	194.60	179.50
	Body mass, kg		55.00	92.00	72.28
	Chest perimeters, cm		78.00	105.80	88.90

DISCUSSION

When analyzing various authors' study data, which were acquired by carrying out anthropometric studies on school age boys in the 20^{th} and 21^{st} centuries, i.e., in K. Ādamsons' study in 1926, in G. Fedder' s study in 1936, L. Jēruma-Krastiņa' study in 1952 and D. Buņimoviča's study in 1958/1959, R. Millere's study in 1962, R. Millere and K. Segleniece's study in the seventies, I. Kokare and Dž. Krūmiņa's study in 1998/1999, S. Umbraško's study in 2003 and 2005/2006, one can find changes in the absolute values of the anthropometric indices in the studied children (Table 2). Analyzing the body height indices in 17-year-old boys in all the above-mentioned studies, one can notice the changes during the century. Between the studies of 1926 and 2005/2006, within a period of 80 years, the body height of definitive age has increased by 12.71 cm, in the period of ten years – by 1.59 cm. After 10 years in G. Fedder's study in 1936, the mean value of 17-year-old boys' height was 170.0 cm, i.e. the increase within ten years was 4.6 cm. In the same year L. Jēruma-Krastiņa published the data of her study where 17-year-old boys' mean height was 173.48 cm. The difference between both studies in the mean values of 17-year-old boys' height was 3.48 cm. It could be explained by the fact that L. Jēruma-Krastiņa had used Riga central school

Table 2. Anthropometric Indices of Definitive Age Adolescents in Investigations in 20 / 21 Centuries

	The Investigator	Body height, cm			Body mass, kg			Chest perimeters, cm		
		Age of boys (years)			Age of boys (years)			Age of boys (years)		
		17	18	19	17	18	19	17	18	19
1.	K. Ādamsons, 1926	165.40			51.00					
2.	G. Fedders, 1929	170.00								
3.	L. Jēruma – Krastiņa, 1936	173.48	172.92		65.18	64.00		85.64	85.38	
4.	D. Buņimoviča, 1952	170.10			60.60			88.60		
5.	D. Buņimoviča, 1958 / 59	170.10			60.90			88.70		
6.	R. Millere, 1962	174.60	175.44		64.14	65.24		85.84	86.72	
7.	R. Millere, K. Segleniece, 1977	175.61	178.34		65.66	68.63		85.29	85.13	
8.	I. Kokare, Dž. Krūmiņa, 1998 / 99	178.50	180.00		67.00	69.00		90.20	90.70	
9.	S. Umbraško, 2003	180.40	178.40		68.70	70.50	69.40			
10.	Z. Cēderštrēma, 2005 / 06	178.11	180.66	179.50	66.84	72.30	72.28	86.19	88.93	88.90

children (2nd gymnasium) where were learning city were studying boys. G. Fedders carried out his study in Riga Pārdaugava schools, where the mean anthropometric values were closer to those scientists who had studied teenagers and adolescents in the country. In the post-war period a very active work in school age children anthropometrics was done by D. Buņimoviča. According to the study data of 1952, the mean value of the 17-year-old boys' height is 170.1 cm which remains stable also in 1958/1959 study. One of the moments, which can explain these phenomena, might be the effect of the war on the children's physical development.

The analysis of studies show that the boys' growing stops at 17 years, which could be considered a definitive age.

According to R. Millere's study in 1962, the mean value of the boys' height was 174.6 cm, but at the age of 18 years 175.44 cm, where one can observe a slight increase, i.e. 0.84 cm. According to the data of the seventies, the mean value of 17-year-old boys' height was 175.61 cm, but at the age of 18 years – 178.34 cm, the increase was 2.73 cm. Thus, according to R. Millere's data the boys kept growing till the age of 18 years. Comparing the study data of D. Buņimoviča and R. Millere, we can see that the boys' height at 17 years was considerably increased by 4.5 cm according to the study data of 1962, but according to the 1970s – by 5.51 cm.

When analyzing the study data of I. Kokare and Dž. Krūmiņa in 1998/99, we can see that the boys continued growing till 18 years and reached the mean indices till 180,0 cm, at the age of 17 years – 178,5 cm. Thus, boys were still growing by 1.5 cm. Comparing these data with R. Millere's definitive age data in 1926, one can see that 18-year-old boys' mean value of the height had increased by 4.56 cm.

According to S. Umbraško' study data, the boys had reached the definitive age at 17 years with the height of 180.4 cm. Analyzing the study data of June 2005, we can see that the boys had reached the definitive age at 18 years, where the mean value of the height was 180.66 cm, but at 17 years – 178.11 cm. Thus, the boys had grown by 2.55 cm.

Starting with the end of the 19990s of the last century, there is a tendency for the stabilization of the mean height value, which is on average 180 cm.

Analyzing the rest of anthropometric parameters, such as the body mass and the chest perimeter, the tendency is similar to that of the body height. In all the mentioned studies, the boys reaching the definitive age, stop growing, the body mass and the chest perimeter stop increasing as well.

The literature data show that in the neighbouring country – Estonia – the anthropometric studies were carried out already from the 19th century, from the year 1811. Since that time up to 2003, 192 years have passed, during which 17-year-old boys' height has increased from 160.7 cm to 179.11 cm, thus by 19.4 cm.

In other countries, like the Netherlands, according to the study data of 1996/97, the mean value of 17-year-old boys' height is 181.3 cm, in Hungary – 175. 7 cm (1994/95); in Belarus – 176.36 cm (1996/97), in the USA – 175.3 cm according to the study data of 1999–2002.

CONCLUSIONS

Analyzing the acquired data on 17–20 year-old boys' anthropometric indices, one can draw a conclusion that:

1. The age of 18 years in boys can be considered the definitive age, since at the age of 19 the increase of the mean value is observed in neither the anthropometric indices, which is confirmed also by the literature data (I. Kokare, Dž. Krūmiņa 1998/1999, S. Umbraško 2003), nor the tendencies of the acceleration of the body height which are observed.
2. The mean value of the BMI is seen to be in conformity with the norm in all the age groups, no obesity signs are observed.

REFERENCES

1. Āboltiņa M., Ē. Brēmanis (1955) Vidusskolas bērnu morfofizioloģiskās īpatnības. Rīga.
2. Ādamsons K. (1927) Skolas bērnu vidējais garums un svars Rīgā. Nākotnes spēks. Rīga, Nr. 3, 131 – 133
3. Fedders G. (1936) Rīgas latviešu pamatskolēnu garums un svars. Rīga.
4. Krūmiņa Dž., Kokare I (2005) Latvijas bērnu fiziskās attīstības normatīvi. Nacionālais Apgāds.
5. Lintsi M., Kaarma H. (2006) Growth of Estonian seventeen – year – old boys during the last two centuries. Economics and Human Biology 4,
6. Millere R., Segleniece K. (1977) Bērna augšana un attīstība. – Rīga, "Zvaigzne".

7. Plūme A. Daži novērojumi par skolēnu garumu Rīgas pamatskolās. Pašvaldības balss, Rīga, 1931, 409–411.
8. Segleniece K (1977) Bērnu fiziskā attīstība. – Rīga, "Zvaigzne", 79. lpp.
9. Tanner J. (1981) A History of the Study of Human Growth Cambridge, University Press, 167–179.
10. Umbraško S. (2005) Skolēnu stājas un pēdas parametru vērtējums kā fiziskās attīstības rādītājs gadsimtu mijā. Disertācija.

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DYNAMIC SPORT-SPECIFIC TESTING AND AEROBIC CAPACITY IN TOP LEVEL BASKETBALL PLAYERS

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ABSTRACT

The ratio of the general to the specific load in conditioning of sportsmen is a highly actual issue as it determines what kind of loads are to be used in training. Correlation between aerobic capacity and sport-specific abilities in basketball players is a determining factor in the management of training process. It is essential to know if the correlation is of permanent or temporary nature and how the orientation of conditioning and methods used affect this correlation.

The aim of this study was to determine and assess the permanence of the correlation between aerobic capacity and intensity of basketball-specific exercise performed within a four-week interval.

Eight competitive male basketball players participated in this study. The investigated athletes performed incremental exercise test on a cycle ergometer. Physiological indices were recorded during exercise testing using the cardiorespiratory system VMAX229, and the indices of aerobic fitness ((VO_2max), maximal heart rate (HRmax), oxygen pulse at the peak of cardiopulmonary test (oxyPuls), respiratory quotient (RQ), minute ventilation at the peak of exercise (VEmax) and power output at the peak of cardiopulmonary test (Wmax) were established.

The heart rate (HR) of each participant was monitored during basketball practice. Mean HR and peak HR were identified using the Polar Team System heart rate monitoring system during 3.5 minutes shooting exercise, which was recognized as basketball-specific. Such basketball-specific exercise was performed during real practices twice within four weeks.

We established strong correlation of oxyPuls with the first mean and peak intensity basketball-specific exercise (r –0.731, p 0.040 and r 0.683, p 0.062) and with the exercise repeated after four weeks (r –0.826, p 0.011 and r –0.814, p 0.014), respectively.

We established correlation between the heart rates achieved during aerobic performance testing and the sport-specific exercise test: lower heart rate during the sport-specific exercise test was related to higher aerobic performance. The correlation is permanent as determined by repeated exercise test.

Basketball players have to develop aerobic performance (general endurance) allowing for better economy in sport-specific activities and acceleration of recovery from anaerobic loads.

Key words: basketball, heart rate, basketball-specific testing, oxygen uptake

INTRODUCTION

Training related phenotypical changes in athletes are mostly dependent on the intensity, frequency and duration of exercise as well as on environmental conditions. During physical exercise, demand for oxygen and removal of carbon dioxide increase, which is one of crucial adaptation mechanisms in sports. Measurement of gas exchange in athletes is used for several reasons. Maximal oxygen uptake is an objective measure of the individual's aerobic exercise capacity and performance (2, 3, 12). Despite the fact that there is no generally accepted definition of exercise intensity, measurement of gas exchange during field testing can furnish rich information about the intensity of exercise or whole practice (9, 10).

Despite advances in the field measurement of breathing gases (9), there are some difficulties in assessment of training intensities during sport games like soccer or basketball because portative gas exchange analysers can influence performance in sports-specific activities. Heart rate monitoring is a suitable tool for expressing exercise intensity (1, 10). Current heart rate monitors have no limitation effect on performance in sport-specific activities and are widely used for monitoring of training in soccer and basketball (1, 4, 7, 11).

In previous research we showed correlation between laboratory-tested aerobic exercise capacity and intensity of basketball-specific exercise during real practice (7). Our findings support arguments for the benefits of aerobic capacity in competitive basketball players (7).

The aim of this study was to determine and to assess the permanence of correlations between aerobic capacity and intensity of basketball-specific exercise performed within a four-week interval.

MATERIAL AND METHODS

Eight competitive male basketball players participated in this study after being informed of all related procedures, risks, and stresses and after providing their written consent. First the anthropometric indices of the participants were determined. Standing height was measured without shoes to the nearest 1.0 cm using a stadiometer model 220 (Seca, Germany). Body weight was measured to the nearest 0.1 kg using an electronic digital scale model 770 (Seca, Germany).

Cardiopulmonary exercise tests were conducted using an electrically braked cycle ergometer Ergoline 800 (Ergoline, Bitz, Germany). Power output was increased by 25 W at every minute and pedalling cadence was kept constant at 60–70 rpm. All tests were carried out under laboratory conditions complying with the ATS regulations (3). Calibration of the flow/volume sensor was achieved immediately before each test by manually pumping a three-liter syringe through the flow meter at a rate similar to that achieved during the exercise test. Continuous respiratory gas analysis and volume measurements were performed breath-by-breath during the test using an automated system VMAX229C (Sensormedics Corps., Yorba Linda, CA, USA). Time based (every 20 sec) mean values of oxygen uptake, heart rate, oxygen pulse and the respiratory exchange ratio were obtained using the VMAX229 gas analyser. The exercise tests were terminated upon volitional exhaustion, or when conventional criteria were reached.

The following variables were sampled for analysis in all eight subjects: maximal oxygen uptake (VO_2max), maximal heart rate (HRmax), oxygen pulse at the peak of cardiopulmonary test (oxyPuls), respiratory quotient (RQ), minute ventilation at the peak of exercise (VEmax), power output at the peak of cardiopulmonary test (Wmax).

The athletes performed a number of exercises during basketball practices. We selected 3.5 minutes shooting exercise as basketball-specific activity. For this exercise, the players were instructed to start shooting from the 3-point line after an audio signal. After every shoot the player ran to fetch the ball, ran dribbling back to the 3-point line and shot again. This activity continued for 3.5 minutes until stopped by the audio signal. Such basketball-specific exercise was performed in real practices twice within four weeks. Exercise intensity distributions were determined using heart rate. Heart rate was monitored using Polar Team System (Polar Electro Oy, Finland) throughout the 3.5 minutes shooting exercise. The collected data was transferred to a PC with the Polar Interface Recharging Unit and processed with the Polar Precision Performance software to determine the peak and average heart rates of each subject during the 3.5 minutes shooting exercise. Spearman's nonparametric rank test was used to evaluate relationships between the parameters of exercise intensity (peak and average heart rates during 3.5 minutes shooting exercises) and between the selected indices of cardiopulmonary testing. Paired sample t-tests compared the variables of intensity during basketball-specific activity performed twice. All statistical analyses were conducted using SPSS for Windows, version 11.0. The level of significance was set a priori at 0.05.

RESULTS

The main characteristics of the investigated athletes are presented in Table 1.

Table 1. Anthropometric indices of the study subjects.

No.	Parameters	Mean±SD	Low	Maximum
1.	Age (years)	22.63±2.97	19	28
2.	Height (cm)	200.13±6.38	190	209
3.	Body mass (kg)	93.88±11.01	80.0	110.4
4.	Body mass index (kg/m^2)	23.36±1.49	21.04	25.18

All investigated subjects completed cardiopulmonary testing procedures and training sessions successfully. Table 2 displays the main parameters measured or established during cardiopulmonary testing. These results are comparable with other findings regarding aerobic fitness of basketball players.

Table 2. Cardiopulmonary testing parameters of the study subjects.

No.	Parameters	Mean±SD	Low	Maximum
1.	VO_2max (l/min)	4.33±0.63	3.45	5.14
2.	Wmax (W)	326.5±37.66	279	381
3.	HRmax (bpm)	170.5±12.94	152	193
4.	VEmax (l/min)	124.7±9.74	109.8	144.1
5.	OxyPuls (ml/bpm)	24.86±5.68	18.5	34.1
6.	RQ	1.13±0.04	1.07	1.18

The mean intensities of the sport-specific exercises expressed as the percentage of individual maximum heart rate were 80.48±2.56% (exercise performed for the first time) and 78.0±4.67% (exercise repeated after four weeks). The peak intensities of sport-specific exercises expressed as the percentage of individual possible maximum heart rate were 87.16±3.38% and 86.15±4.15% respectively. There were no statistically significant differences between the intensities of basketball-specific exercises when the paired samples t-test was used. Very strong positive correlations occurred between the mean and the peak intensities of the studied exercises (r as a minimum of 0.892; p as a minimum of 0.003).

Figures 1 and 2 illustrate the established correlations. Our data confirm that the intensity analysed during 3.5 minutes shooting exercises is well reproducible.

Table 3 gives the results of Spearman's nonparametric rank test. We established strong correlation of oxyPuls with the mean and peak intensities of basketball-specific exercise performed for the first time (r –0.731, p 0.040 and r 0.683, p 0.062) and with the respective intensities of the exercise repeated after four weeks (r –0.826, p 0.011 and r –0.814, p 0.014).

The correlation coefficient r was high in all comparisons between VO_2max and the intensities of sport-specific activity but the value of statistical significance was higher than critical. Despite some trend of relationship between VO_2max and intensity of basketball-specific activity is evident.

Surprisingly, there was no correlation between HRmax during cardiopulmonary testing and intensities of sport-specific activity. Nor did RQ at the peak of laboratory testing correlate with intensities of sport-specific activity.

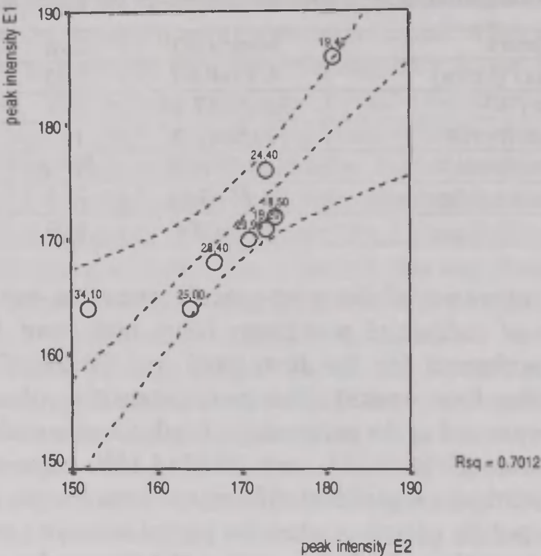

Figure 1. Scatterplot of intensity peaks during basketball-specific exercises labeled by oxygen pulse.

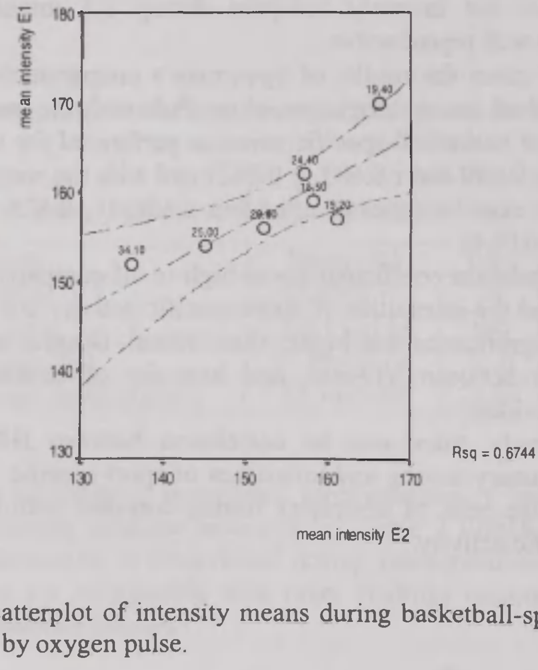

Figure 2. Scatterplot of intensity means during basketball-specific exercises labeled by oxygen pulse.

Table 3. Correlations between variables of laboratory testing and the intensities of sport-specific activity of the study subjects.

Para-meters	Statistical variable	Mean intensity E1	Peak intensity E1	Mean intensity E2	Peak intensity E2
VO2max	r	**–.755**	–.683	–.611	–.659
	p	**.031**	.062	.108	.076
HRmax	r	–.012	–.120	.180	.072
	p	.978	.778	.670	.866
RQ	r	.176	.121	.370	.291
	p	.677	.775	.367	.485
oxyPuls	r	**–.731**	–.683	**–.826**	**–.814**
	p	**.040**	.062	**.011**	**.014**
Wmax	r	–.443	–.371	–.108	–.228
	p	.271	.365	.800	.588
VEmax	r	–.371	–.335	–.180	–.263
	p	.365	.417	.670	.528

Significant correlations are in bold. E1 – first performed exercise, E2 – exercise repeated after four weeks.

DISCUSSION

The present study is the first attempt to investigate relationship between the main variables of cardiopulmonary testing and intensity of basketball-specific exercises during a definite period of time. The results of the study indicate that not all key variables of cardiopulmonary testing correlate with intensity of activities during a sport game. The established correlations confirmed association between intensity of sport-specific activity and quality of aerobic energy production. Lower HR during basketball-specific activity is associated with higher aerobic capacity. Higher aerobic capacity was identified as advantage in soccer (11). In the light of our results it can be maintained that higher aerobic capacity is a favourable condition in basketball as well. The established correlations between oxygen pulse and intensity of sport-specific exercises remained stable compared to the second exercise after four weeks. As there were no significant differences in the intensities of basketball-specific exercise as determined by the paired t-test, we could suggest that changes in the aerobic capacity of the studied subjects can not be tangible during this period of time. This suggestion is in accordance with literature data (8).

When elite athletes are investigated, the number of subjects usually is small, which could explain the loss of significance of correlation between exercise intensity and VO_2max.

Correlations have been confirmed for other fields of sports between the heart rates attained during laboratory testing and real sport activities (5, 6). We could not confirm correlations between heart rate during laboratory testing and real sport-specific exercise. Probably, it is associated with the performance of different patterns of activity. The attained values of the respiratory quotient indicated sufficient volitional efforts of the study subjects during cardiopulmonary testing (2, 3, 12). Despite numerous of determinants of the respiratory exchange ratio, such as training volume, dietary intake, muscle fibres composition, and enzyme activity, there was no high inter-personal variability in RQ at the peak of cardiopulmonary testing. This could be related to absence of correlation with exercise intensity.

Extrapolation of the data of laboratory testing to real conditioning is a highly complicated task of complex nature. The established stable correlations between aerobic capacity and basketball-specific activity can be used for planning of more rational conditioning in male basketball.

Basketball players have to develop aerobic performance (general endurance) allowing to achieve better economy in sport-specific activities and to accelerate recovery from anaerobic loads.

REFERENCES

1. Achten J., Jeukendrup A. E. (2003) Heart rate monitoring: applications and limitations. Sports Med 33 (7), 517–38.
2. ACSM's Guidelines for exercise testing and prescription. (2000) 6th edition. Philadelphia: Lippincot, Williams & Wilkins.
3. American Thoracic Society & American College of Chest Physicians (ATS/ACCP) (2003) Statement on cardiopulmonary exercise testing. Am J Respir Crit Care Med 167 (2), 211–77.
4. Batt M. E., Jaques R., Stone M. (2004). Preparticipation examination (screening): practical issues as determined by sport: a United Kingdom perspective. Clin J Sport Med. 14 (3), 178–82.
5. Boudet G., Garet M., Bedu M., Albuisson E., Chamoux A. (2002). Median maximal heart rate for heart rate calibration in different conditions: laboratory, field and competition. Int J Sports Med 23, 290–297.

6. Chamari K., Moussa-Chamari I., Galy O., Chaouachi M., Koubaa D., Hassen C. B., Hue O. (2003). Correlation between heart rate and performance during Olympic windsurfing competition. Eur J Appl Physiol 89 (3–4), 387–92.
7. Gocentas A., Landõr A., Andziulis A. (2004). Dependence of intensity of specific basketball exercise from aerobic capacity. Papers on Anthropology 13, 9–17.
8. Laplaud D., Hug F., Menier R. (2004) Training-induced changes in aerobic aptitudes of professional basketball players. Int J Sports Med 25 (2), 103–8.
9. Meyer T., Davison R. C., Kindermann W. (2005). Ambulatory gas exchange measurements – current status and future options. Int J Sports Med 26, Suppl 1, S19–27.
10. Saris W. H., Antoine J. M., Brouns F., Fogelholm M., Gleeson M., Hespel P., Jeukendrup A. E., Maughan R. J., Pannemans D., Stich V. (2003). PASSCLAIM – Physical performance and fitness. Eur J Nutr 42, Suppl 1, I50–95.
11. Stolen T., Chamari K., Castagna C., Wisloff U. (2005). Physiology of soccer: an update. Sports Med 35 (6), 501–36.
12. Wasserman K., Hansen J. E., Sue D. Y., Casaburi R., Whipp B. J. (1999) Principles of exercise testing and interpretation. 3rd edition. Philadelphia: Lippincott, Williams & Wilkins.

Papers on Anthropology XV, 2006, pp. 64–82

ANTHROPOLGICAL MATERIAL FROM THE LATE IRON AGE BARROW CEMETERY IN LINDORA

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ABSTRACT

The paper gives the morphological characterisation of the South-East Estonian Lindora (11^{th}–13^{th} cc) barrow cemetery population in comparison with contemporaneous materials from North-East Estonia and the neighbouring districts. The number of buried individuals was 16, including 4 children. Lindora population appeared to be characterized by narrow and high dolichocranic braincase of medium length, narrow leptenic face and rather wide nose. The male population is characterised by comparatively gracile long limb bones and tall body stature. Lindora population differs from the mesocranial population of Jõuga barrow cemetery in North-West Estonia as well as from the contemporaneous dolichocranic population of Estonian pit graves.

The craniums of Lindora share the strongest similarities with cranial samples from 12^{th}–13^{th} cc Tammiku population of Estonia, South-East Ladoga district in Novgorod region, the upper reaches of the Plyusa River and the vicinity of Izborsk and from the ancient territories of Mordovia and Merya.

Key words: South-East Estonia, 11^{th}–12^{th} cc, craniology, osteology, body stature, morphological type

INTRODUCTION

According to paleoanthropological data two anthropological types can be distinguished on the territory of Estonia at the beginning of the II millennium AD (11^{th}–13^{th} cc): the massive dolichocranic type with a long head and high face occurs almost everywhere in Estonia being related to inhumations in pit graves (Küti in Virumaa, Haimre and Martna in Läänemaa, Õvi and Lahepera in northern Tartumaa; Kaberla in Harjumaa; Karja in Saaremaa, Pada in Virumaa) [10, 7]. The representatives of this anthropological type were of tall stature [11, 7]. The second anthropological type – gracile, mesocranial, with a lower and broader face is represented by crania from the 11^{th}–14^{th} cc. barrows of North-East Estonia (Jõuga, Pühtitsa). The body stature of this population was smaller [11]. K. Mark presumed that the latter anthropological type should also occur in South-East Estonia, as some skulls from the 11^{th}–12^{th} century barrows of Verepkovo, south of Pechory in Setomaa, also proved to be with a short head and a low and broad face resembling those in the barrows of North-East Estonia [10].

Some frequencies of traits in population-genetic and odontological material, characteristic of more western populations, are still discernible in some districts of South-East Estonia [13]. The formation of these peculiarities cannot extend into distant past. It seems that in South-East Estonia the earlier contacts with Latgals and their common substratum should be also taken into consideration, as well as the earlier contacts with districts in the south-eastern direction. To observe the formation of the population of South-East Estonia, paleo-anthropological material is of special interest.

From the 11^{th} century inhumation burials began to spread increasingly alongside with cremations. At the beginning of the 2^{nd} millennium AD the population of the western districts of Estonia buried their dead in pit graves, while in the eastern parts of the country, in North-East and South-East Estonia, burials in barrows were spread. The earliest paleoanthropological material from inhumation burials in South-East Estonia comes from Lindora barrow cemetery dating from the late 11^{th} and the early 12^{th} centuries. This population was doubtless one of the components in the formation of the morphological type of the present-day South-East Estonian population.

The grave goods of Lindora burials, especially women's adornments (earrings with three beads, coin pendants as well as pottery) reveal similarities with the antiquities of more eastern regions, e.g. those of Samolva, Verepkovo, Mõla, Laura and Kendishi but also with barrows between the Rivers Zeltcha and Chernaya [9, 20, 28].

This paper gives the morphological characterisation of the 11^{th}–12^{th} cc. population of Lindora in comparison with analogous materials from North-East Estonia and the neighbouring regions.

MATERIAL AND METHODS

Lindora barrow cemetery of the Late Iron Age (the late 11th – the early 12th centuries) is situated in South-East Estonia, 19 km east of Võru, on the terrace of the small river of Raagoja, which flows into the Piusa River (Fig. 1). The cemetery consisted of 16 round sand barrows and was archaeologically excavated in 1977 and 1978 [23, 24]. Each barrow contained a single individual, buried in a pit underneath the barrow with their heads pointing towards the west or the north-west. Only one deceased (barrow IV) had been buried with her head towards the south-west. On the basis of archaeological finds, the barrows were dated to the second half of the 11th and to the first half of the 12th century. The osteological material was generally poorly preserved. Two individuals (female burial VII and child burial XIII) were too decayed to be recovered. The skeletal material from Lindora, 14 individuals in total, is deposited at the Institute of History, except skeleton III (a middle-aged female) which is exhibited at Võru museum. This skull was measured by K. Mark, whose data are used in this paper.

The age and gender of the skeletons were determined by conventional methods [1, 16]. The skeletal material was measured according to the methodology of Martin and Saller [14]. The stature of the Lindora skeletal population was estimated on the basis of maximum lengths of long bones using the methods of Trotter and Gleser [15] and Gerhards [2].

For comparison the author measured the skulls from Verepkovo barrows (11th–12th cc) in the vicinity of Pechory and of different dates from various barrows in the vicinity of Izborsk (excavated by various archaeologists in the 1920s–1930s). The barrows in the vicinity of Izborsk (Mõla and Novaya) also belong to the beginning of the 2nd millennium AD (11th–13th cc) [19, 26]. The dolichocranial skulls from that sample are used for comparison in this paper. The dolichocranial skull from “Slovenskoye pole” of Izborsk was included in that group, too.

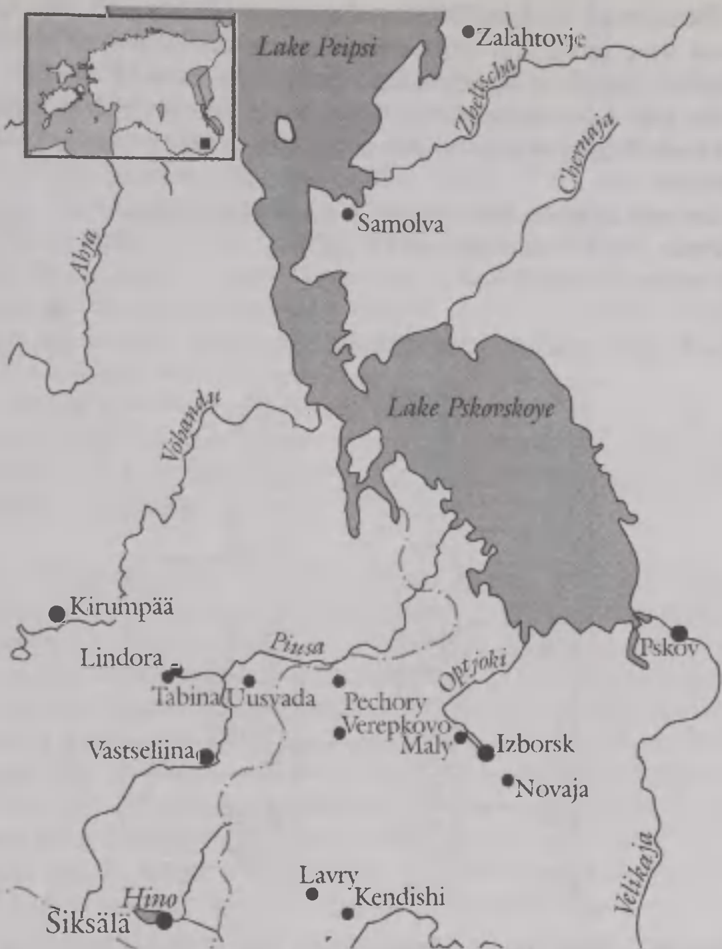

Figure 1. Location of the Lindora XI–XII barrow cemetery in South-East Estonia.

RESULTS AND DISCUSSION

Age and gender of individuals buried in the barrows of Lindora are given in Table 1. Age distribution among the burials (total 16) is: children – 4 individuals (25%), *juvenilis* – 3 (18,75%), *adultus* – 3 (18.75%), *maturus* – 3 (18.75%), *senilis* – 2 (12.5%), *adultus/senilis* – 1 (6.2%).

The ratio of children (25%) in the population is small. No infant burials were found (for comparison: among the Siksali 12^{th}–15^{th} cc. cemetery population in South-East Estonia the ratio of children was 43.8%) [8]. It can be presumed that some of young children's graves have been destroyed or remained beneath the road on the verge of the cemetery.

The ratio of males and females in the population was:
Males (16–19 and older) – 5 (31.25%)
Females – 7 (43.75%).

Table 1. Age and gender of individuals.

No.	Gender	Age
I	Male	40–45
II	Female	> 60
III	Female	Mat.
IV	Female	18–19
V	Male	55–60
VI	Child	~5
VII	Female	?
VIII	Male	25–30
IX	Female	16–18
X	Female	40–45
XI	Male	18–19
XII	Child	~2
XIII	Child	?
XIV	Female	30–35
XV	Male	25–30
XVI	Child	~8

Among the skulls, only the labidodontic type of dental occlusion was observed (3 individuals). Neither diastem nor crowding was observed among the material. Caries occurred in 4 cases among 13 individuals (30.8%), *cribra orbitalia* in 3 cases among 13 individuals (23.1%). *Sutura metopica* occurred in 3 males out of 5 (60% among the male population).

Cranilogical characterisation. The male population of Lindora is characterised by very narrow dolichocranial skulls of medium length (index 71.3) (Table 2, 5). The braincase is high, with moderate or small minimal frontal breadth. According to the height-length ratio the skulls are hypsicranic (index 76.2), and to the height-breadth ratio –

acrocranic (index 108.1). The relief of the frontal and occipital bones is moderately developed.

According to the upper facial index leptenic (index 57.5) the face is narrow and of medium height in both males and females, and according to the facial index (97.6) leptoprosopic. Orbits are low and of medium breadth with small orbital index (77.1), mesokonchik in shape. The nose is of medium height and medium width; according to the nasal index (52.0) the individuals are broad-nosed; the nasal prominence angle is large; nasomalar and zygomaxillar angles are small; the face is well profiled. Dacryal as well as simotic height is large; the breadth measurements are medium. Fossa canina is quite low (3–4 mm).

According to its preserved parts, male skull XI was also dolichocranic in shape like the others, with mesokonhic orbits (orbital breadth – 32 mm, height – 42 mm), and with mesorhin nose (nasal height – 46, breadth –23 mm).

Post-cranial skeleton. The measurement data of long limb bones of Lindora 11^{th}–12^{th} cc male population show that the length of all limb bones were above the medium (Table 6). Length of femur varies within the male population of Lindora from 450–495 mm. According to the ratio between circumferences and lengths of limb bones, the Lindora males have the smallest indices among the comparable male populations in Estonia (Pada 12^{th}–13^{th} cc from North Estonia [6], Makita 12^{th}–17^{th} cc from South-East Estonia [5] and North Estonian males from Kaberla in 13^{th}–15^{th} as well as in 15^{th}–17^{th} cc [11]). That means that the length measurements of Lindora males are bigger and circumferences and diameters smaller in absolute measures: the long limb bones of Lindora males are more gracile compared to the others (Table 3). The pilaster and platymer indices of the femur, however, are bigger in Lindora. According to the higher diaphysis index, the femur is eurymer at the case in Lindora, and the others – platymer.

When all long bones were taken into consideration, stature calculated according to Trotter and Gleser's method [15] was 175.3 cm, and according to Gerhard's method [2] – 174 cm. Calculations from upper limb bones gave somewhat taller stature than from lower limb bones [5, 6]. As upper long limb bones were badly preserved and all of them could not be measured, men's stature was compared as calculated from the left femur. Using Gerhard's method, body stature varied from 170.2 cm (burial I) to 177.4 cm (burial XV), the average being 174 cm.

Table 2. 11^{th}–12^{th} century Lindora craniums and comparative materials

Martin No., Trait	Lindora, 11^{th}–12^{th} cc	Tammiku, 12^{th}–13^{th} cc	Verepkovo, 11^{th}–12^{th} cc	Jõuga, 11^{th}–14^{th} cc	Karja, 13^{th} c	Izborsk, 12^{th}–13^{th} cc	SE Ladoga, 11^{th}–13^{th} cc
1. Cranial length	183.5(4)	187.3(3)	173.3(3)	184.9(18)	190.7(11)	192.3(3)	185.6(17)
8. Cranial breadth	130.3(4)	135.7(3)	137.0(3)	141.3(18)	134.8(11)	135.0(3)	136.0(16)
17. Cranial height	138.3(3)	137.7(3)	132.3(3)	137.1(22)	136.4(8)	139.3(3)	135.5(15)
9. Min. frontal breadth	94.5(4)	96.0(3)	94.3(3)	98.5(10)	96.0(10)	93.0(3)	93.2(17)
45. Bizygomatic breadth	128.3(3)	125.0(2)	130.0(2)	134.0(6)	131.7(11)	127.0(2)	125.6(5)
48. Upper facial height	72.3(3)	67.5(2)	62.0(3)	67.9(17)	73.3(11)	66.5(2)	69.0(10)
55. Nasal height	51.3(3)	48.0(2)	46.0(3)	49.2(9)	52.1(10)	49.3(4)	49.9(12)
54. Nasal breadth	26.7(3)	24.2(2)	26.0(3)	25.1(9)	23.3(10)	24.3(4)	25.3(12)
51. Orbital breadth	42.0(3)	42.0(2)	40.5(2)	41.6(10)	42.2(10)	42.0(4)	42.4(10)
52. Orbital height	32.3(3)	31.7(2)	28.0(3)	31.6(10)	32.0(10)	33.0(3)	32.5(10)
77. Nasomalar angle	135.8(4)	135.8(3)	138.1(2)	137.4(3)	139.0(10)	139.4(2)	132.8(10)
Zygomaxillar angle	125.9(2)	122.8(2)	131.8(2)	127.0(5)	126.9(9)	127.3(2)	126.8(2)
75(1). Nasal angle	29.0(2)	22.0(1)	28.3(3)	29.0(1)	28.3(3)	29.0(1)	23(1)
DS:DC. Dacryal i.	53.5(3)	63.6(2)	47.1(2)	55.2(10)	63.5(7)	56.9(2)	
SS:SC. Simotic i.	51.3(4)	45.2(2)	42.2(2)	46.6(10)	51.7(10)	43.6(2)	47.0(8)
8:1. Cranial index	71.3(4)	72.4(3)	79.0(3)	76.4(18)	70.8(11)	70.2(3)	74.4(16)
48:45. Upper facial i.	57.5(2)	54.1(2)	46.5(2)	50.7(6)	55.7(11)	52.5(2)	56.1(3)
52:51. Orbital index	77.1(3)	76.4(2)	67.9(2)	76.5(10)	75.8(10)	79.3(3)	76.4(9)
54:55. Nasal index	52.0(3)	51.1(2)	56.6(3)	51.3(9)	44.6(10)	49.3(4)	50.0(12)

Table 3. Comparative data of indices of limb bones and femur length

Index, Trait	Lindora, 11^{th}–12^{th} cc	Pada, 12^{th}–13^{th} cc	Makita, 13^{th}–17^{th} cc	Kaberla, 12^{th}–15^{th} cc	Kaberla, 15^{th}–17^{th} cc
H7:H1	16.7	19.9	20.5	21.9	21.2
H6:H5	71.2	77.5	82.5		
F8:F2	18.2	20.5	20.2	20.8	20.5
F6:F7	104.8	99.0	98.6		
F10:F9	86.9	78.4	83.3		
T10b: T1	19.6	20.9	21.4	21.7	21.4
F1	473 mm	454.3 mm	449.8 mm	449.0 mm	457.8 mm

Thus, we can say that Lindora Late Iron Age males were tall in stature. They were as tall as the males of that period in West Estonia and in Verepkovo, south of Pechory [7]. The whole Late Iron Age male population of Estonia was similar body height. Only the body stature of the 12^{th}–14^{th} cc males from Jõuga (North-East Estonia [11, 7] was lower. Long limb bones of Lindora male population (in comparison with other Estonian populations) can be characterised as comparatively gracile.

Although Lindora population was small in number of individuals, it was morphologically quite homogeneous, which makes it possible to give a preliminary overview of it. The average measurements of Lindora, Verepkovo and Izborsk cranial samples are given in Table 2 in comparison with some contemporaneous cranial samples from Estonia and from North-East Ladoga district of Novgorod region.

By its average measurements the Lindora population of 11^{th}–12^{th} cc differs from the contemporaneous mesocranial type of population, buried in north-eastern Jõuga barrow cemetery especially by the narrower head and face measurements and higher face (Table 2). The differences with the mesocranial Verepkovo barrow cemetery population in Pechory district are greater than between Lindora and Jõuga populations. The Verepkovo population differs from Lindorast by a lower braincase, by about 10 mm lower and a flatter face, by a lower nasal root, lower orbits and a wider nose.

From the massive dolichocranial West-Estonian pit-grave burials as Karja population (on Saaremaa Island), Lindora population differs by the smaller braincase and face breadth measurements, with wider nose.

On the basis of 10 craniometric traits the Lindora male sample was compared by the method of cluster analysis with 23 cranial samples from Estonia, Latvia, some areas of Novgorod region and with some samples from the ancient Mordovian and Merya territories (Table 4, Fig 2).

Table 4. Average measures of the compared cranial samples on the dendrogram by clusters (or cluster parts)

Martin No. of traits	Numbers of samples								
	7	15, 21, 22, 18	1	16, 2, 23	11, 3	5, 6, 10, 17,	9, 14, 4, 19, 20	12, 13	8
1	173.3	183.3	183.5	188.4	191.7	188.8	184.7	183.2	181.0
8	137	133.5	130.8	135.6	135.1	140.2	141.3	138.6	144.8
17	132.3	134.5	138.3	137.5	136.2	138.9	137.2	133.7	132.0
9	94.3	94.9	94.5	94.1	97.2	98.3	97.7	96.7	98.8
45	130.0	131.9	128.3	125.9	131.7	136.4	132.6	130.3	132.0
48	62.0	66.4	72.3	67.7	72.1	71.6	68.6	70.5	67.0
55	46.0	48.9	51.3	49.1	51.9	51.2	49.6	51.9	51.5
54	26.0	25.5	26.7	24.7	24.3	25.1	25.4	25.1	24.3
51	40.5	41.7	42.0	42.1	42.7	43.1	42.6	42.7	41.0
52	28.0	31.5	32.3	32.4	33.0	32.2	31.8	33.9	31.7

Sources: 1, 7, 23 – data of the present author; 6, 9 – Heapost 1993 [3], 2006 [8]; 2–5, 8 – Mark 1956 [10], 1962 [11], 1965 [13]; 10 – Алексеев 1969 [17]; 11–14 –Денисова 1975 [21], 1977 [22]; 15–16 – Санкина 2000 [25]; 17– Хартанович, Чистов 1984 [27]; 18–22– Алексеева 1973 [18].
The numbers of series coincide with those given in Fig. 2.

In Figure 2, Lindora sample is located in the first cluster, which includes, one the one hand, dolichocranicial samples: Kotorsk (11th–13th cc) from the lower reaches of the Plyusa River in Novgorod Land, Vjatichis (11th–14th cc) and Krivichis (11th–13th cc) from the ancient Merya territory, and Tsna (8th–10th cc) from Oka district. On the other hand, there are similarities with the Estonian Tammiku sample from Rakvere district and summary series of inhabitants (11th–13th cc) of south-east Ladoga near the rivers Ojat' (Vepsian *Ajät'*), Pasha (Veps. *Pakšjogi*,), Kapsha (Veps. *Kapšjogi*) and Tihvinke.

Dolicho-mesocranial and mesocranial samples are located in the second cluster. The first part of that cluster consists of massive dolicho-mesocranial samples with large measurements: Siksali (12th–13th cc) from South-East Estonia, Latgals (Odukalns sample of 9th–11th cc), Kaberla (13th cc) from North Estonia, Begunitsy (12th–13th cc) from the Izhorian plateau. That grouping of cranial samples is

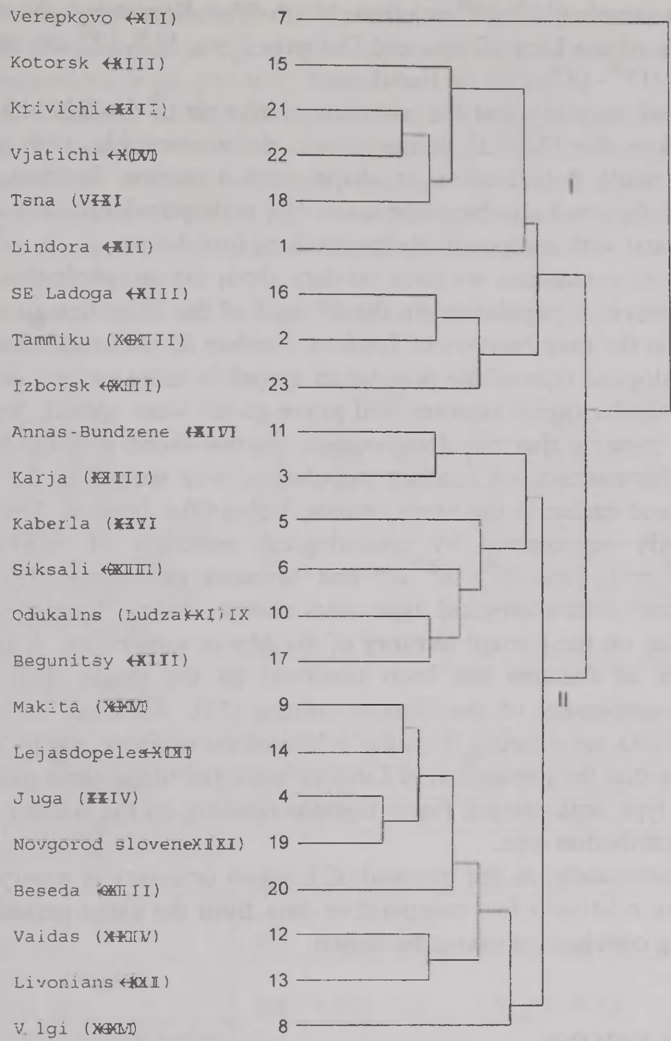

Figure 2. Comparison of cranial samples.

close to the massive, dolichocranic samples of Karja (12th–13th cc) from Saaremaa Island and Annas-Bundzene (13th–14th cc) from northern Latvia. The other part of the second cluster consists of more gracile mesocranial samples: Makita (13th–14th cc from South-East Estonia), Lejasdopeles (11th–12th cc) – the Seli sample from Latvia, Jõuga (11th–14th cc) from North-East Estonia and, close to them, Novgorod "Slovene" (11th–13th cc). That grouping also includes the

Beseda sample (11^{th}–13^{th} cc) from North-West Russia and the cranial samples of the Livs (Gauja and Daugava Livs, 11^{th}–12^{th} cc) and the Vaidas (13^{th}–14^{th} cc) from East Latvia.

So we may say that the morphological type of the inhabitants of Lindora in the 11^{th}–12^{th} centuries was dolichomorphic, with a high cranial vault, dolichocranic in shape, with a narrow, leptenic, well-profiled face and a rather wide nose. The male population was of tall stature and with comparatively gracile long limb bones.

Due to cremations we have no data about the morphological type of the previous population (in the 2^{nd} half of the 1^{st} millennium AD) buried in the long barrows of Lindora. Neither do we know about the morphological type of the population spread in more eastern districts where similar burial customs and grave goods were spread. Still we should mention that the dolichocranic narrow-faced anthropological type, characteristic of Lindora population, was spread in the same period and earlier in the more eastern, Volga-Oka districts. That type is clearly represented by craniological materials of Seliksenski (2^{nd}–7^{th} cc.), Tsna (8^{th}–10^{th} cc) and Muransk cemeteries [18]. The analogical anthropological type also occurs among Vyatiches and Kriviches on the ancient territory of the Merya substratum. A similar complex of features has been observed on the single skull from Troitsk settlement of the Diakov culture [18]. Although anthropological data are missing from the intermediate territory, we may still presume that the population of Lindora belonged to the same morphological type with eastern Finno-Ugrians residing on the western limit of its distribution area.

Unfortunately, as the material of Lindora cemetery is scanty, and there are relatively few comparative data from the same period, far-reaching conclusions cannot be drawn.

CONCLUSIONS

1. The population of the Lindora barrow cemetery of the 11^{th}–12^{th} centuries is distinguished by dolichomorphic morphological type with dolichocranic narrow and high braincase, with narrow, leptenic face, by comparative gracile long limb bones and tall stature.
2. The craniums of Lindora differ from the mesocranial craniums of the barrow cemeteries of North-East Estonia as well as from those of Verepkovo barrow cemetery of Pechory district.

3. Lindora population also differs from the massive dolichocranic high-faced anthropological type with a leptorrhine nose, related to inhumations in pit graves in Estonia in 11th–13th cc.
4. The craniums of Lindora share the strongest similarities with cranial samples from South-East Ladoga district in Novgorod region, the contemporaneous craniums from the region of the upper reaches of the Plyusa River and the vicinity of Izborsk and from the ancient territories of Mordovia and Merya.

Table 5. Individual and average measurements of skulls from Lindora barrow cemetery.

Martin No, trait	Males				M(n)	Females	
	I	V	VIII	XV		III	IV
1. Cranial length	176	189	186	183	183.5(4)	182	
8. Cranial breadth	129	139	124	129	130.3(4)	132	
17. Basion-bregma height	137		138	139	138.3(3)	129	
5. Cranial base length	96		104	100	99.7(3)	100	
20. Porion-bregma height	113		115	114.5	114.2(3)	106	
9. Minimum frontal breadth	91	100	93	94	94.5(4)	85	95
10. Maximum frontal breadth	114		112	115	114.0(3)	103	
11. Biauricular breadth	118		115	116	118.3(3)	114	
12. Occipital breadth	108	112	112	109	104.7(3)	109	
25. Median sagittal arc	370	385	378	377	377.5(4)		
26. Median sagittal frontal arc	130	137	134	126	131.8(4)		
27. Median sagittal parietal arc	132	138	132	138	135.0(4)		
28. Median sagittal occipital arc	108	110	112	113	110.8(4)		
29. Median sagittal frontal chord	115	120	116	112	115.8(4)		
30. Median sagittal parietal chord	115	121	115	121	118.0(4)		
31. Median sagittal occipital chord	91	90	95	98	93.5(4)		

Table 5. Continuation

Martin No, trait	Males				M(n)	Females	
	I	V	VIII	XV		III	IV
8:1. Cranial index	73.3	73.5	67.7	70.5	71.3(4)	72.5	
17: 1. Length-height index	77.8		74.7	76.0	76.2(3)	70.88	
17:8. Breadth-height index	106.2		110.3	107.7	108.1(3)	97.73	
9:8. Transverse fronto-parietal index	70.5	71.9	73.8	72.9	72.3(4)	64.39	
9:10. Transverse frontal index	81.2		83.0	81.7	82.0(3)	82.52	
26:25. Fronto-sagittal index	35.1	35.6	35.4	33.4	34.0(4)		
27:25. Parieto-sagittal index	35.7	35.8	34.9	36.6	35.8(4)		
28:25. Occipito-sagittal index	29.2	28.6	29.6	30.0	29.4(4)		
29:26. Sagittal frontal-index	88.5	87.6	86.6	88.9	87.9(4)		
30: 27. Sagittal parietal-index	87.1	87.7	87.1	87.7	87.4(4)		
31:28. Sagittal occipital-index	84.3	81.8	84.8	86.7	84.4(4)		
40. Basion-prosthion length			98	99.0	98.5(2)	100	
43. Upper facial breadth	106.0	105.0	105.0	103.0	104.8(4)	95 ?	
45. Bizygomatic breadth	133.0		126	126	128.3(3)	120 ?	
46. Middle facial breadth			93.0	97.0	95.0(2)	86	
47. Facial height			125	121	123.0(2)	117 ?	105
48. Upper facial height		72.0	72.0	73.0	72.3(3)	67	64
51. Orbital breadth	40.0		44.0	42.0	42.0(3)	31	40
52. Orbital height	32.0		33.0	32.0	32.3(3)	39	29
54. Nasal breadth		27.0	26.0	27.0	26.7(3)	24	23
55. Nasal height		52.0	52.0	50.0	51.3(3)	46 ?	45.0

Table 5. Continuation

Martin No, trait	Males				M(n)	Females	
	I	V	VIII	XV		III	IV
40:5. Face prominence index			94.2	99.0	96.9(2)	100	
45:8. Transverse cranio-facial index	103.1		100.0	97. 7	100.3(3)	90.9	
48:45. Upper facial index			57.1	57.9	57.5(2)	55.8	
47:45. Facial index			99.2	96.0	97.6(2)	97.5	
48:17. Vertical cranio-facial index			51.8	52.5	52.2(2)	51.9	
52:51. Orbital index	80.0		75.0	76.2	77.1(3)	79.5	72.5
54:55. Nasal index		51.9	50.0	54.0	52.0(3)	52.2	51.1
44. Biorbital chord	98.0	97.0	100.0	99.8	98.7(4)	90.0	
Height of *n* from biorbital chord	17.0	23.3	21.0	19.0	20.1(4)	18.0	
Zygomaxillar chord			92.0	96.0	94.0(2)		
Height of *ss* from zm chord			24.0	24.0	24.0(2)		
DC. Dacryal chord		24.0	23.0	22.5	23.2(3)	21.5	20.0
DS. Dacryal height		12.9	12.0	12.30	12.4 (3)	13.4	10.6
SC. Simotic chord	9.0	10.0	9.0	8.90	9.2(4)	9.50	
SS. Simotic height	4.6	5.0	4.5	4.8	4.7(2)	4.6	
77. Nasomalar angle	141.8	128.7	134.4	138.4	135.8(4)	136.4	
Zygomaxillar angle			124.9	126.9	125.9(3)		
DS:DC. Dacryal index		53.8	52.2	54. 7	53.5(3)	62.3	53.0
SS:SC. Simotic index	51.1	50.0	50.0	53.9	51.3(4)	48.4	44.4
72. Total facial angle			82.0	80.0	81.0(2)	79.0	
73. Middle face profile angle			83.0	81.0	82.0(2)		
74. Alveolar profile angle			74	73	73.5(2)		
75(1). Nasal angle			28	30	29.0(2)		
32. Frontal profile angle (n-m)			79	79	79.0(2)	80	
Frontal profile angle (g-m)			72	70.0	71.0(2)	74.0	

Table 6. Osteometric measurements and indices

Trait nr	Side	Males					M(n)	Females		M(n)
		I	V	VIII	XI	XV		X	XIV	
Humerus										
1. Maximum length	l					354	354(1)			
	r			358			358(1)			
2.Total length	l									
	r			352			352(1)			
5. Max mid-diaphysis diameter	l			23		21	22(2)			
	r			23		23	23(2)			
6. Min mid-diaphysis diameter	l			16		16	16(2)			
	r			16		16	16(2)			
7. Min diaphysis circumference	l			61		58	59.5(2)			
	r			61		60	60.5(2)			
7a. Mid-diaphysis circumference	l			66		61	63.5(2)			
	r			66		63	64.5(2)			
10. Vertical diam. of caput humeri	l					44?	44(1)			
	r									
Femur										
1.Maximum length	l	448		478	471	495	473(4)	390	382?	386.0(2)
	r	450		475		494	472.7(3)	390	382	386.0(2)
2. Total length in natural position	l	446		475		492	471.0(3)	387		387.0(1)
	r	448		472?		491	470.3(3)			
6. Mid-diaphysis sagittal diameter	l	27	28	28		30	28.2(4)			
	r		29	27		29	28.0(3)			
7.Mid-diaphysis transverse diameter	l	28	27	26		28	27.2(4)			
	r		27	26		27	26.7(3)		19	19.0(1)
9. Upper transverse diaphysis diam.	l	32	29	30		31	30.5(4)	27	21	24.0(2)
	r	30	31	29		30	30.0(4)		24	24.0(1)
10. Upper sagittal diaphysis diam.	l	25	27	26		26	26.0(4)	22	16	19.0(2)

Table 6. Continuation

Trait nr	Side	Males					M(n)	Females		M(n)
		I	V	VIII	XI	XV		X	XIV	
	r	25	27	25		26	25.7(4)		18	18.0(1)
18. Vertical diameter of caput femoris	l				47	48	47.5(2)	40		40(1)
	r				46	47	46.5(2)			
19.Sagittal diameter of caput femoris	l	47				49	48.0(2)			
	r	47			48		47.5(2)			
8. Mid-diaphysi circumference	l	85 ?	87	84		91	86.7(4)			
	r		87	83		90	86.7(3)		60?	60(1)
20. Head circumference	l					155	155.0(1)			
	r				151		151.0(1)			
Tibia										
1. Total length	l	345		380	378	386	376.0(4)			
	r	349		377	377		373.0(3)			
1a. Maximum length	l	349		387	382	381	371.0(4)			
	r	354		382	383		367.7(3)			
8. Max. sagittal mid-diaphysis diam	l			28		31	29.5(2)			
	r	27		26		29	27.3(3)			
9. Transverse mid-diaphysis diam.	l			22		24	23.0(2)			
	r	20		24		24	22,7(3)			
8a. Sagittal diam at foramen nutritium	l	29		*30*		33	30,7(3)			
	r	29		27		32	29,3(3)			
9a. Transverse diam at foramen nutricium	l	21		24		26	23.7(3)			
	r	20		25		25	23.3(3)			
10. Mid-diaphysis circumference	l			80		87	83.5(2)			
	r	75		78		85	79.3(3)			

Table 6. Continuation

Trait nr	Side	Males					M(n)	Females		M(n)
		I	V	VIII	XI	XV		X	XIV	
	r	25	27	25		26	25.7(4)		18	18.0(1)
10a. Circumference at foramen nutricium	l	82		84		93	86.3(3)			
	r	82		85		91	86.0(3)			
10b. Min diaphysis circumference	l	71		72		76	73.0(3)			
	r	70		70		75	71.7(3)			
Indices										
H7:H. Massiveness index	l					16.4	16.4(1)			
	r			17.0			17.0(1)			
H6:H5 Mid-diaphysis index	l			69. 6		76.2	72.9(2)			
	r			69. 6		69.6	69.6(2)			
F8:F2. Massiveness index	l	19.1		17.7		18.5	18.4(3)			
	r			17.6		18.3	18.0(2)			
F6:F7. Index pilastricus	l	96.4	103.7	107.7		107.1	103.7(4)			
	r		107.4	103.9		107.4	106.2(3)			
F10:F9. Index platymericus	l	78.1	93.1	86. 7		83.9	85.0(4)	81.5	76.2	
	r	83.3	87.1	96.2		86. 7	88.3(4)		75.0	
T10b:1. Massiveness index	l	20.40		19.1			19.7(2)			
	r	20.35		18.6			19.5(2)			

REFERENCES

1. Ferembach D, Schwidetzky I, Stloukal M. (1979) Empfehlungen für die Alters- und Geschlechtsdiagnose am Skelett. Homo, 30 (2), 1–32.
2. Gerhards G. (2000) Latvijas iedzivotaju kermana garuma izmainas pedejo divu gadu tukstošu laika. Antropologe profesore Dr. habil. Hist. LZA goda locekle Raisa Deņisova. Riga, 55–72.
3. Heapost L. (1993) Makita kalme antropoloogiline aines. Muinasaja Teadus 2. Tallinn, AI, 233–248.
4. Heapost L. (1995) On craniology of South-East Estonian population in XI–XVIII cc. Papers on anthropology VI, 57–69.
5. Heapost L. (2001) Makita 13.-17. sajandi populatsiooni osteomeetrilised andmed, kehapikkus ja proportsioonid. Eesti antropomeetriaregistri aastaraamat 2001, Tartu, 28–44.
6. Heapost L. (2002) Pada 12.–13. sajandi kalme osteomeetria ja rekonstrueeritud somatomeetria. Eesti antropomeetriaregistri aastaraamat 2002, Tartu, 25–45.
7. Heapost L. (2003) Variation of stature in Estonia from the 12th to the 20th centuries. Papers on Anthropology XII. Tartu, TÜ, 51–61.
8. Heapost L. (2006) The Population of SE Corner of Estonia at the End of the Iron Age and in the Middle Ages. – Acta Medica Lituanica, Vol.13, Nr 2, 109–114.
9. Laul S., Valk H. (2006) Siksäla, a community at the Iron Age and Medieval, (in print).
10. Mark K. (1956) Eesti rahva etnilise ajaloo küsimusi paleoantropoloogia valgusel. Eesti rahva etnilisest ajaloost. Tallinn, 191–219.
11. Mark K. (1962) Kaberla kalmistu antropoloogiline aines. Muistsed kalmed ja aarded. Tallinn, 169–181.
12. Mark K. (1965) Ida-Eesti 11.–18. sajandi rahvastiku antropoloogia. Slaavi-läänemeresoome suhete ajaloost. Tallinn, 150–204.
13. Mark K, Heapost L, Sarap G. (1994) Eestlaste antropoloogia seoses etnogeneesi küsimustega. Tallinn.
14. Martin R, Saller K. (1957) Lehrbuch der Anthropologie, Bd. I. Stuttgart.
15. Trotter M, Gleser G. C. (1952) Estimation of stature from long bones of American Whites and Negroes. American Journal of Physical Anthropology, 16 (1), 463–514.
16. Ubelaker D. H. Human Skeletal Remains (1978) Analyses, Interpretations. Chicago.
17. Алексеев В. П. (1969) Происхождение народов Восточной Европы. Москва.
18. Алексеева Т. И. (1973) Этногенез восточных славян по данным антропологии. Москва.

19. Грушина Л. Е. (1987) Курганный и жальничный могильники у дд. Лопатово и Новая в округе Изборска. К 1125-летию Изборска. Юбилейные чтения. Изборск, 10–12.
20. Грушина Л. Е. (1987) Грунтовый могильник у деревни Кендиши. Земля Псковская, древняя и социалистическая. Псков, 100–102.
21. Денисова Р. Я. (1975) Антропология древних балтов. Рига.
22. Денисова Р. Я. (1977) Этногенез латышей. Рига.
23. Лаул С. (1978) Исследование курганов позднего железного века в Линдора. TA Toimetised, 27(4), 344–349.
24. Лаул С. (1979) Исследование курганов в юго-восточной Эстонии. TA Toimetised, 28(4), 373–377.
25. Санкина С. Л. (2000) Этническая история средневекового населения Новгородской земли по данным антропологии. С.-Петербург.
26. Седов В. В. (1976) Мальский курганно-жальничный могильник близ Изборска. Краткие сообщения АН СССР, 146, 87–95.
27. Хартанович В. И., Чистов Ю. К. (1984) Антропологический состав средневекового иаселения Ижорского плато. Проблемы антропологии древнего и современного населения Севера Евразии, Ленинград, 74–105.
28. Хвощинская Н. В. (2004) Финны на западе Новгородской земли, С.-Петербург, 159–161.

Papers on Anthropology XV, 2006, pp. 83–92

LUDWIG EMIL VON CICHORIUS (1770–1829)

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After Daniel Georg Balk, ordinary professor of pathology, semiotics, therapy and clinic, had started lectures of medical-philosophical anthropology at the University of Tartu (the former Imperial University of Dorpat) on his own initiative in the autumn term of 1802, several other lecturers of the Faculty of Medicine gradually became interested in teaching anthropological subjects.

Thus, in 1805, four out of the six professors of the Faculty of Medicine engaged in lectures related to anthropology: three ordinary professors (along with D. G. Balk, Heinrich Friedrich Isenflamm and Martin Ernst Styx) and one extraordinary professor – prosector of the *Theatrum Anatomicum* Ludvig Emil von Cichorius. In total, they delivered five different lecture courses on anthropology or its elements. The year 1805 can be considered the heyday of teaching anthropology at the Faculty of Medicine of the University of Tartu throughout its history. After that the number of professors lecturing on anatomy as well as the number of lectures began to decrease. Teaching of anthropology ended in the period of political reaction that began in Russia after the war of 1812 [7].

On his post, prosector L. E. Cichorius, who had the rights and obligations of an extraordinary professor, had to fulfil the duties of the assistant to the ordinary professor of anatomy, physiology and forensic medicine H. Fr. Isenflamm and to teach students the same three subjects as the head of the anatomical theatre. However, the German-language lists of courses of the university reveal that from the beginning of the autumn term of 1805 to the end of the spring term of 1810 L. E. Cichorius also taught anthropology, during 10 terms in total, six hours per week (in the 1st half of 1806, only two hours a week) [17]. It should be noted that, starting from the autumn term of 1805, the lists of courses did not provide any descriptive adjectives for Cichorius' lectures of on anthropology as they were given for the lectures of Balk and ordinary professor of dietetics, *materiae medicae* (study of medicinal remedies), history of medicine and medical literature Styx (medical-philosophical, physical-philosophical, natural historical-philosophical, physiological-philosophical and physical-philosophical respectively).

In addition, during the spring term of 1805, Cichorius also delivered lectures on differences between people resulting from their physique, age and gender. These lectures also included elements of anthropology. He also delivered lectures on the main chapters of anatomy for exam preparation, which included revision of anthropology, physiology, pathology, dietetics and therapy in the autumn terms of 1806–1807 and 1809–1811 and in the spring terms of 1810–1811 [17]. Thus, Cichorius delivered lectures that contained elements of anthropology during three spring and five autumn terms, eight terms in total.

In the spring term of 1805, he also started lecturing on history of anatomy (until the beginning of the 19th century). Cichorius' lectures on history of medicine (general part) started in the first half of 1808 and were delivered six times a week. He continued these lectures in the two following years, in the autumn term of 1809 and the spring term of 1810 [17]. This subject should have been taught by the ordinary professor of dietetics, *materiae medicae*, medical history and literature as provided for the Faculty of Medicine by the 1803 statutes of the University of Tartu (the former Imperial University of Dorpat) [13]. Although, immediately after the implementation of the statutes, the first person appointed to that post was M. E. Styx [6], he had not started lecturing on history of medicine by that time. Actually, the first and the last time during Prof. Styx' long career when he delivered lectures on history of medicine was as late as in the autumn term of 1820 [17].

While working as prosector, extraordinary professor Cichorius also delivered lectures on folk medicine, dissection, general and special pathology, medical police, popular medicine, dietetics and zootomy.

After becoming an ordinary professor, Cichorius first restricted himself to teaching anatomy, physiology and forensic medicine, later anatomy and forensic medicine only [17]. In 1822 he was also Dean of the Faculty of Medicine [15].

The scanty publications on the life and work of Prof. Cichorius contain some inaccuracies; below we are going to draw the readers' attention to two of them.

Ludwig Emil von Cichorius was born in Leipzig on 7 April 1770. He studied at the university of his hometown where he received a bachelor's degree in medicine and a master's degree in philosophy. In

1803 he came to Livonia where he became tutor for the family of Count von Sievers of Õisu [9].

From 16 November 1804 L. E. v. Cichorius was employed by the Imperial University of Dorpat. For the following nine and a half years he became prosector enjoying the rights of an extraordinary professor [9]. Thus, he took up the post that had remained vacant from M. E. Kauzmann, the first prosector in the history of the Faculty of Medicine, who had served at the *Theatrum Anatomicum* under the ordinary professor of anatomy, physiology and forensic medicine H. Fr. Isenflamm [8]. After the latter had left the university, L. E. Cichorius applied for his post, but his application rejected. The post that remained vacant for more than 11 months was filled by Karl Friedrich Burdach MD, who was also from Leipzig [4]. After Prof. Burdach left Dorpat (Tartu) for Königsberg, prosector Cichorius still had to wait for more than three and a half months before, on 19 May 1814, he finally became ordinary professor of anatomy, physiology and forensic medicine [9]. In this office, L. E. Cichorius had to face the changes introduced by the university statutes approved in June 1820, which redistributed between professors the disciplines taught at the Faculty of Medicine. According to the new statutes, physiology was separated from the disciplines taught by the ordinary professor of anatomy, physiology and forensic medicine Cichorius and was given to the ordinary professor who was going to teach pathology and semiotics. After that change, L. E. Cichorius became ordinary professor of anatomy and forensic medicine [16] and held this post until his resignation because of illness on 20 September 1827 [9].

The whole career of Prof. Cichorius at the university (22 years, 10 months and 5 days) can be divided into two periods: working as prosector of *Theatrum Anatomicum* and extraordinary professor (9 years, 6 months and 3 days) and as ordinary professor (13 years, 4 months and 2 days). Cichorius' work as ordinary professor from 1814–1827 also falls into two periods: first, from 1814–1820, he was ordinary professor of anatomy, physiology and forensic medicine and, thereafter, from 1820–1827, ordinary professor of anatomy and forensic medicine.

Thus, the formulation that from 1814–1827 Cichorius was ordinary professor of anatomy, physiology and forensic medicine cannot be considered correct [3, 9].

Soon after shifting to emeritus status, Cichorius developed a mental disease and died in Tartu on 15 March 1829at the age of 59. At the dissection of his brain, ordinary professor of therapy and clinic

Johann Friedrich Erdmann diagnosed the "brain cancer" as described by Rostani [11].

Prof. Cichorius left a library, an overview of which can be obtained from the inventory (bequest list) made from 29 March to 9 April 1829. Although the list need not register all the books, it still includes the majority. It reveals that the library contained 1004 volumes (632 titles), 49% of which was medical literature. In addition, there was music (Mozart, Beethoven and others, 57 items), books on philosophy (Rousseau, Voltaire, Mably, Kant, Fichte, Schelling, Jakobi), aesthetics, (Napoleon), magazines (*Der deutsche Merkur*, *Die Muse*, *Thalia*, *Musenalmanach*); literature by German (Gellert, Klopstock, Wieland, Bürger), English (Shakespeare, Goldsmith, Scott) and French (Rabelais) authors, German juvenile and children's literature. Four books dated back to the 16th century [10].

Thus, the 1929 remark by the ordinary professor of forensic medicine Siegfried Ferdinand Talvik that the library left by Cichorius' consisted of a single tattered manuscript about the construction of windmills is grossly misleading [14].

Several interesting facts on Prof. L. E. Cichorius can be found in the memoirs of some of his colleagues and students from the time they spent in Dorpat (Tartu).

K. Fr. Burdach, who worked for nearly two years and seven months as the ordinary professor of anatomy, physiology and forensic medicine, describes in his autobiography how he worked with prosector, professor extraordinary Cichorius in the *Theatrum Anatomicum* on Toome Hill, now known as the Old Anatomical Theatre. The well-known scholar, reminiscing about his life, writes about his colleague, "Professor Cichorius, who worked as the prosector, was of absolutely no use for me as I will explain below. Luckily, my assistant Pietsch was skilled, diligent and loyal to me; he prepared the organs of cadavers that came to be used at demonstrations and added quite a few specimens to the remarkable collection Isenflamm had purchased and created by his own efforts. Pietsch was engaged in research himself and assisted me in my studies. In the year he was beside me, I kept a detailed journal on the management of the anatomical theatre; we dissected thirty corpses during the period, arranged the collection of specimens, compiled a catalogue of specimens according to their location and made considerable additions to the collection. After Pietsch's departure, I was alone at the anatomical institution and was not able to contribute so much to the anatomical theatre.

I had endless trouble with my prosector, Extraordinary Professor Cichorius. He came from Leipzig, had been dealing with philosophy and literature there and had achieved some renown through that. By the time I joined the university he had delivered private lectures on anatomy; then he had been a tutor in Livonia for a few years; after that he obtained the position of the prosector in Tartu and, after Isenflamm's departure, applied for his professorial post, which, however, was given to me. Thus, my relations with the prosector were not pleasant. From the viewpoint of my professional duties, the situation turned out to be even more unhappy because of his character. As early as in Leipzig, he had become known as a stubborn weirdo, but in Tartu he had also become a heavy drinker who was intoxicated most of the time. He considered his own knowledge the ultimate truth, he put in a lot of time and effort to work on anatomy, but for his own demonstrations only; he did not undertake any research or prepare any specimens for the anatomical collection. His spare time that remained from lectures and preparation for them was a subject for unbelievable stories. Therefore it was absolutely impossible to use him as an assistant; I avoided any encounters with him and directed the tasks related to preparation for lectures to my assistant Pietsch, after his departure, however, took care of the matters myself so that Cichorius needed to do almost nothing for me. Nonetheless I constantly had to struggle with his unreasonable arrogance and complaints [2]."

These few excerpts reveal that Prof. K. Fr. Burdach did not give a quite positive characterization of his subordinate, prosector L. E. Cichorius.

Below, we will add a few excerpts from the memoirs of students of the Faculty of Medicine written several years later, which contain different judgments about Cichorius.

The founder of modern embryology K. E. v. Baer, who studied medicine in Dorpat (Tartu) from 1810–1814, has written, "As early as during the first semester I had to listen to lectures on one of the most important disciplines – anatomy – that were not to my liking. Isenflamm had just left, and attempts were made to find a worthy successor for him. There was another anatomist working in Tartu as the prosector, Prof. Cichorius, who, however, either because of his eccentricities of for some other reason, was not trusted with the vacant post. Unfortunately, by the time of my arrival he was the only lecturer of anatomy. An *animal curiosum* (the Latin for weirdo) in all respects. The window shutters of his apartment were closed throughout the day, and it was rumoured that he was sitting there by candlelight in a dressing-gown or a fur coat. To the lectures of anatomy, however, his tall figure always appeared in a long uniform with a very broad white cravat, which, covering the chin, reached his mouth, so that one could surmise there was a goitre that no one had seen. Seeming to be imbued with the importance of his profession, he energized himself for each lecture by spirits, and therefore suffered from frequent burps. From time to time, he delivered short addresses where he, to the accompaniment of lively movements of his body, declared that when teaching he was teaching in the name of the Emperor. These admonitions happened when he had heard or noticed that he was smirked at. The reason for laughter, which, however, never became loud, was his manner of speech that strove for elegance but was entirely out of place for the situation as well as his dialect, which was not only unaccustomed for us but also difficult to understand, as we were not used to it. As I remember, he consistently pronounced voiced consonants as voiceless and vice versa. One of the students, after having listened to his lectures for a week asked me in all seriousness if I could tell him the location of *ossa jabidis*; he could not find them in his book. Instead of *capitis*, Cichorius always said *gabidis*; in the usage of that student from the border between Brandenburg and Pommern *ga* had become *ja*, making the word totally incomprehensible. I got used to his pronunciation quickly. What, however, was very unpleasant for me was the unclear presentation of the material in a singsong voice. Perhaps trying to avoid cumulation of terms – anatomy is very rich in them – Cichorius entwined questions and answers into the lecture, which one had to listen to in order to not lose track, but which made the memorization of the lecture even more difficult. [– – –]

One could not reproach Cichorius for lack of eagerness, but his eagerness produced an adverse effect. He did not need six hours per week for his osteology lectures because of the wealth of material but because of his wordy manner of presentation. Burdach's lectures were much easier to remember; particularly the more general treatments, for example, his lectures on general anatomy were entirely comprehensible and easy to memorize. [– – –]

What was particularly saddening for me, and what turned out to be even more aggravating later was the lack of practical training in anatomy as the art of dissecting the human body. Although respective rooms had been equipped under Isenflamm already, no dissections took place when I was a student. Partly, the reason for this was the existence of two prosectors: one of them official, the other unofficial.

In the list of lectures Cichorius figured as a prosector, but considering the emphasis he laid on his lengthy lectures, he had no time for taking care of students' practical training. Later, after Burdach's arrival, it became impossible. Because of the smallness of the town, the number of cadavers available for the anatomical theatre was limited. Burdach and Cichorius now delivered their lectures quite separately. Therefore, the need for fresh specimens doubled."

At the end of his last year of studies, K. E. von Baer applied to the Faculty of Medicine for permission to take the necessary examinations for the doctoral degree (*examen rigorosum*). The exam took place on 12 June 1814, which was a very hot summer day, when the honoured board (consisting of six professors: D. G. Balk, M. E. Styx, C. Ch. Fr. Ledebour, L. E. Cichorius, Ch. Fr. Deutsch, G. Fr. Parrot) and two witnesses appointed by the University Council (professors G. B. Jäsche and J. P. G. Ewers) expected answers to 34 questions from 18 disciplines learnt during the period of studies. Baer gives a detailed description only of the section of anatomy and physiology:

"This was entirely the concern of Prof. Cichorius, as Burdach had, following the invitation from Königsberg, left Dorpat (Tartu) in January 1814. First I drew a question on lower extremities muscles. The answering proceeded as could be expected, if you have watched the demonstration only once and thereafter have tried to memorize the complicated musculature from books without any visualization or thorough study on your own part. I was able to present some of the muscles well, the treatment of some others remained half-finished, and some were entirely missing. There were also too many of them. I would not like to claim that nature has made some superfluous ones, but there were really too many of them for the poor medic, who, within one day, has to be able to discuss all the bones, ligaments, muscles, nerves, blood vessels, internal organs and to demonstrate his knowledge of physics, chemistry, zoology, botany, pharmacology, pathology, etc. Professor Cichorius' face clouded over a bit. Then, in physiology, I drew the questions: how many varieties of organized matter are there? I would like to know if Cuvier or Meckel, who were still alive then, would have been able to answer that question, or whether any of the living luminaries of physiology or zootomy would venture to answer if I did not borrow them an Ariadne's thread (in the figurative meaning: a way out of a complicated situation). I, however, gave such a brilliant answer to that question that Cichorius' face beamed like the sun. I said (let all the people know it throughout the times!) that there were only two kinds of living matter: liquid and semi-liquid, there were no absolutely solid ones. How could I know it? Naturally, only from Cichorius' lectures, where else could such wisdom be found? Burdach had not taught the whole course of physiology, only *History of Life*, which I had listened to. My academic record sheet, however, had to show that I had taken all the main subjects. Thus, I had to study physiology under Cichorius. No one would doubt now that his lectures in 1812 or 1813 were poor, but this poorness was very special. Even now, I would not be able to say more about it. [– – –] [1]"

In the early 19th century there were only a few Estonians who, living in serfdom, managed to obtain higher education. One of the first ethnic Estonians among the students of the Imperial University of Dorpat was Friedrich Robert Faehlmann (1798–1850). During his studies (1817–1827) at the Faculty of Medicine he also took interest in the humanities, particularly the Estonian language. In 1827 F. R. Faehlmann was the first Estonian to obtain the qualifications of a physician and a doctoral degree in medicine at the University of Dorpat (Tartu). With his dissertation *Observationes inflammationum occultiorum* (Observations on hidden inflammations), which discussed the pathological changes accompanying heart inflammation, a problem that had been little studied at that time, Faehlmann blazed the trail for cardiology at the university. Nonetheless, he continued the career of a practising doctor that he had begun in 1824. Quite soon he became the most sought-after doctor for all social strata in Tartu and its vicinity [5]. In addition to his everyday work, Faehlmann worked at the university from 1842–1850 (for 16 semesters) as the lecturer of Estonian and, from 1843–1845 (for 5 semesters) as a part-time lecturer of pharmacology and the art of prescription writing [17]. He initiated the foundation of the Learned Estonian Society in Dorpat (Tartu) in 1838. The society, which operated in German, united Estonian and Baltic German intellectuals; Faehlmann was its chairman from 1843–1850. Faehlmann also put forward the idea of writing the Estonian national epic *Kalevipoeg* [5]. Concerning the relations between F. R. Faehlmann as a student and Prof. L. E. Cichorius, and their appreciation of each other, Professor of Forensic Medicine S. F. Talvik has written the following:

"F. R. Faehlmann had great respect for Prof. Cichorius. As soon as he became convinced of the excellence of his teacher, the human weaknesses of the latter lost importance. As Faehlmann was fond of preparing anatomical specimens, he soon became Cichorius's favourite student. Their friendship continued, and throughout his career at the university, Cichorius always stood up for Faehlmann. Prof. Cichorius wanted Faehlmann to be his successor in the professorship of anatomy and forensic medicine [14]."

The Russian surgeon and anatomist Nikolai Pirogov, originator of the anatomical-experimental trend in surgery, a graduate of Moscow University, studied at the Institute of Professors at the Imperial University of Dorpat from 1828–1832 and, thereafter, from 1836–1841 was ordinary professor of theoretical and practical surgery here [15]. By the time he arrived in Dorpat (Tartu), Prof. Cichorius had already retired. Nonetheless, in his memoirs *Matters of Life. An Old Doctor's Diary* Pirogov wrote in the last weeks of his life, in 1881, "Professor of Anatomy Cichorius was a peculiar man, a hard-core German, witty, talented and with an extraordinary memory (knew Wieland's *Oberon* by heart) but a heavy drinker, a confirmed bachelor, who sat at home behind closed shutters through days and nights. Round the clock, a candle was burning on his table. Instead of furniture, there were loads of empty bottles in his rooms [12]."

This was how Prof. Cichorius was characterized by his colleagues and students.

We can say that Prof. Cichorius was the lecturer who delivered the greatest number of lectures on anthropology or its elements during the first decade of the University of Tartu (the former Imperial University of Dorpat) after its reopening in 1802. From 1805–1811 he lectured on anthropology during ten successive terms and delivered lectures containing elements of anthropology during eight terms.

REFERENCES

1. Baer K. E. (1866) Teateid hr. salanõunik dr. Karl Ernst von Baeri elu ja teoste kohta tema enda jutustuses. Tartu ülikool 1810–1814. In: Mäletusi Tartu ülikoolist (17.–19. sajand). (1986) Koost S. Issakov. Tallinn, Eesti Raamat, 67–90.
2. Burdach K. Fr. (1848) Tagasivaade oma elule. Autobiograafia. In: Mälestusi Tartu ülikoolist (17.–19. sajand). (1986) Koost S. Issakov. Tallinn, Eesti Raamat, 91–101.
3. Deutschbaltisches biographisches lexikon 1710–1960. (1970) Köln, Wien.
4. Kalnin V., Lepp E. (1996) Karl Friedrich Burdach (1776–1847) In: Eesti arstiteaduse ajaloost. Koost V. Kalnin. Tartu, 38–41.
5. Kalnin V. (1996) Friedrich Robert Faehlmann (1798–1850) In: Eesti arstiteaduse ajaloost. Koost V. Kalnin. Tartu, 51–56.

6. Kalnin V. (1996) Martin Ernst Styx (1759–1829) In: Eesti arstiteaduse ajaloost. Koost V. Kalnin. Tartu, 16–19.
7. Kasmel J. (2005) On anthropology at the University of Tartu throughout two centuries. In: Papers on Anthropology. XIV. Tartu, University of Tartu, 24–26.
8. Kasmel T., Kasmel J. (2005) An overview of the structure of the faculty of medicine at the University of Tartu (the former Imperial University of Dorpat) in the early 19th century. In: Papers on Anthropology. XIV. Tartu, University of Tartu, 137–155.
9. Левицкий Г. В. (1902, 1903) Биографический словарь профессоров преподавателей Императорского Юрьевского, бывшего Дерптского университета, за сто лет его существования (1802–1902) Т. I. Юрьев; Т. II. Юрьев.
10. Noodla K. (1983) Tartu ülikooli õppejõudude isiklike raamatukogude koostisest 19. sajandi I poolel. In: Tartu Ülikooli ajaloo küsimusi XIII. Tartu, Tartu Riiklik Ülikool, 11–21.
11. Normann H. (1925) Katkend Tartu Ülikooli arstiteaduskonna algetest. Eesti Arst, 11, 325–326.
12. Pirogov N. (1887) Elu küsimusi. Vana arsti päevik. In: Mälestusi Tartu ülikoolist (17.–19. sajand). (1986) Koost S. Issakov. Tallinn, Eesti Raamat, 138–171.
13. Statuten der Kaiserlichen Universität zu Dorpat. (1803) [Dorpat].
14. Talvik S. (1929) F. R. Faehlmann kui inimene ja arst. In: Friedr. Rob. Faehlmann`i album. Tartu, 17–53.
15. Tartu Riikliku Ülikooli arstiteaduskond aastail 1802–1975. (1976) Koost V. Kalnin, E. Raudam. Tartu.
16. Устав Императорского Дерптского университета. Statut der Kaiserlichen Universität Dorpat. (MD CCC XX). Dorpat.
17. Verzeichnis der Vorlesungen … 1803–1850. (1803–1850). [Dorpat].

Papers on Anthropology XV, 2006, pp. 93–102

INFLUENCE OF AGE ON SOMATIC VARIABLES HEIGHT, WEIGHT AND CHEST CIRCUMFERENCE

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ABSTRACT

The body composition changes occur differently in women in the various phases of aging, influencing anthropometry. Aging is the progressive accumulation of changes with time, and it is an important factor in classifying height, weight, chest circumference and the body mass index (BMI). There are some data on age-related changes in three important body measurements (body height, body weight and chest circumference) of 873 women aged 18–65 and 66+ years in Latvia. Anthropometric data were studied from 2001 to 2005. Altogether 900 women participated in the anthropometric study. We examined age difference changes in three body measurements between age groups (18–20, 21–25, 26–35, 36–45, 46–55, 56–65, 66+). Anthropometric measurements were assessed using standardized techniques. The BMI was also calculated. The mean values were compared and differences between the age groups were analysed.

Significant age differences exist in body height, body weight, chest circumference and the BMI. Comparisons of age groups showed that the body height decreased with age. There was an increase in body weight, chest circumference and the BMI with age. The changes were greater at higher ages.

The data can be used in clinical practice and the epidemiological studies based on the interpretation of anthropometric measurements in the women aged 18–65 and 66+ years in Latvia.

Key words: age, anthropometry, women, somatic variables

INTRODUCTION

Human aging is associated with many factors, including physical, physiological and social factors [14, 15, 16]. Research into human aging requires many kinds of examinations and specialists in various areas. Aging is a multi-factorial phenomenon, and it is a process of gradual and spontaneous change, resulting in maturation through childhood, puberty, young adulthood and then decline through middle and late age [16, 18]. The aging process is accompanied by changes in the body composition [7, 9]. The type of change, however, may vary from population to population depending upon various environmental and genetic factors [4, 10]. In Latvia changes in the body composition with age have been well documented in children, adolescents, adult men. Little is known about the anthropometrical data of adult women. Specific anthropometric reference data for the women are necessary. In different age women are characterized by the different body shape and body composition, but there is an important difference between the child, adolescent and adult age.

Anthropometric data for adults are used to evaluate the health dietary status, disease risk, the body composition changes that occur over the adult, lifespan, and these data serve as indicators of the biological status of womens physical development. The anthropometric, measurements most commonly used for assessing physical status are height, weight and chest circumference [18, 19]. The relationships between age, physique, health and performance are wide, similar as the interindividual variability in these parameters. Complex information on the anthropometric characteristics together with the detailed analysis of somatic variables and relationships is relatively rare, especially in very young or old subjects. Understanding the normal changes in the body and its composition with the increasing age are important to the health status and the individual`s nutritional status [7, 10, 14].

The principal aim of the present study was to provide and to describe the age distribution values (body height, body weight, chest circumference and the body mass index (BMI)) for the anthropometric characteristics based on a study of women aged 18–65 and 66+ in Latvia.

MATERIAL AND METHODS

The anthropometrical investigation was carried out from 2001 to 2005 at the Department of Anthropology of Institute of Anatomy and Anthropology of Riga Stradins University and embraced 900 women in Latvia. Our population-based sample included healthy persons, as they were part of the general population. The age of the women was 18 to 65 and 66+ years. The following three anthropometrical markers were measured for each participant: body height (cm), body weight (kg) and chest circumference (cm). All the measurements were taken by a well-trained anthropometrist. During the investigation anthropometrical measurements have been made according to the standards techniques [11, 12]. Subjects were measured in their bare feet, wearing only underwear. Body height was measured using the firm "Siber-Hegner", a flexible standard anthropometer (1 mm precision). Body weight was measured by a portable electronic digital scale with a 0.1 kg precision. Chest circumference was measured with a flexible, but inelastic graduated tape to the nearest 0.1 cm applied horizontally, with the subject standing. All the data of women were registered in a special form. The body mass index (BMI) was also calculated as body weight (kg) divided by squared height (m^2). To evaluate the prevalence of overweight and obesity in our study, we classified subjects on the basis of two cut-off points commonly used in clinical practice: $25 \leq BMI < 30\ kg/m^2$ was used to identify overweight subjects; $BMI \geq 30\ kg/m^2$ was used to indicate obesity according to the classification system recomended by the World Health Organization [18].

Among the 900 women enrolled in this study, 27 women were excluded from the present analysis because of missing some anthropometric data. This gave a total of 873 women. The population study was divided into age groups: 18–20, 21–25, 26–35, 36–45, 46–55, 56–65, 66+. Afterwards the data were processed using the methods of mathematical statistics. The statistical analyses were conducted using the SPSS Windows 10.0 statistical software program. Standard statistical methods were used to calculate the mean and the standard deviations. The analysis of variance was used for determining the statistically significant differences ($p<0.01$) between the age groups for the mean values of the anthropometric variables in women.

RESULTS

The distribution of studied women by age groups is shown in Table 1.

Table 1. The distribution of women by age groups.

Age group (years) / Number of women n (%)	I (18–20)	II (21–25)	III (26–35)	IV (36–45)	V (46–55)	VI (56–65)	VII (66+)	Total
Number of women n (%)	349 (40.0)	201 (23.0)	94 (10,8)	105 (12.0)	61 (7.0)	44 (5.0)	19 (2.2)	873 (100.0)

The mean age of women was 28.78±13.76 (where 13.67 is the standard deviation). The majority of measured women were 18–20 (40.0%) and 21–25 (23.0%) years old.

Age-specific values (mean and standard deviation) of some anthropometrical measurements and the body mass index (BMI) are presented in the following analysis. The distribution of women by somatic variables and age groups is presented in Table 2.

The height of all the studied women ranged from 145.30 cm to 182.30 cm, and the mean height was 165.10±6.62 cm. Women tended to be shorter with age. The mean height in 18–20 years old women was 166.76±6.37 cm. The mean height started decreasing after age 20. The mean height in 21–25-year-old women was 165.56±6.23 cm, which made 99.3% of the mean value of the height parameter of 18–20-year-old women. The mean height parameters for 36–45 and 45–55-year-old women were almost similar: 163.73±6.53 cm for 36–45-year-old women and 163.86±6.50 cm for 46–55 years women. At 66+ years the mean height was 160.64±5.20 cm, which made 96.3% of the mean value of the height parameter of 18–20 years old women. The mean difference in height between the youngest group (18–20y) and the oldest one (66+y) was 6.12 cm.

The weight of all the studied women varied from 40.30 kg to 124.10 kg, and the mean weight was 63.38±12.22 kg. We observed a tendency that the weight of women gradually increased with age. The mean weight started increasing after age 25. The growth of the mean value of body weight from 21–25 years to 66+ years was 14.04 kg. The greatest body weight growth peak was after age 35+, and in 36–45-year-old women this increasing was 6.10 kg.

Table 2. Distribution of women according to somatic variables and age characteristics.

Age group (years)	I (18–20) n=349	II (21–25) n=201	III (26–35) n=94	IV (36–45) n=105	V (46–55) n=61	VI (56–65) n=44	VII (66+) n=19	(Total)[1] n=873
	x	x	x	x	x	x	x	x
Body height, cm	166.76	165.56	165.06	163.73	163.86	161.95	160.64	165.10
Sx	6.37	6.23	6.35	6.53	6.50	6.56	5.20	6.62
Body weight, kg	59.91	59.51	64.30	70.40	72.17	73.16	73.55	63.38
Sx	8.84	9.23	12.34	14.31	14.39	13.58	19.19	12.22
Chest circum-ference, cm	83.00	83,78	86.57	90.82	93.03	95.96	94.60	86.11
Sx	5.36	5.74	8.33	9.74	7.54	8.35	11.40	8.09
Body mass index (BMI), kg/m^2	21.52	21.69	23.59	26.24	27.47	28.31	29.53	23.29
Sx	2.83	3.17	4.27	5.35	4.92	4.94	6.93	4.58

x – mean of value, Sx – standard deviation, n – number of women, 1 – mean of value for all women

The chest circumference of all the studied women ranged from 57.00 cm to 126.00 cm, and the mean chest circumference was 86.11±8.09 cm. The mean increasing of chest circumference started after the age 20. The mean value of the chest circumference in women at 18–20 years of age was 83.00±5.36 cm. The most intensive increasing of chest circumference was after the age 35. In women the highest mean value of the chest circumference was 95.96±8.35 cm at the age of 56–65. In 18–65-year-old women the chest circumference was increased by 12.96 cm. At 66+ years the mean chest circumference started decreasing 94.60±11.40 cm.

The mean BMI of women was 23.29±4.58 kg/m^2. The BMI of all the women ranged from 15.64 kg/m^2 to 48.00 kg/m^2. The mean BMI in 18–20-year-old women was 21.52±2.83 kg/m^2. The mean BMI tended to increase after age 25. The women at 66+ years have the mean value of the BMI 29.53±6.93 kg/m^2. The BMI values ranged normal at age 18–35, but overweight maximum values were presented at age 56–65.

The BMI was less than 20 kg/m^2 for 22.3% of all the women, and 17.7% of all were overweight (Table 3). Obesity was observed for 8.6% of all the women, and 51.4% of women had the normal BMI between 20 and 24.99 kg/m^2 (Table 3).

Table 3. The distribution of all the women by the BMI.

BMI, kg/m^2	Number of women, n	Percent of women, %
<20	194	22.3
20–24.99	448	51.4
25–29.99	154	17,7
≥30	77	8,6
Total	873	100.0

We indicated statistically significant differences in body height, body weight, chest circumference and the BMI according to the age ($p<0.01$).

There was a strong and positive correlation between age and: body weight ($r=0.405$), chest circumference ($r=0.509$), BMI ($r=0.504$). The correlation of age and body height was statistically significant and negative ($r=-0.316$).

A significant, negative and small correlation was found between the BMI and height ($r=-0.209$).

There was a strong correlation between body weight and: body height (r=0.203), chest circumference (r=0,874). Although body weight was highly correlated with the BMI (r=0,912).

The chest circumference was correlated with the BMI (r=0,887).

DISCUSSION

Physical development is the indicator of the health of the body during the growing and aging periods. The basic somatic variables of physical development (body height, body weight and chest circumference) were considered in the article. The changes of three somatic variables were analysed in the period of aging. Our analyses clearly demonstrated that the age was an important factor in classifying height, weight and the BMI. We have observed a tendency that the body height decreased, but body weight, the BMI and chest circumference increased with age. We compared our data with those provided by similar studies. Some studies reported analogous findings [1, 2, 13].

Body height

Height in adults is a reflection of the interaction of the genetic potential for growth and environmental factors that influence the realization of that potential [6, 18]. In some developed countries, genetic potential is the primary determinant of height, since environmental constraints, such as acute and chronic disease, malnutrition, and socioeconomic deprivation, are minimized during the years of linear growth [18]. In less developed countries variation in adult height is the result of environmental influences on linear growth [18]. Decline in height with age has been noted in the studies throughout the world [10, 18]. It is the result of vertebral compression, the change in height and shape of the vertebral discs, the loss of muscle tone and postural changes [15, 18]. Reduction in body height has also been reported in cross-sectional and longitudinal studies [1, 2, 13]. The average body height of adults varies markedly from country to country. Adult height usually declines with age, and our data demonstrated the well-known fact that women tended to be shorter with age.

Body weight

Body weight measured at various times during life has been widely used to assess the health and the nutritional status [3, 14]. It varies not only among individuals, but also within a given individual during aging. The interpretation of weight changes may vary differentially depending on the health and the nutritional status, the physiological condition, and according to genetic determinants. Body weight is the sum of all the aspects of the body composition. Weight increases with age, but the pattern of change is quite different from that of height and it varies. Such a trend was seen in this study.

Height and weight are closely correlated.

Body mass index (BMI)

The large variation in weight within a specific height category has given rise to various expressions such as the body mass index (BMI). Like weight, average BMI in industrialized populations tends to increase in middle age [18]. The BMI is a more informative indicator than the body weight and in epidemiological studies it is used in order to evaluate the prevalence of overweight and obesity among population [5]. As it is well known, the enlarged BMI is one of the important risk factors of the coronary heart disease, hypertension, cancer or other non-communicable diseases [5, 8, 9]. According to our findings, there was a difference in the prevalence of overweight in the oldest age groups. In women, the prevalence of overweight continues to rise until old age and then levels off. This prevalence of overweight can vary substantially in different countries [18].

We found a strong correlation between the BMI and weight, a small inverse correlation between height and the BMI. A significant inverse correlation between the BMI and height was found in most populations, and squared height was not obtained as the optimal power for describing the weight-height relationships in most populations [18]. The sign of the correlation between body height and the BMI is age dependent.

Chest circumference

The age has a certain impact on chest circumference. Chest circumference reflects the past and the current status, but it is less responsive than weight in health and nutritional conditions [18]. Like weight, chest circumference increases with age.

CONCLUSIONS

1. The associations were found between age and anthropometric measurements.
2. The mean values for body height were significantly smaller in the older age groups.
3. The mean values for body weight, the BMI and chest circumference were significantly higher during aging.
4. Age-specific distributions for some anthropometric measurements and all the data for the women can be used in clinical and epidemiological practice, they can be used as reference values for the population in Latvia to detect individuals at a greater risk for one or more disabilities or diseases and to evaluate the programmes of health promotion and disease prevention.

REFERENCES

1. Baumgartner R. (1997) 1980–1997. Body composition and anthropometry. In: Garry P. J., Owen G. M., Eldridge T. O. (Eds), The New Mexico Aging Process Study from the Clinical Nutrition Program. University of New Mexico, 88–145.
2. Baumgartner R. N., Stauber P. M., McHugh D., Koehler K. M., Garry P. J. (1995) Cross-sectional age differences in body composition in persons 60+ years of age. Journal of Gerontology, 50A, 307–316.
3. Bemben M. G., Massey B. H., Bemben D. A., Boileau R. A., Misner J. E. (1998) Age-related variability in body composition methods for assessment of percent fat anf fat-free mass in men aged 20–72 years. Age and Ageing, 27, 147–153.
4. Cole T. J. (2003) The secular trend in human physical growth: a biological view. Economics and Human Biology, 1, 161–168.
5. Dregval L., Vaičaitiene R. (2006) Anthropometrical data and physical fitness of Lithuanian soldiers according to the sociodemographic characteristics. Medicina (Kaunas), 42 (1), 57–63.
6. Eveleth P. B., Tanner J. M. (1990) World-wide variation in human growth. 2nd edn. Cambridge: Cambridge University Press.
7. Gillette-Guyonnet S., Nourhashemi F., Andrieu S., Cantet C., Albarede J. L., Vellas B., Grandjean H. (2003) Body composition in French women 75+ years of age: The EPIDOS study. Mechanisms of Ageing and Development, 124, 311–316.

8. Kuczmarski R. J. (1989) Need for body composition information in elderly subjects. American Journal of Clinical Nutrition, 50, 1150–1157.
9. Kuczmarski F. M., Kuczmarski R. J., Najjar M. (2001) Effects of age on validity of self-reported height, weight, and body mass index: Findings from the third National Health and Nutritional Examination Survey, 1988–1994. Research, 101 (1), 28–34.
10. Launer L. J., Hariss T. (1996) Weight, height and body mass index distributions in geographically and ethnically diverse samples of older persons. Age and Ageing, 25, 300–306.
11. Martin R. Lehrbuch der Anthropologie. I und II Bd. Jena, 1928.
12. Martin R., Saller K. Lehrbuch der Anthropologie. Stuttgart, Fischer, Bd. I, 1957.
13. Noppa H. M., Anderson M., Bergteson G., Bruce A., Isaksson B. (1980) Longitudinal study of anthropometric data and body composition: the population study of women in Göteborg, Sweden. American Journal of Clinical Nutrition, 33, 155–162.
14. Perissinoto E., Pisent C., Sergi G., Grigoletto F., Enzi G. (2002) Anthropometric measurements m the elderly: age and gender differences. British Journal of Nutrition, 87, 177–186.
15. Rossman J. (1979) The Anatomy of Aging. In: Rossman J., Ed. Clinical Geriatrics. Philadelphia, Pa: JB Lippincott Co.
16. Siniarska A., Wolanski N. (2000) Ecology of Aging. Delhi, 216 p.
17. Visser M., Ven Den Heuvel E., Deurenberg P. (1994) Prediction equations for the estimation of body composition in the elderly using anthropometric data. British Journal of Nutrition, 71, 823–833.
18. WHO Expert Committee (1995) The Use and Interpretation of Anthropometry. WHO Technical Report Series no. 854. Geneva: WHO.
19. Тегако Л. И., Марфина О. В. Практическая антропология. Учебное пособие. Ростов на Дону. Феникс, 2003, 70–82.

Papers on Anthropology XV, 2006, pp. 103–113

CHARACTERISTIC BODY COMPOSITION IN RENAL REPLACEMENT THERAPY

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ABSTRACT

Researchers and clinicians from the Department of Internal Medicine of Tartu University Hospital have been interested in the measurement of the body composition of chronic renal failure patients (CRF). In this study were measured anthropometrical variables of the patients with chronic renal failure (males n-37, females n-38). For nutritional assessment in Chronic Kidney Disease (CKD) objective (anthropometry) and subjective methods (anamnesis) were used. All the data were collected and analyzed. Anthropometrical data of weight, height and the body mass index were compared in three groups: hemodialysis (HD), peritoneal-dialysis (PD) and renal transplant (RT) patients. We observed no differences in comparing HP, PD and TR groups. In very few patients the increase of the body fat content was revealed which might be caused by the retreating of uremic phenomena and the improvement of appetite.

Key words: body height, body weight, anthropometric variables, chronic renal failure patients, body composition

INTRODUCTION

According to literature more population research has been made with the purpose of stressing the need for the more profound research of the composition of the body and nutrition in general medicine. Significant risk factors are moderate albuminuria, the increase of the creatinine in the serum, diabetic nephropathy, secondary hypertension, anemia and overweight. The risk factors chronic renal failure (CRF) are also hypertension, hyperglycemia, hyperlipidemia and genetic predisposition.

When a renal disease progresses, the final stage renal failure develops quickly within 1–2 years. With decreasing microalbuminuria, proteinuria it is possible to improve the renal function. In conformity with the patients health status and glomerular filtration rate (GFR) hemodialysis (HD), peritonealdialysis (PD) or renal transplantation (RT) is administered. The developing premature atherosclerosis, systemic inflammation and malnutrition of the CRF and dialysis patients is connected with the decrease of the filtration rate of glomerular filtration (GFR) and the cumulation of many toxic substances in the organism. After renal replacement therapy (RRT) the status of patients improves but further results depend on the patients prior preparation, complex treatment which starts already in the stage of predialysis.

Kahraman et al. have indicated a cross-sectional study of the association mechanisms between the body composition, and the nutrition and inflammation markers. An interesting finding of this study, however was that when higher BMI values associated with inflammatory and atherosclerosis determinants, both obesity and underweight were significantly associated with inflammation and atherosclerosis in HD patients [1]. Overweight and obesity constitute a global problem in the USA and European countries. The data from the Korean population research suggested that overweight and obesity have become severe problem in the last ten years. Lee et al. compared the anthropometrical data of HD patients (n– 10304) with Korean population (n– 12436) and indicated that 70% of HD patients were with normal weight, 30% were in owerweight and obese class [2]. A prospective study of S. Stall et al did not any difference in the body fat percentage between 20 HD and 20 PD patients [3].

For hemodialysis patients the most common body composition methods were used. Probably anthropometric measurements had special problems because of body measurements techniques and depend on various populations [4]. A. M. Grzebalska et al compared our study two groups (HD, PD) patients without diabetic patients and conclude that the 20 PD patients had better anthropometric indicators of nutritional status than the adequately treated 20 HD patients [5]. The waist circumference and the ratio of the waist circumference to the hip circumference are similarly correlated with the measures of risk factors for the coronary heart disease. The waist and hip circumference and the waist to hip ratio are important and useful in clinical practice. C. H. Jones et al from England indicated in their study that in the hemodialysis patients with abnormal nutrition midarm circumference (MAC), weight, triceps skinfold and the body mass index was reduced. Both in HD patients with normal and abnormal nutrition were not reliably identified [6]. In the comparison of the data of the triceps skinfold (TSF), the subscapular skinfold (SSF) and the midarm circumference (MAC) measurements in 925 patients in 27 dialysis facilities, E. E. Nelson notice any significant difference with the National Health and Nutrition Examination Survey data (NHANES II) for the dialysis population [7]. In the study by J. B. Wasserfallen et al. using the Euroqol- 5D questionnaire, to better understand the patients problems and needs, it was indicated that 14% HD and 23% PD patients have pain, discomfort, anxiety and depression and the lowest scores of physical activities.[8].

Patients with serious illnesses reported fewer problems with the main activity, smoking habits, previous health status, the experience with a serious illness in the family and others or in themselves. In all the intensive care units a modified guestionnaire to measure and to interpret patients problems [9]. A. W. Wu et al can be used in a gross prospective cohort study with the baseline questionnaire analyzed and noticed that the health quality of life was better in the PD patients in comparison with the HD patients [10].

The aim of the investigation was to study the nutritional status and to compare data groups in stable RRT patients.

MATERIALS AND METHODS

Subjects

We studied 75 consecutive stable CRF patients: 37 males (mean age 48±15 years) and 38 females (mean age of 54±16). All the patients were divided into three groups by renal replacement therapy: hemodialysis patients (5 males and 5 females), peritonealdialysis patients (11 males and 6 females) and renal transplanted patients (21 males and 26 females).

Anthropometric assessments
All the anthropometric variables were measured on the patients right side. The ivestigation was performed one time.

Body mass was measured with medical scales in kg (±0.05 kg). Each patient was weighed on a Soehnle (Germany) electronic scale (precision 0.05 kg).

Standing- height was measured using a Martin metal anthropometer in cm (±0.1 cm).

Circumferences (cm) were measured with anthropometric tape 3 meters, 7 mm wide, flexible steel, black scale on yellow, adapted with zero interface and small filed passage notch, fully retractable without button device.

Skinfolds (mm) thicknesses were measured with the Holtain Skinfold Calliper. Four circumferences (cm): relaxed midarm, waist, hip and upper leg. The caliper can be dropped without damage. Accuracy was interpolated 0.5 mm, with a calliper pressure of 10 g per sq mm, range of 0 to 85 mm, the caliper meets the requirements for scientific and professional use.

The body fat percentage was measured with hand to hand bioelectrical impedance (BIA) between the right and the left hand with the Omron® BF 300 body fat monitor (Omron/Matsusaka, Japan).

Height- weight-based equation (body mass index, BMI) was calculated as kg/m^2.

Waist to Hip Ratio(WHR) were calculated.

The anthropometrical data of weight, height and the body mass index were compared in three groups: hemodialysis, peritonealdialysis and renal transplant patients.

Measurements were performed in the morning between 9.00 and 12.00. All the patients had a light breakfast 2 h before the study. All the measurements were taken by a well- trained anthropometrist.

Ethics and Statistics
The study has been approved by the Ethics Committee on Human Research of the University of Tartu, Estonia (protocol no 103/1; 2002) and carried out at the Tartu University Hospital. The data were processed using the SAS- system at the Institute of Mathematical Statistics. Results were given as mean values (X) and standard deviations (± SD). The comparison of means (t- test) was used to evaluate the body composition differences between hemodialysis (HD), peritonealdialysis (PD) the renal transplant (RT) groups. Statistical significance was accepted when $P < 0.05$.

RESULTS

The results of this study indicate that the anthropometric profile of the Estonian chronic renal failure (CRF) patients with renal replacement therapy (RRT) had individual differences. All the data were selected with anthropometric variables: skinfolds thicknesses, the body mass index (BMI), the body fat (BF, kg), the body fat (BF, %), the waist to hip circumferences ratio (WHR). The subjects was divided into three groups according to renal replacement therapy: HD (14% male and 16% female patients), PD (30% male and 16% female patients), RT (57% male and 68% female patients).

The mean body mass index in male patients was 25.8±6.2 kg/m^2 and in female patients 27.0±6.3 kg/m^2, which is caused by the increase of the body content and a great age variety of the subjects (18–78 years). In the studied RRT patients groups were significantly different by mean age ($P<0.05$). The characteristics of the measured anthropometric variables in the chronic renal failure patients are shown in Table 1, Table 2.

The mean height in males was 174.9±7.8 kg and females 162.0±6.2 kg; the weight in males 78.9±18.4 kg and females 71.0±18.1 kg. See Figure 1, Figure 2.

Body mass index (BMI) is the most frequently used clinical measure for determination of relative fatness. In the study were used WHO body mass indices classification [11]. In the group of males only 54% of the subjects had normal weight (BMI 18.5–24.9), while another 27% males had overweight (BMI 25–29.9). One male patiens were malnourished, BMI <18.5 and one patients had obese class III ≥40. See Figure 3.

In the group of females 34% of the subjects had normal weight, while another 24% females was overweight (BMI 25–29.9). Only three female patients had malnutrition with BMI 14.9; 18.4 and 16.2. Two female patients had obese class III with BMI 43.8 and 46.1.

Anthropometrical parameters showed overweight and obesity, fat accumulation in the body, especially in the abdominal region of the body in females group (BF, 34–38%). In males group is mean body fat lower than in women (BF, 18.9–20.3%).

Acknowledgements. The preparation of the manuscript was supported by scientific grants TARSK 0472 and DARCA 1880.

Table 1. The characteristics of anthropometric the measurements in the renal replacement therapy of male patients (n– 37)

Renal replacement therapy methods	HD	PD	RT	*P- value	*P-value	*P-value	*P-value
Groups (1, 2, 3)	Group 1	Group 2	Group 3	1, 2, 3	1 - 2	1 - 3	2 - 3
Patients (n)	n = 5	n = 11	n = 21				
Variable	X±SD	X±SD	X±SD				
Age (years)	53.2±8.1	55.2±11.7	43.0±15.5	*	NS	NS	*
Weight (kg)	86.2±11.3	80.8±21.1	76.1±18.3	NS	NS	NS	NS
Standing- height (cm)	175.2±3.7	172.0±5.4	176.4±9.2	NS	NS	NS	NS
Circumferences (cm)							
Midarm (relaxed)	34.0±4.2	30.9±3.9	30.2±5.2	NS	NS	NS	NS
Waist	103.6±10.9	98.8±17.2	90.0±13.5	NS	NS	*	NS
Hip	106.2±8.5	102.7±13.0	98.8±10.5	NS	NS	NS	NS
Upper leg	38.6±3.1	36.9±3.4	34.9±3.2	NS	NS	*	NS
Skinfolds (mm)							
Biceps	4.6±1.8	5.8±4.5	5.1±3.1	NS	NS	NS	NS
Triceps	10.8±4.7	10.4±5.0	10.5±5.5	NS	NS	NS	NS
Subscapular	13.7±8.0	12.6±10.4	10.9±6.9	NS	NS	NS	NS
Suprailical	8.7±6.0	11.9±9.5	9.6±5.0	NS	NS	NS	NS
Sum 4 skinfolds	37.9±18.4	40.6±26.9	36.1±18.3	NS	NS	NS	NS
Indices							
Body fat (%) by OMRON	20.3±7.1	21.2±10.1	18.9±8.1	NS	NS	NS	NS
Body fat (kg) by OMRON	18.1±7.9	18.8±13.7	15.3±10.8	NS	NS	NS	NS
BMI- body mass index (kg/m^2)	28.2±4.0	27.3±6.8	24.5±6.3	NS	NS	NS	NS
WHR- waist to hip ratio	1.0±0.0	1.0±0.1	0.9±0.1	NS	NS	NS	NS

Abbreviations: X, mean; SD, standard deviation; HD, hemodialysis; PD, peritonealdialysis; RT, renal transplantation; group 1, HD versus PD (*P< 0.05); group 2, HD versus RT (*P< 0.05); group 3, PD versus RT (*P< 0.05); NS, no significant changes.

Table 2. The characteristics of anthropometric the measurements in the renal replacement therapy of female patients (n- 38).

Renal replacement therapy methods	HD	PD	RT	*P- value	*P-value	*P-value	*P-value
Groups (1, 2, 3)	Group 1	Group 2	Group 3	1, 2, 3	1 -2	1 - 3	2 - 3
Patients (n)	n = 6	n = 6	n = 26				
Variable	X±SD	X±SD	X±SD				
Age (years)	67.8±7.7	69.3±8.8	48.2±15.6	*	NS	*	*
Weight (kg)	66.8±10.1	62.8±14.9	73.9±19.7	NS	NS	NS	NS
Standing- height (cm)	157.6±5.3	160.0±3.9	163.5±6.3	NS	NS	*	NS
Circumferences (cm)							
Midarm (relaxed)	31.7±3.4	28.6±3.8	32.1±5.3	NS	NS	NS	NS
Waist	90.1±13.1	86.3±11.5	90.0±15.4	NS	NS	NS	NS
Hip	102.6±7.4	101.1±13.8	108.2±14.5	NS	NS	NS	NS
Upper leg	35.6±2.1	34.1±5.4	37.1±5.7	NS	NS	NS	NS
Skinfolds (mm)							
Biceps	8.2±3.5	4.4±1.9	9.1±4.9	NS	*	NS	*
Triceps	16.2±4.6	13.9±3.3	19.1±7.1	NS	NS	NS	*
Subscapular	16.2±8.2	11.8±5.6	15.6±7.6	NS	NS	NS	NS
Suprailical	12.9±4.8	11.0±7.8	15.0±8.6	NS	NS	NS	NS
Sum 4 skinfolds	53.5±19.5	41.0±17.1	58.8±25.6	NS	NS	NS	NS
Indices							
Body fat (%) by OMRON	37.7±4.7	33.1±5.9	33.7±10.3	NS	NS	NS	NS
Body fat (kg) by OMRON	25.4±5.9	21.3±8.2	25.9±12.2	NS	NS	NS	NS
BMI- body mass index (kg/m^2)	27.0±4.6	24.4±4.8	27.6±6.9	NS	NS	NS	NS
WHR- waist to hip ratio	0.9±0.1	0.9±0.0	0.8±0.1	NS	NS	NS	NS

Abbreviations: X, mean; SD, standard deviation; HD, hemodialysis; PD, peritonealdialysis; RT, renal transplantation; group 1, HD versus PD (*P< 0.05); group 2, HD versus RT (*P< 0.05); group 3, PD versus RT (*P< 0.05); NS, no significant changes.

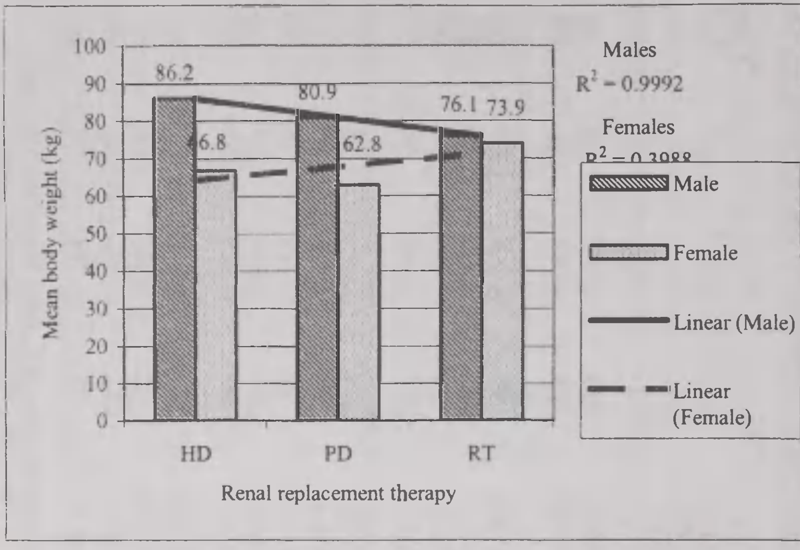

Figure 1. Data of the body weight (male n-37; female n-38).

Abbreviations: HD – hemodialysis patients, PD – peritoneal dialysis patients, RT – renal transplantation patients; R^2 – linear regression level.

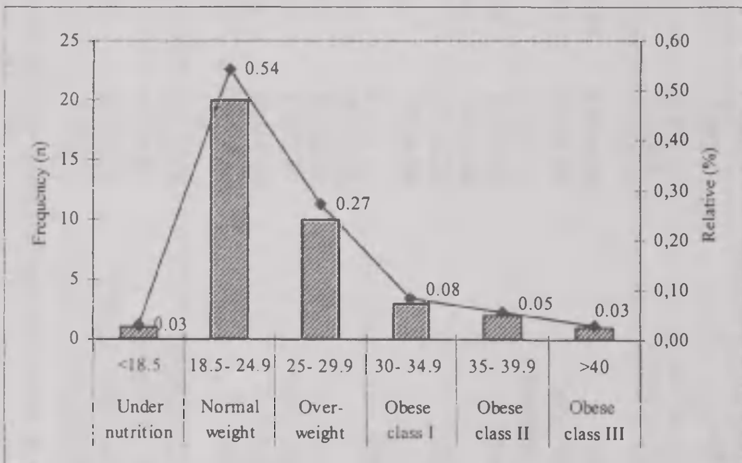

Figure 2. Data of the body mass index in the renal replacement therapy of male patients (n-37).

Abbreviations: BMI, body mass index (kg/m^2).

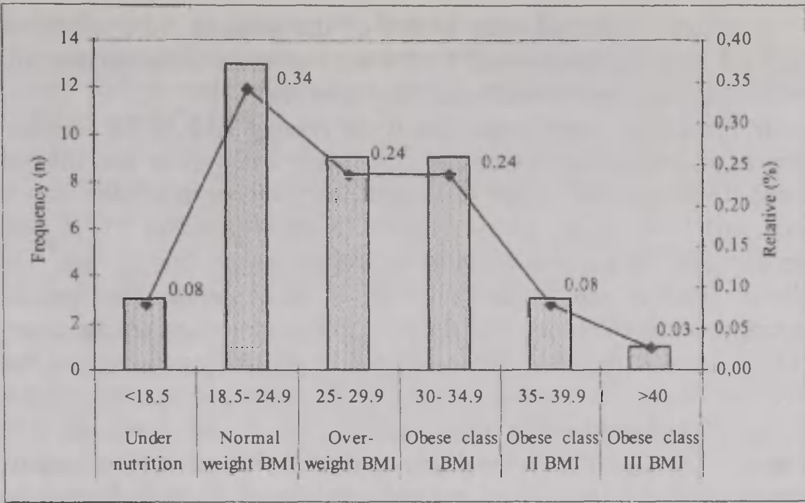

Figure 3. Data of the body mass index in the renal replacement therapy of female patients (n– 38).

Abbreviations: BMI, body mass index (kg/m^2).

CONCLUSION

In conclusion it can be said that all the patients retained a subjectively satisfactory general status of health during observation.

No significant worsening of the renal function was also objectively noticed during the period of observation.

To assess the patient`s body composition, it is important to measure and dynamically observe the anthropometric characteristics: weight, height, the circumference of the arm, the thickness of skinfolds and the calculated indices.

Anthropometric data allow the researcher to find connections with diseases to study their spreding and distribution. The use of anthropometric data presumes continuous collection and classification of data in solving medical, health promotion and economic problems [12].

Anthropometry is the single most portable, universal, inexpensive and noninvasive technique for assessing the size, proportions and the composition of the human body in individuals, populations and clinical decisions use. By the WHO Expert Committee the use of the interpretation of anthropometric measurements was recommended for future[13].

G. Wilson indicated, that 64.3% of the patients were mildly to moderately malnourished and 13.3% were severely malnourished and 16.3% of the patients were found food insecure [14].

In the Italian Longitudinal Study on Ageing (ILSA) the relationship of anthropometric characteristics to age and gender was investigated. The body mass index was significantly higher in women than in men, and lower in the oldest subjects. Malnutrition was 5% in both genders and obesity was a higher in women goups than in men. The clinical practice and the epidemiological study showed that specific anthropometric reference data for the elderly age groups are necessary [15]. I. Larsson included obese subjects in the study and showed that body fat linearly correlated with the WHR index and is more optimal weight- for- height index than is BMI [16]. In the study of 1135 Swedish Obese Subjects randomly collected data of anthropometric measurements were obtained and indicated that BMI, body fat and the waist circumference in women is smaller than in men [17].

Patients nutrition status in comparison with the data in literature is better which might be connected with the fact that the patients were better prepared for the pre- dialysis and the dialysis periods. It refers to the good cooperation of specialists and monitoring of patients.

On the basis of the research, nutritional recommendations must be worked out with the purpose of making the work of diatologists, nefrologists and transplanting specialists more efficient in the complex monitoring of CRF patients whose life quality could be improved.

REFERENCES

1. Kahraman S., Yilmaz R., Akinci D. et al. (2005) U- Shaped association of body mass index with inflammation and atherosclerosis in hemodialysis patients. Journal of Renal Nutrition, Vol 15: 4, pp 377–386.
2. Lee S. W., Park G. H., Lee S. Y. Et al. (2005) Comparison of anthropometric data between end- stage renal disease patients undergoing hemodialysis and healthy adults in Korea. Yonsei Medical Journal, Vol 46: 5, pp 658–666.
3. Stall S, Ginsberg N. S, DeVita M. V et al. (1998) Percentage body fat determination in hemodialysis and peritoneal dialysis patients: comparison. Journal of Renal Nutrition, Vol 8: 3, pp 132–136.
4. Chumlea W. C. (2004) Anthropometric and body composition assessment in dialysis patients. Seminar in Dialysis, Vol 17: 6, pp 466–470.

5. Grzebalska A. M., Majdan M., Bober E. et al. (2004) Comparison between some anthropometric measurements in adequately treated peritoneal dialysis and hemodialysis patients. Annales Univ Mariae Curie Sklodowska, Vol 59: 1, pp 20–23.
6. Jones C. H., Wolfenden R. C., Wells L. M. (2004) Is subjective global assessment a reliable measure of nutritional status in hemodialysis? Journal Renal Nutrition, 14: 1, pp 26–30.
7. Nelson E. E., Hong C. D., Pesce A. L. (1990) Anthropometric norms for the dialysis population. American Journal of Kidney Disease, Vol 16:1, pp 32–37.
8. Wasserfallen J. B., Halabi G., Saudan P. (2004) Quality of life on chronic dialysis: comparison between haemodialysis and peritoneal dialysis. Nephrol Dial Transplant, Vol 19: 6, pp 1594– 1599.
9. Granja C., Teixeira-.Pinto A., Costa-.Pereira A. (2002) Quality of life after intensive care- evaluation with EQ-5D guestionnaire. Intensive Care Med, Vol 28, pp 898–907.
10. Wu A. W., Fink N. E., Marsh-.Manzi J. V. et al. (2004) Changes in quality of life during hemodialysis and peritoneal dialysis treatment: generic and disease specific measures. J Am Soc Nephrol, Vol 15: 3, pp 743–753.
11. Kopple J. D. (2001) National kidney foundation K/DOQI clinical practice guidelines for nutrition in chronic renal failure. American Journal of Kidney Disease, Vol 37, pp 66–70.
12. Lintsi M., Kaarma H., Saluste L. (2002) Systematisation of anthropometric data of body structure if height class is large and body weight in three classes. Tartu University, Papers on Anthropology XI, pp 151–163.
13. Word Health Organization. (1995) Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. World Health Organ Tech Rep Ser, 854, pp 1–452.
14. Wilson G., Molaison E. F., Pope J. et al. (2006) Nutritional status and food insecurity in hemodialysis patients. Journal of Renal Nutrition, 16: 1, pp 54–58.
15. Perissinotto E., Pisent C., Sergi G. et al. (2002) Anthropometric measurements in the elderly: age and gender differences. British Journal of Nutrition 87: 2, pp 177–186.
16. Larsson I., Henning B., Lindroos A. K. (2006) Optimized predictions of absolute and relative amounts of body fat from weight, height, other anthropometric predictors, and age 1. American J Clin Nutrition, 83: 2, pp 252–259.
17. Larsson I., Berteus Forslund H., Lindroos A. K. et al.(2004) Body composition in the SOS (Swedish Obese Subjects) reference study. Int J Obes Relat Metab Disord, 28: 10, pp 1317–1324.

Papers on Anthropology XV, 2006, pp. 114–123

DENTAL ENAMEL HYPOPLASIA IN THE PADA CEMETERY (12TH-13TH CC.) POPULATION IN NORTH-EAST ESTONIA

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ABSTRACT

Linear enamel hypoplasia (LEH) is one of the unspecific stress indicators, which is widely used for showing childhood stress. The current work observes the occurrence of the linear hypoplasia in the group of individuals from the Pada cemetery. The Pada cemetery has the best-preserved and most numerable skeleton series from the Late Iron Age period in Estonia. Observations included 80 individuals with the age above 15 years (32 females and 48 males) and 37 infants over 7 years (13 girls and 24 boys). All the individuals included in study had observable permanent maxillary central incisors or permanent lower canines, which are the most common hypoplastic teeth. The e-mail defects were registered – linear enamel hypoplasia (LEH) which could be seen with the naked eye. Severity and the age of formation of all the observed stress lines were registered. LEH was registered in different age classes in men and women. There were no statistically significant differences in the occurrences of LEH between infants and over 15-year individuals. 77.8% of all the observed individuals had LEH. Men showed LEH more often and their hypoplasia was more severe than in women. Especially big was the difference between men and women in the *adultus* age group and this difference was statistically significant.

Males had the occurrence of LEH quite similar in all the observed age groups. But females had LEH more frequently in infantile than in individuals over 15 years. The frequency of LEH in the female *adultus* age group was lowest. The most common age of the formation of the first hypoplasia was in both men and women 2.5 years, the second peak frequency of the formation of the first LEH was 4 years in males and 4.5 years in females. The number of the individuals affected with LEH in certain age was found. Most of the observed individuals had LEH that formed between 5–6 years of life.

Key words: metabolic stress, linear enamel hypoplasia, the Iron Age

INTRODUCTION

The health status of historical populations is possible to be described only by using skeletons. But in skeletons we can see only such abnormalities that have left traces on human hard tissues – on bones or teeth. Such a possibility is given by dental enamel hypoplasia which is the enamel developmental defect and that is formed by the formation of dental enamel in metabolic stress.

Enamel hypoplasia is any disturbance in tooth formation associated with macroscopic defects in the surface of the enamel (19). Furrow-type defects are most common and are often referred to as linear enamel hypoplasia (LEH)(13). LEH is defined as the presence of horizontal lines of decreased enamel thickness on the external surface of the tooth crown. They are due to the disturbance of enamel formation during tooth crown formation. Such disturbances are caused by the factors that affect the activity of ameloblasts so that the formation of dental enamel stops. After the child survives the stress the normal formation of dental enamel is continuing leaving the thinner line of enamel to the surface of the tooth. Some inherited and infectious diseases, changes in dietary habits, malnutrition, intoxication and others can be the factors that cause metabolic stress [19]. Perhaps, the most unique feature of enamel hypoplasia is that, unlike nearly any other possible indicator, one may infer the time of their formation [14, 21].

It is taken for granted that a LEH on the permanent teeth of individuals is a good indicator of childhood stress [7]. Thus, LEH is widely used for the evaluation of the health status of a particular population and for interpopulation comparisons [3, 7, 15, 18]. There are two different opinions about the fact if the individuals with more LEH had bad life conditions and had experienced more stress during their childhood or the individuals with more LEH had in contradiction good life conditions that enabled them to survive the stress [1, 9, 17].

The main purpose of this work was to describe the occurrence of linear hypoplasia in the Pada inhabitants, to observe the LEH occurrence in different sexes and different age groups and this way work out the methods for further investigations of hypoplasia in Estonian skeletal series.

MATERIALS AND METHODS

The cemetery of Pada was excavated from 1987 to 1989 by T. Tamla. The cemetery belonged to the Pada stronghold which was the largest at the Iron Age in the Vironia. This cemetery is situated in North-East Estonia near the River of Pada beside the Tallinn-Petersburg road. The graves are dated to 12th–13th centuries (the Late Iron Age). There were Pit Graves in the Pada cemetery. The Pada cemetery has the best-preserved and most numerable skeleton series from the Late Iron Age period in Estonia. The skeletons are quite well preserved. All the skulls are deposited in the ossuary of the Institute of History, Tallinn, Estonia. Odontological study of individuals showed that skulls have north-gracile odontological type [10]. There was great sexual dimorphism in the skeleton size but also in the tooth size (8, 11).

The analysis was performed on 117 individuals (80 over 15 years and 37 infants over 7 years) of the Pada cemetery (Table. 1). The sex and age of adult individuals were estimated by Leiu Heapost using post-skeleton and cranial features [20]. The age of infants was estimated by the author using tooth eruptions [20]. The sex of juveniles and infants was determined using the linear discriminate analysis based on the metrics of lower jaw permanent canines (probability 90.0%, r=0.78) or of upper jaw permanent first molars (probability 80.6%, r=0.67) (11).

All the individuals were classified according to the age groups:

Senilis 56 years and more

Maturus 35–55 years.

Adultus 20–34 years.

Juvenilis 15–19; individuals who had all permanent teeth erupted (except third molars).

Infantilis II 7–14; individuals who had upper first permanent incisors and first permanent molars erupted.

Table 1. Sex and age distribution of Pada cemetery skeletons.

Age group	Males	Females	Total
Senilis	*2*		*2*
Maturus	*20*	*7*	*27*
Adultus	*21*	*22*	*43*
Juvenilis	*5*	*3*	*8*
Over 15 years	48	32	80
Infantilis II	*24*	*13*	*37*
Total	72	45	117

All the individuals included in the study had observable upper incisors or upper or lower canines which are most hypoplastic teeth [22]. The same researcher investigated the entire series, thus eliminating the possible bias due to the intraobserver error. The occurrence and severity of LEH were recorded on all the permanent teeth. The severity of hypoplasia was recorded in degrees: 1st degree – mild, 2nd – moderate and 3rd degree – severe [2]. All the individuals were classified in accordance with the most severe episode. In all the observed teeth the age at LEH formation was recorded and the age of the formation of the first hypoplasia was registered in every individual. The age at LEH formation was determined according to Massler et al. [19].

All the observed features were recorded separately in the males and females age classes. Statistically significant differences between males and females were found using the X^2-test. The statistical package SPSS was used for data processing.

RESULTS

In total 77.8% of the observed Pada individuals had LEH. The frequency of LEH was higher among males – 80.6%. Females had hypoplasia in 73.3% (Table 2).

Males had more LEH only in *adultus* age group and this difference between males and females was even statistically significant ($p=0.042$). Since males in other age groups did not have more LEH than females, then the difference between all the observed men and all the women was not statistically significant. Also males had a higher degree of LEH more often than females (Table 3).

Table 2. Number of individuals with one or more LEH in different age groups.

	MALES			FEMALES			P	TOTAL		
	N	n	%	N	n	%		N	n	%
Senilis	2	1	50					2	1	50
Maturus	20	15	75.0	7	6	85.7		27	21	77.8
Adultus	21	18	85.7	22	12	54.5	0.04	43	30	69.8
Juvenilis	5	5	100	3	3	100		8	8	100
Over 15 years	*48*	*40*	*83.3*	*32*	*22*	*68.8*	0.12	*80*	*62*	*77.5*
Infantilis	24	18	75.0	13	11	84.6		37	29	78.4
All observed individuals	*72*	*58*	*80.6*	*45*	*33*	*73.3*	0.36	*117*	*91*	*77.8*

N – number of observed individuals in the age group, P – significance of differences between sexes

Table 3. Average severity of LEH.

Age group	Males		Females		P	Total	
	N	Average severity of LEH	N	Average severity of LEH		N	Average severity of LEH
Senilis	*2*	*0.51*				*1*	*1*
Maturus	*20*	*1.26*	*7*	*1.0*		*27*	*1.15*
Adultus	*21*	*1.33*	*22*	*0.77*	0.064	*43*	*1.05*
Juvenilis	*5*	*2.0*	*3*	*1.67*		*8*	*1.88*
Over 15 years	48	1.31	22	0.96	0.059	80	1.15
InfantilisII	*24*	*1.04*	*13*	*1.15*		*37*	*1.11*
All observed individuals	72	1.24	45	1.0	0.132	117	1.14

N – number of observed individuals in the age group, P – significance of differences between sexes

The average severity of hypoplasia was 1.24 in males and 1.0 in females. This difference was not statistically significant and the average severity of LEH in the whole Pada group was 1.14 (STD=0.77). The higher degree of hypoplasia (degree 3) was not observed.

The most common age of the formation of the first hypoplasia was 2.5 years in males and 2.5–3.0 years in females. The other age of higher formation of first hypoplasia was 4.0 years in males and 4.5 years in females (Figure 1).

From all the observed defects of LEH the most common age of the formation of defects was 4 years of life (Figure 2). The age at which hypoplasia was formed is similar in males and females. Only the number of affected individuals was different, males had more hypoplasia in all the age classes.

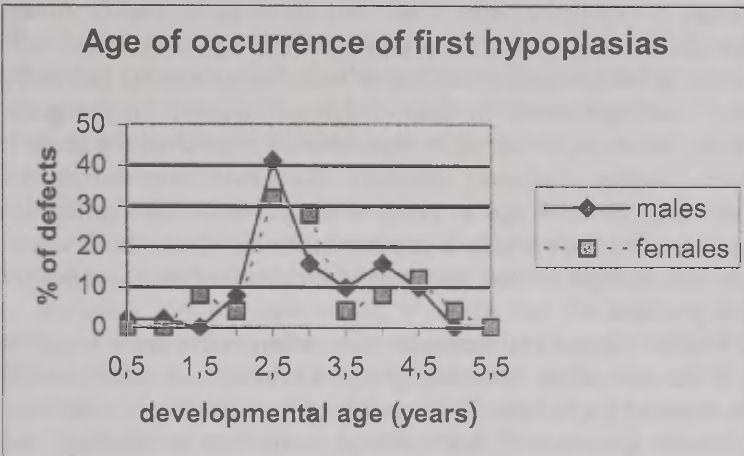

Figure 1. The age of the occurrence of the first hypoplasias in the Pada males and females.

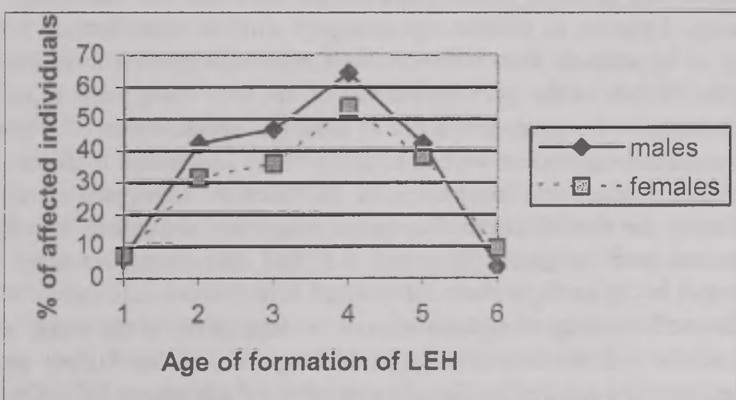

Figure 2. The percent of the individuals affected with LEH in certain years of life.

DISCUSSION

In the entire Pada group, the occurrence of hypoplasia is rather high compared to modern populations where hypoplasia incidences usually remain under 20 per cent [15]. In historical skeleton series, hypoplasia has occurred in some cases in even 100% of the population [5] although it usually remains under this level [3, 9, 15,17]. Juveniles suffered from hypoplasia more than the other age categories – all the individuals had indications of hypoplasia. These persons had suffered strong metabolic stress in their childhood because on the scale of severity, in seven of the eight cases studied it reached the score of 2 degrees. Besides childhood, metabolic stress must have continued also during their juvenile age as most of the juveniles had suffered also from cribra orbitalia which is another indicator of metabolic stress on the bones. It might be that the cause of the death of the juveniles was a health problem.

Usually it is the children who most often suffer from hypoplasia, but it was not so in the Pada group. Children and adults had both indications of hypoplasia. The number of hypoplasia cases differed by sex. Males aged over 15 had suffered more from it than boys, while the case was vice versa with the females.

Among males, the frequency of hypoplasia did not differ much by age groups; but it could be seen that the individuals who had died younger had suffered more. Such deduction could not be drawn for females. Females in adultus age category showed significantly fewer signs of hypoplasia than individuals of other age groups. It is known that the burials of the period (the end of the Iron Age) were as lavish for women as for men, this hints at the high social status of women. There are stipulations in written sources of the Livonian-Latgal law on inheritance which are most unusual for Western European countries and even for the Northern European countries, according to which both sons and daughters inherited the land, but daughters were the priority [16]. The high status of women in Estonia could account for the lower frequency of metabolic stress among girls. At the same time, the number of dental pathologies, hinting also at the higher social status, was not smaller in the women of the Pada group [12]. On the other hand, dental pathologies have been certainly more connected with the general biological status of women (giving birth). It seems that the differences of the life styles of boys and girls, expressed by hypoplasia, cannot be observed in adult men and women.

Although male/female differences cannot be noted in maturus age group, it should be mentioned that the number of women in this group was very small (only 7), consequently the absence of the differences in this group cannot be taken for granted. If all the individuals of all the age groups are compared, there are no differences in the frequency of hypoplasia among men/women.

Among females, hypoplasia was also less severe in all the age categories, slightly more severe cases were found only among girls (children age group). At the same time, the differences by sex are not statistically significant. The severity of hypoplasia among men lessens with the increase of age while for females it is the lowest in the adultus age category.

The specific feature in the Pada group is that there were no extremely severe cases (with the severity of 3 degrees), the average severity of the group was only 1.14 degrees. As the intensity of hypoplasia increases with stronger stress, it seems that the Pada children either did not suffer from such extreme stress or it might be that the children influenced by extreme stress simply died. According to archaeological findings, one might conclude that the people in the Pada stronghold had more likely good, rather than poor living conditions. The stronghold was once a trade centre and a landing place for vessels. The grave goods discovered from the location were also most abundant. The latter does not necessarily testify that the population had been very wealthy; still, fine grave goods are not a sign of poor people either [16].

Primary hypoplasia of the Pada men showed a clear peak frequency at the age of 2.5 years; as for females, the age of the formation of the peak was extended from 2.5 to 3 years of age. From this, one might at first deduct that it was the period of weaning infants, as the first peak of hypoplasia is usually associated with weaning [15], but it has been discovered that in some populations the primary hypoplasia peak frequency cannot be tied to weaning [4]. Another sharp increase of the formation of primary hypoplasia was at the age of 4.5 for females and around the age of 4.0 for males. In general, the same results have been discovered in other populations and it might be suggested that such features are more likely related to the formation of teeth, especially considering that similar hypoplasia peak frequencies at the age of 2–3 years and 3.5 to 4 years have been registered with other populations [5, 9, 15]. This is the age when the enamel defects of the most hypoplastic teeth – maxillary incisors and mandibulary canines – are most often formed [6].

If one is to analyse the formation of all hypoplastic lines, the first increase lies also on the lines formed during the second year and the second great maximum on the lines formed during the forth year of age. Here the corresponding data are absolutely similar for males and females. The pattern of the formation of all hypoplasia lines is similar to the Central-Lithuania Iron Age series [18].

Although the incidence of LEH in Pada is high, the severity of LEH is low. The highest degree of LEH was not registered. Males showed LEH more often and the severity of LEH was higher than in females. In males all the age groups had similar frequencies of LEH, but in females the lowest occurrence of LEH was in *adultus* age group and the highest in juveniles. The peak age of the formation of the first hypoplasia was 2.5 years in males and 2.5–3 years in females.

REFERENCES

Arcini C. (1999) Health and disease in Early Lund: osteopathologic studies of 3305 individuals buried in the first cemetery area of Lund 990–1536. Sweden: Department of Community Health Sciences, Medical Faculty, Lund University.

Brothwell D. R. (1972) Digging up bones. Trustees of The British Museum. London.

Blakey M. L., Coppa A., Damadio S., Vargiu R. (1990) A comparison of dental enamel defects in christian and meroitic populations from Geili, Central Sudan. Inter. J. of Anthrop., 5,193–202.

Blakey M. L., Leslie T. E., Reidy P. (1994) Frequency and cronological distribution of dental enamel hypoplasia in enslaved African Americans: A Test of the Weaning Hypothesis. Am. J. of Phys. Anthropol., 95, 371–383.

Goodman A. H. (1988) The chronology of enamel hypoplasias in an industrial population: a reappraisal of Sarnat and Shour (1941, 1942) Human Biology, 60, 5, 781–791.

Goodman A. H., Armelagos G. J. (1985) Factors affecting the distribution of enamel hypoplasias within the human permanent dentition. Am. J. of Phys. Anthropol., 68, 479–493.

Goodman A. H., Armelagos G. J., Rose J. C. (1980) Enamel hypoplasias as indicators of stress in three prehistoric populations from Illinois. Human Biology, 52/3, 515–528.

Heapost L. (1995) On craniology of South-East Estonian Population in XI – XVIII CC. Papers on Anthropology VI, 57–69.

Lanphear K. M. (1990) Frequency and distribution of enamel hypoplasias in a historic skeletal sample. Am. J. of Phys. Anthropol., 81, 35–43.

Limbo J. (2001) Odontology of Pada Cemetery. Papers on Anthropology, 10, 128–140.

Limbo J. (2003) Pada kalme (XI –XIII saj.) odontoloogiline iseloomustus. Odontology and Odontometry of Pada Cemetery (11th–13th cc.) Magister work. Tartu. Library of Tartu University.

Limbo J. (2004) Dental pathologies in individuals from Pada Cemetery (12th –13th cc) Estonian Journal of Archaeology 8, 1, 49–75.

Hillson S. (1996) Dental anthropology. Cambridge University Press.

Hillson S., Antoine D., Dean C. (2000) A detailed developmental study of the defects of dental enamel in a group of post-medieval children from London. Proceedings of the 11th International Symposium on Dental Morphology, 323–337.

Krenz-Niedbała M. (2001) Biological and cultural consequences of the transition to agriculture in human populations on Polish Territories. Variability and evolution 9, 89–99.

Mägi M. (2003) Eesti ühiskond keskaja lävel. In. *Eesti aastal 1200 (Estonia in 1200)*, Mägi M. ed. Kiıjastus Argo, Tallinn.

Palubekaitė Ž., Jankauskas R. (2001) Dental enamel hypoplasia in Lithuanian paleopopulations. Acta medica Lituanica, 8, 12 –17.

Palubekaitė Ž., Jankauskas R., Boldsen J. (2002) Enamel hypoplasia in Danish and Lithuanian late medieval/early modern samples: a possible reflection of child morbidity and mortality patterns. Int. J. Osteoarcheol., 12, 189–201.

Pindborg J. J. (1970) Pathology of the dental hard tissues. Munsgaard. Copenhagen.

Rösing F. W. (1977) Methoden der aussagemöglichkeiten der antrhropologischen Leichenbrandbearbeitung. Archäologie u. Naturwissenschaften, 1, 53–80.

Skinner M., Goodman A. H. (1992) Anthropological uses of developmental defects of enamel. In: Skeletal Biology of Past Peoples: Research Methods pp 153–174 Wiley-Liss, Inc.

Šlaus M. (2000) Biocultural analysis of sex differences in mortality profiles and stress levels in the late medieval population from Nova Rača, Croatia. Am. J. Physical Anthrop., 111(2), 193–210.

Papers on Anthropology XV, 2006, pp. 124–135

PREVALENCE OF EATING DISORDERS AMONG 10–19-YEAR-OLDS IN PÄRNU

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ABSTRACT

In today's society, there is a widespread belief that being overweight is a symbol of illness and ugliness, and that being slim represents health, beauty and success. This attitude markedly increases the number of young people whose self-esteem depends significantly on appearance and weight alone and therefore creates an impulse for early eating disorders. Eating disorders do not affect the whole of society, but this does not lessen the seriousness of the problem.

The aim of this paper is to examine the distribution of eating disorders in the town of Pärnu, Estonia. According to the statements posed and the analysis carried out, it can be said that the eating habits of a number of young people between the ages of 10 and 19 are very similar and several of them, girls especially, could develop an eating disorder.

The results of quantitative research among 594 young people aged 10–19 showed that 36% of girls in Pärnu had some kind of eating disorder and the most common of the two main types of disorder was anorexia. As eating disorders are a hidden problem in society, the percentage could actually be even higher. If the problem is not dealt with, it can lead to more serious results.

Keywords: young people, food addiction, eating disorder, *anorexia nervosa*, *bulimia nervosa*

INTRODUCTION

The current article seeks to provide an overview of a survey which studied eating disorders among young people aged 10–19 years in the town of Pärnu in the spring of 2006.

Over recent decades, eating disorders have become the most widely spread mental health disorder in young women. An integral part of today's society is a healthy life style: sport and exercise and balanced diet are promoted, and the adverse effects of alcohol and tobacco are explained. Young girls are eager to skip meals and go on diets in pursuit of ideal weight, but forget that starving and healthy nutrition are worlds apart, and that the former may result in a serious health condition or even prove fatal.

The number of cases of eating disorders among young girls and women is rocketing in Estonia. For instance, in Tartu the number of people who see the doctor because of this problem is nine times higher today than it was four years ago. In 2004, nearly 500 cases were registered in Estonia, while the actual number of cases is presumed to be three times higher. [4]

Eating disorders are traditionally considered a women's disease, but recently they have been discovered in men as well. Psychologists admit that this disease appears in men whose job involves appearing in public. Experts maintain that eating disorders are increasingly beginning at a younger age [7: 17–18].

The eating disorders related to weight loss have become a topical issue over the last few decades, but this is not a new issue at all – ancient Greek and Roman authors distinguished unhealthy or insatiable hunger from regular hunger. Homer mentions it in the 8th century BC, and Xenophon used the term *bulimos* in Greek ("bou" – large quantity, "limos" – hunger) in order to describe the feebleness and fainting which accompany a feeling of hunger [7: 17–18].

A breakthrough article on eating disorders was published in 1969 by Hilda Bruch, a pioneer in the field, in which she was intrigued by the question why some women refuse to eat and consequently nearly starve to death. She hypothesised that a cause might have been an inadequate understanding of the needs of the body and how to respond to them. Various hypotheses were presented to pinpoint the causes of such behaviour ranging from ever younger girls struggling to achieve the hard-attained ideal of female beauty, to hyper-dominant mothers making their daughters feel guilt and shame [1: 292–293].

Eating disorders may result from exaggerative diets aiming to cause weight loss which seems to be the ultimate cause. Being underweight is normally considered less dangerous than being overweight, but the arguments for weight loss seem only to be related to physical appearance and other people's approval [8:112].

Obviously it is the social pressure which makes many girls go on a strict diet, thus eating disorders may be considered a cultural phenomenon or a social problem [3: 50].

Every person suffering from an eating disorder has had "the last straw" which makes them decide to lose weight. As a rule, the trigger is an important person, unfortunately enough, often the mother, who makes a remark about the girl's weight [3: 53].

Eating disorders are behavioural syndromes related to disorders in physiological functions and physical or somatic factors [10:10]. They are most commonly a wrong attitude towards food, eating and one's body.

Eating disorders are usually classified as follows:

1. anorexia nervosa;
2. bulimia nervosa;
3. overeating with other psychological disorders;
4. vomiting with other psychological disorders;
5. other eating disorders. [6]

Within the group of eating disorders two most significant and distinctive syndromes are described: *anorexia nervosa* and *bulimia nervosa*, which therefore are studied in more detail in this article. Both disorders are linked to eating instincts, and their course, compulsive in nature, is similar to addiction, such as alcoholism, where the limit for normal consumption disappears. Young teenage girls often have disorders which arise from their fear of being fat, or their wish to have a better figure. Dieting may grow into strict starvation and then into an eating disorder. Anorexia and bulimia are illnesses which must be noticed, because the sufferers frequently avoid talking about them [7:134].

MATERIAL AND METHODS

The prevalence of eating disorders has not been widely researched in Estonia, but according to a study conducted in Holland up to 2% of the population suffer from them. The percentage of patients who fully recover from bulimia is slight [2: 7–8].

Psychologists have argued that the percentage of anorexics in Estonia currently stands at 0.2%, but actually it should be higher, especially among girls aged 11–18. Due to the higher rate of occurrence of bulimia and anorexia and the need for specific treatment of them, a centre for the treatment of eating disorders was opened in the psychiatric clinic of the University of Tartu in March 2005. Treating patients with bulimia or anorexia together with other patients did not prove effective since such patients require a special approach and observation. Lots of effort should be targeted to make them acknowledge their problem at all [11].

Psychologist Heli Zilenski concluded in the analysis of a study of schoolchildren (conducted in 2001) that a risk factor for eating disorders is lack of care and absence of security in relationships with parents. It is universally clear that the more security children perceive in their relationships with parents and peers, the higher their self-esteem is. Low self-esteem makes a person sensitive to social standards, and they tend to believe that if their body is fit, then other people will like them better. On top of this, dissatisfaction in other spheres of life may be transferred to the body [5].

The study described in this article was a **quantitative study**. Data were collected by a questionnaire. The objective of the questionnaire was to gather data on the occurrence of eating disorders, their causes and types among the children and adolescents aged 10–19 in the town of Pärnu. To this end random selection was used via an e-survey (the questionnaire was emailed into several lists that students of the schools in Pärnu use), and a hard copy distributed in various NGOs.

For **data analysis** and compilation of figures, the spreadsheet program Microsoft Excel was used.

The survey sample contained 10 to 19 year old children and adolescents living in Pärnu. This age range was based on references stating that eating disorders appear to be most frequent among 14 to 19 year olds. Children younger than 14 were included because the problem has become "younger" over the years. In 2005 there were 5963 young people between 10 and 19 years of age in Pärnu; therefore we collected data from a sample that amounted to 10% of the overall target population. The survey included a total of **594 adolescents**, 34% of whom were boys and 66% girls. **The respondents' age** was between 10 and 19, the average being 14.5 years; most respondents were 13–19 years old (see Table 2). There were fewer respondents between 10 and 12, but they were not the primary target group of the survey. Girls were better represented, and the reason for this might be that eating disorders are normally considered a girls' problem, and consequently more widespread among girls than boys. However, boys also face the issue, therefore the researchers decided to include boys in the survey as well, in order to gain the best insight into this issue in Pärnu.

Table 2. The number of respondents in Pärnu

Age (years)	Total (number)	Percentage (%) Sex	
		Boys	Girls
10	23	22	78
11	37	38	62
12	22	36	64
13	78	86	14
14	56	45	55
15	84	25	75
16	77	43	57
17	64	59	41
18	82	26	74
19	71	38	62
Total	594	41.8%	58.2%

In order to assess the **respondents' weight**, their body mass index (BMI) was analysed. Body mass indices were calculated as a ratio of height and weight using the following formula:

$$BMI = \frac{weight\ (kg)}{height^2\ (m)}$$

and then analysed (see Table 3) in order to establish the number of underweight and overweight respondents. Specialists have shown that people whose body mass index is below 18 run a higher risk of having eating disorders. A healthy BMI range is between 19 and 25. Should a person's BMI remain below the minimum and be 17.5 or less, it could reveal anorexia.

The **analysis** consisted of several parts. Firstly, the current body weight of the 10–19-year-olds was studied along with their day-to-day eating habits, their satisfaction with their body, and the thoughts and feelings they had after their meals. Which eating disorders they were aware of was also studied, and in italics we have inserted passages from the responses in the questionnaires which are published without any changes.

Table 3. Body mass index values of young people aged between 10 and 19

Age (years)	Body mass index					
	Boys (number)			Girls (number)		
	Under-weight	Normal weight	Over-weight	Under-weight	Normal weight	Over-weight
10	2	3	0	5	11	2
11	2	9	3	8	12	3
12	0	6	2	6	6	2
13	6	15	3	20	25	9
14	9	7	9	17	14	0
15	0	16	5	38	19	6
16	12	14	7	23	15	6
17	5	13	8	19	19	0
18	3	17	1	32	19	10
19	3	15	9	28	16	0

RESULTS

The study revealed that **being underweight is more often a girls' problem and being overweight a boys' problem** (see Figures 1 and 2). The reason for boys being overweight might be their lack of interest in sports, as today most young boys spend their time surfing the internet or watching TV rather than being outdoors, which could explain a decline in interest in sports.

Figure 2 shows that among 12-year-old respondents, nearly a half of the girls (43%) are underweight. In the same age group there are no underweight boys. One reason is surely a period of intensive growth when children grow faster in height than in weight. However, children at this age run and move about in their games more than older children. Thus it cannot be stated with certainty that the high percentage of underweight girls implies an occurrence of eating disorders in this particular age group. In the same age group of boys a quarter (25%) were overweight, and their problem might be that they do not exercise enough. The situation among 15- and 19-year-old-girls is extremely worrying. 60% of 15-year-old girls were underweight, as were 64% of 19-year-old girls.

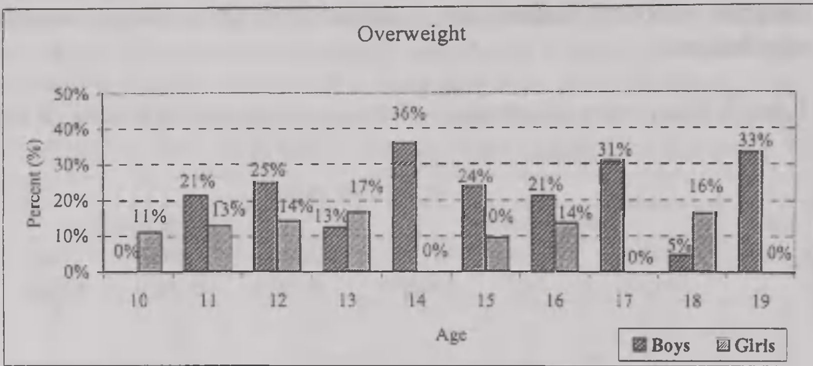

Figure 1. Assessment of respondents overweight by gender (%) (compiled by the author)

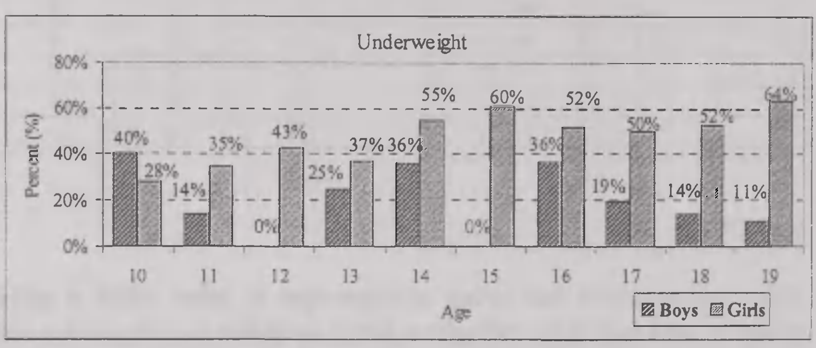

Figure 2. Assessment of respondents underweight by gender (%) (compiled by the author)

The percentage of overweight boys at ages of 14, 17 and 19 was over 30%. It may be caused by lack of exercise, a passive lifestyle and unhealthy eating habits. The study showed that only 36% of the respondents have regular meals and have three balanced meals a day. 20% of all boys said they consume daily food which may be classified as junk food: French fries, chips, hamburgers, pizza, or pastry.

A third of the respondents stated that they definitely do not have three balanced meals a day, and below are a few examples of their eating habits in their own words:

In the morning at about 7.30 I have some muesli with milk or yoghurt;, I do not have school lunch, when I get hungry I buy an apple or some other fruit in the café; at about 5 pm I usually have some light soup or make some hot broth. When I feel like having something sweet, I eat a pot of non-fatty curds. I do not usually eat after 6 pm, but if I am really hungry, I can afford to eat an apple. (a girl, 15, height 1.76, weight 45 kg).

In the morning an apple, coffee without sugar, vitamin-C drink. At lunch I eat fruit which I take to school (a banana, an apple, or an orange, sometimes grapes) and a small 150g pot of yoghurt. In the evening at 6 pm I usually eat soup which I cook myself. Before going to bed I have a snack, some apple because I am really hungry at 9 pm. I know I eat little, but I have no time to eat more. (a girl, 16, height 1.58, weight 40 kg).

In the morning I usually have muesli with milk (lots of it) and some apples, at lunch I have a couple of slices of toast with cheese, 2 apples and tea, and in the evening I have soup or boiled vegetables, sometimes porridge, and drink green tea. (a girl, 19, height 1.80, weight 55 kg).

In the morning I have crispbread with chicken pate or processed cheese. I have lunch at school but am not very hungry. When I return home I have a cup of coffee and have some crispbread with paté and some apples. In the evening, after my exercise class, I have apples again and cook some hot sandwiches with turkey ham and light cheese. (a girl, 18, height 1.65, weight 47 kg).

I normally eat about a kilo of fruit, for instance apples or pears, and a bar of rice chocolate. My need for sweet things is extremely high. I also drink three glasses of water. On a few days my menu only includes apples, no chocolate. (a girl, 15, height 1.65, weight 55 kg).

I do not feel particularly hungry in the morning or during the day and actually have no time to eat. After school I eat ten open sandwiches with sausage, ten boiled or fried eggs and a packet of chocolates or a tub of ice cream. My body does not tell me I am full, I constantly feel like eating. (a boy, 16, height 1.78, weight 67 kg).

Several responses imply that the children attempt to eat very light, non-fatty food and that cooked meals are absent from the menu altogether. Most of the girls in this age group listed the following foodstuffs in their regular daily menu: fruit, yoghurts, salads from fresh vegetables, stewed vegetables, cornflakes and muesli, canned soups of the light range, porridge, 4-cereal flakes, light curd desserts, vegetable soup, broth, wok meals, mashed potatoes, fish, vegetable burgers, chicken, pasta. 21% of the girls wrote about the Kellogg's cornflakes *Fitness* or *Kellogg's Special*, which means it is diet food. When considering these responses, it can be stated that the six young people either have eating disorders already or are at risk of acquiring such disorders.

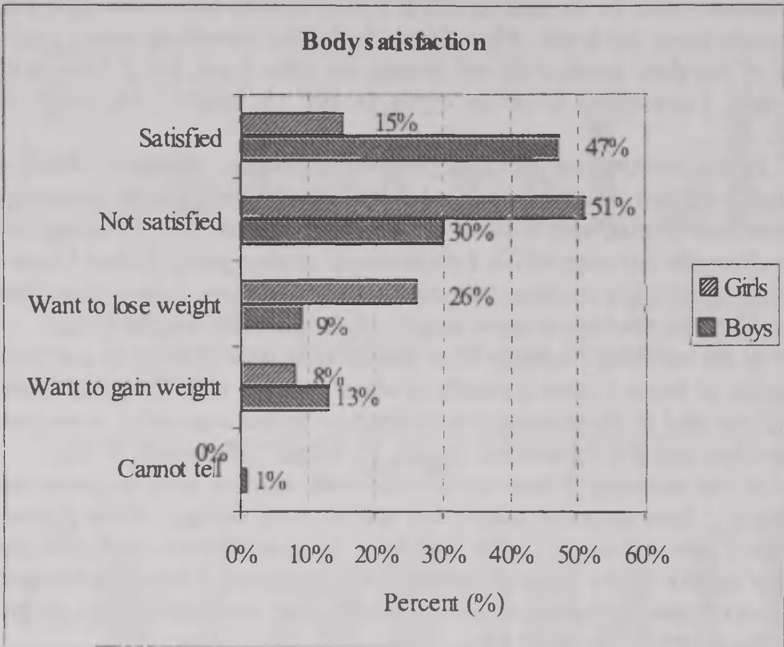

Figure 3. Body satisfaction among boys and girls (%)

The average Estonian girl thinks she is fat and wants to weigh less; this is proved in Figure 3 which shows that **51% of girls are dissatisfied with their current** weight and 26% of girls would like to lose weight.

Nearly half of the boys (47%) were satisfied with their body as opposed to only 15% of the girls. Considering the high percentage of underweight girls it might be assumed that some of those girls who dislike their present weight or would like to lose weight may perceive their body incorrectly and some of them may display features characteristic of anorexia or bulimia. There were more overweight than underweight boys, which suggests that the 30% of the boys who are dissatisfied with their weight do not belong among those youths who might have an eating disorder, and that the reasons may rather lie in their passive lifestyle and lack of exercise.

Since eating disorders are not only caused by food and nutrition but by a person's way of perceiving their own body and food, their thoughts and feelings after the meals were also studied. The multiple choice options contained specifically those thoughts and feelings that specialists regard as characteristic of most people with eating disorders.

The responses showed that 64% of the respondents have no negative feelings after a meal. One of the responses was: *I am full and feel good, that's all*. The following responses, however, imply that an eating disorder may be manifest.

I normally eat Kellogg's cornflakes for breakfast and that is sufficient. I do not eat at school and have no appetite either, but when I return home in the evening my mother makes me eat her cooked food, even though I'd rather eat something light, not rich. It is as if mother did not care that I have no appetite. She thinks I eat too little. It angers me and always makes me cry that she makes me eat when I don't want to. I would so much like to lose weight but it is not possible like this. After a big meal I feel guilty and would like to cry, and this is why I run to the toilet secretly and vomit. It feels much better after that. (a girl, 15, height 1.68, weight 52 kg).

I am constantly thinking of food. I am always starving but I never dare eat anything but fruit. I am afraid to gain weight because after each meal I fear I have put on weight. The dance group which I attend did not accept five girls in the autumn because they had gained weight in summer. I am afraid it might happen to me. (a girl, 19, height 1.70, weight 50 kg).

I often feel guilty when eating sweet things. During the day I eat regular food too and in normal quantities but cannot stop myself eating sweet things. My partner usually buys biscuits, chocolate, wafers and sweets on the way home. I am not able to control myself. I begin eating this stuff and the result is awful and I feel bad. My tummy hurts and I am afraid of becoming fat, I really fear it. At birthday parties I eat at least five big slices of cake while my friends hardly eat one. I feel good when they say they envy me because I am thin and can eat as much as I want. I repeat every morning to myself that I'll give up everything sweet, but I can't and the fear prevents me from sleeping properly. (a girl, 19, height 1.62, weight 43 kg).

I am so fat and after a meal I feel even fatter. I would so much want to be thin like all my friends and most of the women are. Instead of my tummy I only see fat and rolls. I am frustrated and don't want to live like this. I have tried starvation but can never starve more than a day. Each time I think of starving, I think of food. Then I think that an ice cream would do no harm, which is then followed by a sandwich and then by everything else in the kitchen. (a girl, 15, height 1.68, weight 60 kg).

Specialists find such thoughts frightening, especially when looking at the respondents physical characteristics.

The questionnaire also included a question on **whether the respondent thinks they have an eating disorder**. It appeared that anorexia has a higher prevalence than bulimia. 15% of the girls thought they were anorexic and 13% of the girls considered themselves bulimic. However, the results are not very reliable since the research also showed that only 11% of the girls had received psychiatric treatment and it remains unknown how many of them had seen a psychiatrist about an eating disorder. It could only be assumed that the girls had attempted to identify which of the disorders they have or have had on the basis of articles in the media. The analysis also revealed that 8% of the respondents had suffered from both disorders, which is quite probable because when a person with a disorder fails to get treatment, one disorder may develop into another.

The survey also **studied young people's opinion about their health**. Having compared different health problems which may result from eating disorders, it became evident that **the adolescents mostly had digestive and sleep problems**. The girls with an eating disorder often also had disorders in their menstrual cycle. If the body does not receive sufficient quantities of nutrients, menstruation may terminate and result in infertility. The survey showed that 9% of the girls had problems with an irregular cycle.

DISCUSSION

The specialists dealing eating disorders do not believe that in Estonia these disorders could threaten society at present, but if it turns out that the number of young people who suspect they have the problem but hide it, rises massively, the society as a whole could be at risk. Boys being overweight can be ascribed to the internet and TV watching which have replaced outdoors activities and sport. A reason for the girls being underweight is that they pay more attention to their weight, and they may also have more eating disorders.

The young girls who are dissatisfied with their body aim to eat as little as possible and foods as light and low in fat as possible, which is not beneficial for their health and causes various health problems which are characteristic of eating disorders. 36% of the respondents admitted they have unpleasant thoughts in relation to food, such as pangs of guilt, constant thoughts of food, or the fear of being excluded from the dance group.

In order to prevent the change, certain effective methods should applied. One of the most effective methods used in treating eating disorders is the framework method, but it is still under development. This method would help specialists get a better picture of the sources of the problem and suggest possible solutions.

In conclusion, the authors think that, as eating disorders are a problem of a welfare society, parents should be told that their children need attention and empathy to avoid such disorders. In the modern world many parents have grown apart from their children, and therefore they do not notice that the young people could already have developed an eating disorder. The problem is sometimes noticed only when it is already too late.

REFERENCES

1. Goleman D. (2000) Emotsionaalne intelligentsus. Tartu: Väike Vanker.
2. Järv A. (2000) Praktilised juhised söömishäiretega patsientide raviks. Ameerika Psühhiaatrite Assotsiatsioon, 01.01.2000, 38 pp. (manuscript)
3. Järvelaid M. (2001) Teismeliste eesti koolilaste kehaehituse trendist 20. sajandil. – Eesti antropomeetriaregistri aastaraamat, 50–54. Tartu .
4. Laev, S. Söömishäiretega inimeste arv tõusuteel. – Eesti Päevaleht. 15.03.2005, p. 7.
5. Kivimaa, E. (2003) Lõputu võitlus kehakaaluga. Eesti Naine, 5, 24–26.
6. Paju, I. (2003) Söömishäiretega heaolu. Eesti Päevaleht, 06.04, 4.
7. Valman, B. (1998) Lapse tervise käsiraamat. Tallinn: Varrak.
8. Wettenberg, L. (2000) Psühhiaatria käsiraamat. Tartu: AS Paar.
9. Naine tunne oma keha: käsiraamat. (1998) Tõlkinud K. Veiksaar. Tallinn: Eesti Raamat.
10. Psüühika- ja käitumishäirete klassifikatsioon: RHK-10: kliinilised kirjeldused ja diagnostilised juhised. (1999) Vastutav toimetaja V. Vasar. Tartu: Tartu Ülikooli Kirjastus.
11. Tartu psühhiaatriakliinikus on nüüdsest õdus olemine. (2005) Meditsiiniuudised, 05.04. [http://www.mu.ee/?mid=3&pid=189&id=13202]. 10.04.2005

Papers on Anthropology XV, 2006, pp. 136–141

A REAPPRAISAL OF CAMERANO'S SOMATIC COEFFICIENT

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ABSTRACT

The somatic coefficient, a convenient tool for computing ratios of two measurements, was proposed by L. Camerano in 1900. Most certainly it has not found widespread use. The application of this coefficient and of other measures for quantifying variability of anthropometric data was demonstrated by Giuffrida-Ruggeri on a total of 110 subjects. These results were reviewed and compared with the results obtained by modern statistical processing by which, however, the claimed larger variability of the female was not confirmed. Nevertheless, Camerano's work remains remarkable at the time of an increasing use of mathematical methodology in biology and early somatotyping.

INTRODUCTION

In 1900 Lorenzo Camerano (1856–1917), a famous zoologist of his time, a convinced devotee of the evolution theory and author of many erudite publications in the field of entomology, somatometry and general biology, has proudly introduced a somatic coefficient ω ("*coefficiente somatico individuale*") [2]. His idea was based on the work by Angelo Andres published in 1897 who had proposed to use the thousandth part of a base length for comparison purposes in zoology ("*metodo di millesimi somatici*", the method of somatic thousandths) [7]. The suggested method, however, stands for nothing else but expressing a relative measure in per mils. The use of such fractions seemed to be advantageous for comparative studies in biology. Though Camerano admits that the application of Andres' method gives good results, he argues that computing the relation

1000/L (L being the given base length) is quite longish and tedious. Therefore, he believes that using 360 instead of 1000 as numerator would straightforwardly satisfy the situation and serve the envisaged purpose better. To promote the practical application of the somatic coefficient, he published detailed tabulated figures for ω, the 360th part of base values between 0.25 to 360, and their 2- to 9-fold multiples which ease to perform the required algorithms [5].

With the use of the somatic coefficient Camerano had hoped to be able to set up safe boundaries for the individual variability of and within different species and also to reunite good quality material for systematic and quantitative animal studies.

The aim of this study was to reassess the results which had been obtained through Camerano's methodology and to compare them with the methods used nowadays for statistical data analysis.

MATERIAL AND METHODS

In order to demonstrate the larger variability of the female, Vincenzo Giuffrida-Ruggeri (1872–1921) applied Camerano's somatic coefficient to anthropometric measurements [6]. For his studies he used the data published by Peli [7] who obtained them on 60 male and 60 female corpses from the city of Bologna. He excluded 5 measurements each of the male and female corpses as these were more advanced in age.

The trunk lengths were chosen as the base length (L) for the calculation of the somatic coefficient and were measured from the 7th cervical vertebra to the ischiatic tuberosity; the upper limb lengths were taken from the top of the humeral caput to the tip of the middle finger; the distance from the apex of the trochanter to the plane of the foot sole served as the lower limb lengths. The way of measuring the biacromial breadths was not stated.

Applying Camerano's method of data handling [3] Giuffrida-Ruggeri performed the following calculations (names of variables are left unchanged):

ω: the somatic coefficient $\omega = 360/L$;

C: the number of observed classes between the largest and the smallest observation with a class interval of 1 [cm];

A: the range (in this context also called the index of variability) which is the difference between the smallest and the largest item in the sample;

a: the so called variation index which results from C/A;

C_e: the extreme classes which are the smallest and the largest observed class;

M: the middle class which is obtained as the mean between the smallest and the largest class and which does not need to be occupied;

F<M: the so called frequency index, which is the number of classes below M or above M (F>M) which is obtained by dividing the respective number of classes by the total number of observations;

Σ: the so called index of deviation which is the sum of the number of classes (e.g. if there were 3 classes then $\Sigma = 1+2+3$).

The figures for the somatic index were recalculated from trunc length and compared with the published figures by which two erroneously given data were detected and replaced. The new figures were used to recalculate the original data for the upper and lower limb length and for the bicromial breadth. All the data were subjected to computerised processing with SPSS (ver 12.0), and common statistics were calculated and compared with the original findings. These results are listed in Table 1.

RESULTS

All the calculations are based on 55 male and female subjects each. The age of the subjects was almost identical (mean±SD): males: 43.7±9.3; females: 43.5±7.7 ($p=0.894$). This is due to the fact that Giuffrida-Ruggeri has already trimmed the data in order to avoid bias through some very old.

The length of the trunk which served as the base length L for the calculation of the somatic index $\omega=360/L$ was different for both genders: male:664.6±35.7; female: 607.9±26.5. This difference was highly significant ($p<0.001$), and not surprisingly so the somatic index ω as well (male 0.543±0,030; female 0.593±0.027; $p<0.001$).

The data for the variables upper limb length, lower limb length, and biacromial width were published by Giuffrida-Ruggeri as relative figures by multiplying the absolute data with ω according to Camerano's proposals. To demonstrate the value of such a procedure, the original data were recalculated and thus the absolute figures for these variates were obtained. Table 1 shows the published statistics for the relative data, and the results of basic statistical procedures used nowadays for both, the relative and the absolute data (mean, SD, variance, range, maximum and minimum values).

All of Camerano's suggestions for identifying variability are based on discrete variables and make mainly the use of the statistics of dispersion. In his paper Giuffrida-Ruggeri has calculated the mean class M as the only measure of location as well, but he did not use it for further interpretaion of his results. Furthermore, the encountered differences between male and female variates and their dispersions were not estimated conclusively and they were likewise not statistically founded.

For example, he stated that the variability of the lower limb in females is much larger than in males because of A, the "index of variability" (i.e. range) being larger (169 vs. 125). The range, however, is known to be only an inefficient estimator of dispersion as it generally underestimates the true population range. He also considers F<M and F>M as an indicator of the larger variability of the female. Especially the use of Σ is by no means justified to demonstrate a given variability.

In order to re-interpret Giuffrida-Ruggeri's data contemporary significance tests were applied. Comparing the means of relative and absolute data between the three variables (t-test) of the male and female group revealed that none of the relative means was statistically significantly different, and only the recalculated data were highly different between both genders (Table 1).

As a test of homogeneity the highly efficient Kolmogoroff-Smirnoff-test was applied. Again, it was found that the data manipulated by multiplying with ω were not different but were strongly inhomogenous in their original form (Table 1).

Table 1. Results for different indices proposed by Camerano and presented by Giuffrida-Ruggeri for three anthropometric measurements in male and female subjects. Additionally the results of basic statistics and significance testing are listed.

	Male						Female					
	upper limb length		lower limb length		biacromial width		upper limb length		lower limb length		biacromial width	
	rel	abs	rel	abs	rel	abs	rel	abs	rel	abs	rel	abs
C	45		42		80		44		49		31	
A	116		125		74		118		169		82	
a	0.3879		0.3360		0.4054		0.3729		0.2899		0.3781	
Cmin	351		407		127		358		386		131	
Cmax	466		531		200		475		554		212	
M	408.5		469.0		16.5		416.5		470.0		171.5	
F<M	0.3818		0.5273		0.4727		0.5455		0.5091		0.6182	
F>M	0.6182		0.4727		0.5273		0.4545		0.4909		0.3818	
Σ	1682		1953		685		1741		3570		841	
mean	416.2	767.3	470.7	867.9	163.7	301.5	411.7	695.7	472.0	795.5	167.1	281.2
SD	23.5	43.4	26.9	53.7	12.4	20.6	26.7	42.7	36.5	49.9	14.9	25.3
variance	553.2	1887.2	723.2	2880.4	153.6	423.1	713.6	1824.8	1333.0	2486.5	222.4	638.3
median	416	775	470	871	165	301	415	695	469	800	167	283
range	115	236	124	280	73	120	117	235	168	239	81	145
min	351	600	407	695	127	240	358	607	386	654	131	228
max	466	836	531	975	200	360	475	842	554	892	212	373
t-test												
p-value	0.342	0.000	0.826	0.000	0.199	0.000						
KS-test [*]												
p-value	0.453	0.000	0.899	0.000	0.453	0.000						

[*] KS-test: Kolmogoroff-Smirnoff-test

DISCUSSION

In addition to defining the somatic index, Camerano also devoted himself to the quantitative study of organisms by using indices of variability, of variation, of the frequency of deviation, and of isolation (2–4). All this must be seen in the light of the developing art of statistics at the turn of the 20th century. Thus, in his publications reference is made to the progress achieved by the newly established English and American schools on quantitative studies of animals.

The somatic index ω, proposed by Camerano, has been only a more or less suitable means for calculating ratios between two measurements at a time when computers were not available. It is of no relevance in itself as an indicator of variability and has never been recommended as such. The other algorithms claimed to refer to variability are either very old fashioned or statistically unjustified. Nevertheless, the use of ratios and percentages may be useful as basic quantities in biological research. For instance, the shape may be better described by using the ratio of two different measurements than just one variate. But they must be used with caution because they are relatively inaccurate and in most cases not normally distributed which has to be considered while choosing the correct statistical procedure.

REFERENCES

1. Andres A. (1897) In: Rendiconti R inst Lombardo di lett. Serie II, 30.
2. Camerano L. (1900) Lo studio quantitativo degli organismi ed il coefficiente somatico. Boll musei zool anatom comp Torino 15(375), 1–18.
3. Camerano L. (1901) Lo studio quantitativo degli organismi e gli indici di variabilità, di variazione, di frequenza di deviazione, e di isolamento. Boll musei zool anatom comp Torino 16 (405), 1–14.
4. Camerano L. (1901) Lo studio quantitative degli organismi e gli indici di mancanza, di correlazione e di asimmetria. Boll musei zool anatom comp Torino 16(406), 1–5.
5. Camerano L. (1903) Tabelle per la riduzione delle misure assolute in misure espesse in 360esimi somatici. Boll musei zool anatom comp Torino 18 (436), 1–50.
6. Giuffrida-Ruggeri V. (1903) La maggiore variabilità della donna dimostrata col metodo Camerano (coefficiente somatico). Monit zool ital 14(12), 294–304.
7. Peli (1881) Sulle misure del corpo nei Bolognesi. Mem acad scienze istit Bologna. Serie IV (2) Fasc 3.

Papers on Anthropology XV, 2006, pp. 142–149

ASSOCIATIONS BETWEEN TEMPERAMENT TYPES AND BODY BUILD IN 17–22-YEAR-OLD ESTONIAN FEMALE STUDENTS

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ABSTRACT

The study was focused on the associations between temperament features and body build, using an original self-report questionnaire and a 5SD classification of height and weight. The sample consisted of 392 female students of the University of Tartu aged from 18 to 22 years. A 5SD classification of height and weight was applied for assessment of body build. Temperament types were determined by a questionnaire and methodology developed by J. Liivamägi and previously used on a population of inpatient children in Tartu University Psychiatric Clinic and on normal pupils and students. Some interesting regularities were noticed – different distribution of temperament types showed statistically significant difference in different height-weight classes, referring to associations with body proportions as well as variability in body size.

Key words: temperament, body build, anthropometry, height and weight classification

INTRODUCTION

It is assumed that temperament characteristics are inherited and form a part of the neurobiological basis of the personality [10]. Personality and features of temperament, which represent stable variations of mood and behaviour, differ among individuals. This variability has been examined to find possible links between personality psychology and psychopathology. Historical surveys look at the early concepts of humour and temperament, at the concept of a general vulnerability to psychosis and deviance, and later typologies arising from the work of Eysenck, Freud, Kretschmer, Pavlov and Sheldon [12]. Kretchmer categorized personality variants according to the concept of fundamental body types.

Many authors have demonstrated that similar biochemical factors determine physical growth and body build formation as well as are associated with certain behavioural patterns. The serotonin system has long been of interest in biological models of human personality. Several laboratory findings indicate a link between the serotoninergic system and harm avoidance. In cerebral cortex, high values of [(18)F]FESP binding values are associated with a high tendency to avoid danger, indicating the involvement of the serotoninergic system and, in particular, 5HT(2A) receptors, in this trait of personality [13]. Yasuno et al. have demonstrated the significant relation between D2R binding in amygdala, BMI and personality trait of harm avoidance [18]. An association between striatal D(2) dopamine receptors and emotional detachment has been recently reported. Binding potential of 5-HT(1A) receptors correlated inversely with scores for self-transcendence, a personality trait covering religious behaviour and attitudes [1].

Recently, several lines of evidence have suggested that the central dopamine system may underlie the regulation of weight and personality traits. At the same time, optimal concentration of dopamine and norepinephrine in brain tissue increases somatotrophine secretion and release from hypophysis; these catecholamine are correlated with social domination, curiosity, activity, extraversion and impulsive behaviour [19]. Distress can decrease the growth hormone level by restraining the SH stimulating factor and/or elevation of somatostatine level [4].

Body composition changes result from the balance between lipogenesis and lipolysis, which is probably regulated by the balance between insulin, somatotropine, somatomedines, corticosteroids, sexual hormones and other factors [8].

Disease susceptibility and drug response of individuals are presumed to be different depending on their personal traits. Constitutional traits have been found to show a distinct relevance to major psychiatric disorders. In this view, somatotyping appears valuable in diagnosis and prognosis of mental disorders [17]. Typological research has been developed by German authors using modern uni- and multivariate statistical methods and successfully applying them. As a result, it was possible to objectify in several studies certain features as premorbid personality types [16]. The Sasang typology, a traditional Korean medical typology, explains the individual differences of vulnerability to pathology. It distinguishes between contrasting psychological features, which are found to be partially associated with anthropometric characteristics [3].

However, results of typological approach to temperament and body build are controversial and depend on methods. No significant associations between somatotype and temperament were found in a study based on 45 subjects where Sheldon's somatotyping was studied in association with temperament according to Cortes and Gatti. But some significant results were found by examining the self-actualization scores and the body type/temperament match or mismatch [2].

The aim of present study was to find associations between temperament features and body build, using an original self-report questionnaire and a 5SD classification of height and weight.

MATERIAL AND METHODS

The sample consisted of 392 female students of the University of Tartu aged from 18 to 22 years. The methodology of anthropometric study relied on long-term research carried out on many populations at the Department of Obstetrics and Gynaecology and the Centre for Physical Anthropology at the University of Tartu [5, 6, 14]. Anthopometric measurements were taken according to the classical method of Martin as described in Knuβmann's handbook [9]. A 5-SD classification of height and weight was applied for assessment of body build. This approach has justified itself in our earlier studies, as it provides an universal instrument for systematic comparison of length, breath and depth measurements, circumferences and body composition characteristics in various populations [15, 7, 11].

The basis for the classification was the mean height, weight and their standard deviations. Initially 3×3 SD classes were formed and further, 5 classes were developed on the basis of accordance/non-conformity between height and weight:

Class 1 (small):

weight < $\bar{x}_w - 0.5\ SD_w$ and height < $\bar{x} - 0.5\ SD_h$

Class 2 (medium):

$\bar{x}_w - 0.5\ SD_w \leq$ weight $\leq\ \bar{x} + 0.5\ SD_w$ and $\bar{x}_h - 0.5\ SD_h \leq$ height $< 0.5\ SD_h$

Class 3 (large):

weight $\geq\ \bar{x}_w + 0.5\ SD_w$ and height $\geq\ \bar{x}_h + 0.5\ SD_h$

Class 4 (pyknomorphs):

weight $\geq\ \bar{x}_w - 0.5$ SD and height $<\ \bar{x}_h - 0.5\ SD_h$ or

weight $\geq\ \bar{x}_w + 0.5$ SD and height $<\ \bar{x} + 0.5\ SD_h$

Class 5 (leptomorphs):

weight $<\ \bar{x}_w - 0.5$ SD and height $\geq\ \bar{x}_h - 0.5\ SD_h$ or

weight $<\ \bar{x}_w + 0.5$ SD and height $\geq\ \bar{x}_h + 0.5\ SD_h$

Temperament types were determined by the questionnaire and methodology developed by J. Liivamägi. This methodology allows assessment of strength, balance and mobility of nervous activity. The method differentiates between "strong" (sanguine, phlegmatic, choleric 1st and 2nd subtype) and "weak" types (melancholic, subtypes 1–4) [10]. In our analysis, separate melancholic subtypes were not differentiated.

Distribution of temperament types was compared in body build classes.

RESULTS

By this method of investigation of temperament features, 77.3% of the study population had "strong" types of temperament; 22.7% had "weak" types. The most frequent temperament type is sanguine (36.48%). Distribution of temperament types in body build classification is shown in Table 1. Comparing different height and weight classes, we can see that the percentage of "strong" types in the small class (68.9%) and in leptomorphs (75%) is lower than in other classes. The prevalence of "weak" types in these classes is respectively higher. Although the sanguine type is the most frequent in the study group, it has little representation in the small weight and height class, which differs significantly from all the other body build classes.

Table 1. Distribution of temperament types in height-and-weight classes.

Temperament types	Height-and-weight classes					Stat. significant difference
	1 – Small	2 – Medium	3 – Large	4 – Pyknomorph	5 – Leptomorph	
Sanguine	**15** 3.83%	**27** 6.86%	**27** 6.86%	**35** 8.93%	**39** 9.95%	1&2; 1&3; 1&4; 1&5
Phlegmatic	**17** 4.34%	**6** 1.53%	**7** 1.79%	**13** 3.32%	**7** 1.79%	1&2; 1&3; 1&5
Choleric	**14** 3.57%	**14** 3.57%	**9** 2.30%	**12** 3.06%	**37** 9.44%	1&5; 2&5; 3&5; 4&5
Choleric (II subtype)	**5** 1.28%	**6** 1.53%	**4** 1.02%	**4** 1.02%	**5** 1.28%	
Melancholic	**23** 5.87%	**10** 2.55%	**11** 2.81%	**16** 4.08%	**29** 7.40%	1&2; 1&3; 2&5; 3&5

The group with small body size is associated with relatively greater frequency of the phlegmatic and lesser frequency of the choleric type. On the other hand, both choleric subtypes are relatively more frequent in the leptomorph and medium classes. The melancholic type ("weak" subtypes 1–4) is the relatively most frequent temperament type in the small class, although both small and leptomorph class have a statistically significant difference in the frequency of the melancholic type. Medium and large height and weight classes have quite a similar distribution of temperament types. In general, leptomorphs show a controversial count of different temperament types – they have a bigger count of sanguine, choleric and melancholic types – indicating the broader variability among this group.

The pyknomorphous body type is differentiated by relatively numerous representation of sanguine temperament and significantly lower percentage of choleric type compared to leptomorphs. We can also see relatively more phlegmatic types among pyknomorphs, however the comparison results are not clinically significant.

DISCUSSION

There is not much data on temperament of Estonian children and youth. Temperament features of inpatient children in Tartu University Psychiatric Clinic and in normal pupils and students have been comparatively investigated by J. Liivamägi. According to the results of this study, 71% of healthy pupils had "strong" temperament types while only 60% of the inpatient population had "strong" types [10]. The proportion of "strong" and "weak" temperament types in our group is concordant with proportions, obtained on the healthy young population in earlier studies.

We can see that both characteristics – temperament types and height-weight classes – are not evenly distributed in our sample. Prevalence of strong types as well as leptomorph body build is not surprising for this particular population. At the same time, we can see some interesting regularities. The group with small height and weight is particularly different from the others. Having proportional small anthropometric measurements, they have their own temperament type profile, which is significantly different from the other groups and shows relative resemblance with the distribution of temperament types of the inpatient population. While our height and weight classification is simultaneously taking into account body proportions as well as body size, it is interesting that the group with small height and weight differs significantly from other groups with proportional body dimensions (medium and large class). According to prior studies, individuals with "weak" temperament types in unfavourable conditions are predisposed to phobias, depression and somatoform diseases [10]. As in our population the bigger proportion of "weak" types appeared in small and leptosomic classes, it refers to possible relation of smaller weight with weaker nervous activity and may be associated with predisposition to respective disorders.

Surprisingly, there is no significant difference between the traditionally contrasted body build classes – pyknomorphs and leptomorphs. The only statistically significant difference can be detected in the proportion of the 1st choleric subtype. Still, the objectification of such difference corresponds to classical theories of humours and fundamental body types.

Medium and large body build classes represent harmonious body proportions and have a similar distribution of temperament features with predominantly "strong" types. These results support the association of stronger nervous activity with harmonious body build.

The 5SD height and weight classification, used in this study, represents the whole system of body measurements and allows comparability of different populations. Our present results have shown that different body proportions as well as variability in body size can be associated with different temperament features.

REFERENCES

1. Borg J., Andree B., Soderstrom H., Farde L. (2004) The serotonin system and spiritual experiences. Am J Psychiatry, Sep, 161(9), 1720–1.
2. Catell P., Metzner R. (1993) Associations among somatotype, temperament and self-actualization. Psychol Rep, Jun, 72(3 Pt 2), 1165–6.
3. Chae H., Lyoo I. K., Lee S. J., Cho S., Bae H., Hong M., Shin (2003) An alternative way to individualized medicine: psychological and physical traits of Sasang typology. J Altern Complement Med, Aug, 9(4), 519–28.
4. Hauger R. L., Irvin M., Richter R. (1991) Developmental Aspects of Psychoendocrinology. Child and Adolescent Psychiatry. A Comprehensive Textbook. Ed. by M Lewis. Baltimore-Maryland USA, 1991, 63–76.

5. Kaarma H. (1981) Multivariate statistical analysis of women's anthropometric characteristics system. Valgus, Tallinn.
6. Kaarma H. (1995) Complex statistical characterization of women's body measurements. Anthrop Anz, 53, 239–244.
7. Kaarma H., Veldre G., Stamm R., Lintsi M., Kasmel J., Maiste E., Koskel S. (2001) Regularities of body build structure of Estonian girls and youths. Morphology, 120, 80–82 (in Russian).
8. Knittle J. L., Timmers K., Ginsberg-Fellner F., Brown R. E., Katz D. P. (1979) The growth of adipose tissue in children and adolescence. Cross-sectional and longitudinal studies of adipose cell number and size. Journal of Clinical Investigation, 63, 239–46.
9. Knuβmann R. (1988) Anthropologie. Handbuch der vergreichenden Biologie des Menschen. Band I: Wesen und Methoden der Anthropologie. Gustav-Fischer Verlag. Stuttgart/New York, 139–309.
10. Liivamägi J., Peterson J., Aluoja A., Kanter H., Johanson M., Lintsi M. (2001) Temperament and mental disorders in teenagers. Eesti Arst, Suppl. 3, 26–27
11. Lintsi M., Kaarma H., Saluste L., Vasar V. (2002) Systemic changes in body structure of 17–18-year-old schoolboys. Homo, 53, 157–169.
12. Maher B. A., Maher W. B. (1994) Personality and psychopathology: a historical perspective. J Abnorm Psychol, Feb, 103(1), 72–7.
13. Moresco F. M., Dieci M., Vita A., Messa C., Gobbo C., Galli L., Rizzo G., Panzacchi A., De Peri L., Invernizzi G., Fazio F. (2002) In vivo serotonin 5HT(2A) receptor binding and personality traits in healthy subjects: a positron emission tomography study. Neuroimage, Nov, 17(3), 1470–8.
14. Peterson J., Saluvere K. (1998) Systematization of anthropometric data of 18-year-old girls by statistical model. Biol Sport, 15, 105–112.
15. Saluvere K., Peterson., Saluste L., Koskel S. (1998) Systematization of anthropometric data of 17-year-old schoolgirls from Tartu, Estonia. Anthrop Anz, 56, 267–280.
16. Schafer M. L. (2001) The importance of the type concept in psychiatry. Fortschr Neurol Psychiatr, Jun, 69(6), 256–67.
17. Sivkov S., Akabaliev V. (1999) Somatotyping of schizophrenic and affective disorder patients. Folia Med (Plovdiv), 41(4), 62–7.
18. Yasuno F., Suhara T., Sudo Y., Yamamoto M., Inoue M., Okubo Y., Suzuki K. (2001) Relation among dopamine D(2) receptor binding, obesity and personality in normal human subjects. Neurosci Lett, Mar 2, 300(1): 59–61.
19. Zuckerman M. (1995) Good and Bad Humors: Biochemical Bases of Personality and Its Disorders. Psychological Science, vol. 6, No 6, Nov.

Papers on Anthropology XV, 2006, pp. 150–177

RELATIONS BETWEEN BODY BUILD AND FOODSTUFFS CONSUMPTION IN FEMALE STUDENTS (AGED 17–23 YEARS) OF THE UNIVERSITY OF TARTU

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ABSTRACT

By means of a questionnaire, we studied foodstuffs consumption habits in 331 female students aged 17–23 years. The questionnaire included nine groups of foodstuffs (131 products in total), which the subjects ate daily, often (2–3 times a week) or sometimes (1–2 times a week). All the students were measured anthropometrically (37 basic measurements and 12 skinfolds from which 7 body composition characteristics were calculated). To systematize the anthropometric data, a 5 SD classification was used with the following classes: (1) small height – small weight, (2) medium height – medium weight, (3) big height – big weight, (4) pycnomorphs (big weight – small height), (5) leptomorphs (small weight – big height).

The detailed study of foodstuffs consumption was conducted in the same classes into which the subjects had been placed according to their anthropometric data. Absolute number and percentage of consumers of each product was found; for statistical comparison between classes z-test was applied.

In two thirds of products, the frequency of consumption differed essentially between classes. Leptomorphs who formed the largest class also consumed the greatest number of products most often. An interesting fact was that the consumption of many foodstuffs by the tallest and heaviest girls in class 3 was lower than that by the smallest girls in class 1, although the difference was not statistically significant.

The systematically different frequency of consumption by different body types (morphotypes) may be caused by metabolic differences due to differences in constitution.

INTRODUCTION

In the whole world, healthy nutrition of men and women at all ages is receiving increasing attention. This is testified by the recommendations published in recent years by WHO [1, 3] and the Commission of the European Communities [4].

Anthropometric data are an essential component when assessing nutrition habits. Unfortunately, no common agreement has been reached, which of the body measurements are the most informative and how many of them there should be. Until now, main attention has been paid to the generally known BMI values of for adults, which are ≥ 25 for overweight and ≥ 30 for adiposity [2]. Along with that, the significance of waist circumference is emphasized [1], which reflects changes in risk factors for cardiovascular diseases and other forms of chronic diseases, even though the risks seem to vary in different populations. There is an increased risk factor of metabolic complications for men with a waist circumference ≥ 102 cm and women with a waist circumference ≥ 88 cm. Some authors also require the inclusion of height, weight, BMI, waist circumference, hip circumference, ratio of waist-to-hip circumference [17].

In the opinion of physicians and anthropologists, nutritional research should make use of more detailed anthropometric data in order to obtain, by studying the constitutional morphotype, valuable information on the metabolic type of the individual.

Estonia has particularly long experience in studies of girls' and young women's body build [5, 13, 15] and nutrition [12]. An anthropometric classification has been used for analysing food energy and main nutrient contents in 24-hour menus of 17–23-year-old female students [14].

The present article is a continuation to the studies mentioned above. Applying the body build classification, we analyse differences in the consumption of different foodstuffs in relation to body build.

MATERIAL AND METHODS

Subjects

The sample consisted of 331 first- and second-year female students of the University of Tartu, aged from 17 to 23 years who were measured and questioned in 1996 and 1997.

Anthropometric research

The methodology of anthropometric study of these students relied on long-term research carried out on many populations at the Department of Obstetrics and Gynecology and the Centre for Physical Anthropology at the University of Tartu [5, 13].

Anthropometric measurements were taken personally by the first author of the article. Students were measured according to the classical method of Martin [9].

Thirty-seven anthropometric variables and 12 skinfolds were taken. For body composition analysis, body mass index, body density [18], body surface area, mean skinfold, mass and relative mass of subcutaneous adipose tissue and relative mass of fat by Siri were calculated.

Nutrition research

All the subjects filled in a questionnaire compiled by the Centre for Physical Anthropology on frequency of consumption of different food products. The questionnaire included questions on nine groups of products: 1) milk and dairy products (14 products), 2) cereal and flour products (12 products), 3) meat products (15 products), 4) fish products (8 products), 5) vegetables (2 products), 6) fruit (15 products), 7) sweets (11 products), 8) drinks (17 products), 9) ready-made foods (19 products).

A detailed list of food products is given in Table 2. The subjects could choose between five options about the frequency of consumption of each product: 0 – never, 1 – very seldom (1–2 times a year), 2 seldom – (1–2 times a month), 3 – sometimes (1–2 times a week), 4 – often (2–3 times a week), 5 – daily.

The present paper analyses the consumption of these products that were eaten daily (5), often (4) or sometimes (3).

The analysis of the material started by finding correlations between the mean values of the subjects' basic anthropometric variables and the mean values of consumption of each group of foodstuffs. The positive correlations found gave reason to apply the 5 SD classification of body build; thus the frequency of consumption of each product was assessed in the same body classes into which the subjects had been placed according to their body build.

Statistical analysis

Statistical analysis was performed using the SAS program. First, the mean values ($\bar{x}$) and standard deviations (SD) of all anthropometric variables were calculated for age groups 17–23. However, as age-related differences were mostly insignificant, the young women were further analysed as one age group.

The basis for creating the anthropometric classification was the mean height, weight and their standard deviations for all young women. To create the 5 SD classification, initially formed 3 × 3 = 9 SD classes of height and weight were formed. From these nine classes, three classes of concordance between height and weight were taken (small height – small weight, medium height – medium weight, big height – big weight). The remaining six classes were joined into two classes of disconcordant height and weight (pycnomorphs with big weight and small height and leptomorphs with small weight and big height, see Fig. 1) [10].

Thus, the five height-weight SD classes were created according to the following rules:

Class 1 (small):

weight < $\bar{x}_w - 0.5\ SD_w$ and height < $\bar{x} - 0.5\ SD_h$

Class 2 (medium):

$\bar{x}_w - 0.5\ SD_w \le$ weight < $\bar{x} + 0.5\ SD_w$ and $\bar{x}_h - 0.5\ SD_h \le$ height < $0.5\ SD_h$

Class 3 (large):

weight ≥ $\bar{x}_w + 0.5\ SD_w$ and height ≥ $\bar{x}_h + 0.5\ SD_h$

Class 4 (pycnomorphs):

weight ≥ $\bar{x}_w - 0.5$ SD and height < $\bar{x}_h - 0.5\ SD_h$ or

weight ≥ $\bar{x}_w + 0.5$ SD and height < $\bar{x} + 0.5\ SD_h$

Class 5 (leptomorphs):

weight < $\bar{x}_w - 0.5$ SD and height ≥ $\bar{x}_h - 0.5\ SD_h$ or

weight < $\bar{x}_w + 0.5$ SD and height ≥ $\bar{x}_h + 0.5\ SD_h$ (see Fig. 1).

The subjects were placed into the classes of this classification according to their individual heights and weights (Table 1). Thereafter, the mean values of all anthropometric variables were calculated for all classes.

Using the Scheffé-test, the class mean values of all anthropometric data were compared between classes 1–3 but also between classes 4 and 5 using the significance level $\alpha = 0.05$. There were no statistically significant differences between the classes in the age of the subjects.

The study of relations between anthropometric data and consumption of concrete food products began with correlation analysis.

The mean values of all anthropometric valuables of all subjects were correlated with the mean values of the nine groups of foodstuffs consumed by them. We found many statistically significant correlations, which gave us reason to study the consumption of foodstuffs in body build classes. Thus, the consumption of all food products was studied in the same height-weight classes into which the young women had been placed according to their anthropometric data. Absolute number and percentage of consumers of each product was found; for statistical comparison between classes z-test was applied.

RESULTS

The aim of the study was to find a method for statistical assessment of relations between 49 anthropometric measurements and 7 characteristics of body composition and consumption of 131 food products belonging to 9 groups (milk and dairy products, cereal and flour products, meat products, fish products, vegetables, fruit, sweets, drinks, ready-made foods).

We started by calculating the means of all anthropometric variables and the mean values of consumption of the 9 groups of foodstuffs and finding the correlations between these results. We found 65 statistically significant correlations.

In order to assess the relations between a great number of variables, we applied the 5 SD classification of height and weight (Table 1). Here all the length, breadth and depth measurements, circumferences and body composition characteristics have been systematized into classes, and, as the table shows, different body types – small, medium, large, pycnomorphs, leptomorphs – can be statistically significantly differentiated.

Table 1. Means and standard deviations of female students (n=331) basic anthropometric measurements and body composition characteristics in body build classes

No	Variable	Mean		Small n=62		Medium n=52		Large n=52		Sta-tistics	Pycnomorphs n=73		Leptomorphs n=92		Sta-tistics
		$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD		$\bar{x}$	SD	$\bar{x}$	SD	
1.	Weight (kg)	60.395	8.901	50.736	3.424	60.039	2.679	72.421	7.018	+	64.810	7.925	56.805	4.817	+
2.	Height (cm)	167.19	6.00	160.43	2.92	166.98	1.65	174.63	3.69	+	163.43	4.40	170.64	3.72	+
3.	Sternum length (cm)	16.53	2.28	15.57	2.04	16.41	2.08	17.80	2.45	+	16.14	2.14	16.84	2.19	+
4.	Abdomen length (cm)	33.99	2.80	32.72	2.38	34.22	1.94	34.82	2.53	+	33.68	2.99	34.50	3.18	–
5.	Trunk length (cm)	50.52	2.81	48.29	1.76	50.62	1.84	52.61	2.24	+	49.82	2.65	51.34	3.06	+
6.	Upper limb length (cm)	72.21	3.53	69.17	2.48	72.19	2.23	75.68	2.44	+	70.20	3.16	73.90	2.78	+
7.	Lower limb length (cm)	89.15	4.28	85.10	2.43	88.90	1.99	93.96	2.68	+	86.51	3.81	91.34	3.10	+
8.	Biacromial breadth (cm)	35.80	1.67	34.54	1.41	36.08	1.33	37.32	1.55	+	35.60	1.45	35.79	1.52	–
9.	Chest breadth (cm)	24.47	1.46	23.40	1.27	24.42	1.17	25.67	1.39	+	24.99	1.35	24.14	1.19	+
10.	Waist breadth (cm)	23.59	2.08	22.01	1.30	23.45	1.39	25.66	1.69	+	24.64	2.13	22.72	1.56	+
11.	Pelvis breadth (cm)	26.78	1.55	25.48	1.22	26.69	1.25	28.27	1.60	+	26.95	1.48	26.74	1.13	–

Table 1. Continuation

No	Variable	Mean		Small n=62		Medium n=52		Large n=52		Sta-tistics	Pycnomorphs n=73		Leptomorphs n=92		Sta-tistics
		$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD		$\bar{x}$	SD	$\bar{x}$	SD	
12.	Chest depth (cm)	17.21	1.55	16.23	1.21	17.10	1.26	18.72	1.79	+	17.56	1.26	16.80	1.26	+
13.	Abdomen depth (cm)	15.99	1.76	14.91	1.04	15.74	1.33	17.35	1.87	+	16.94	2.07	15.35	1.06	+
14.	Femur breadth (cm)	8.98	0.62	8.45	0.44	8.92	0.41	9.52	0.64	+	9.17	0.57	8.93	0.53	+
15.	Ankle breadth (cm)	6.60	0.61	6.30	0.48	6.63	0.68	6.89	0.69	+	6.56	0.60	6.66	0.51	–
16.	Humerus breadth (cm)	6.03	0.59	5.76	0.52	6.07	0.60	6.29	0.56	+	6.01	0.55	6.07	0.60	–
17.	Wrist breadth (cm)	4.91	0.50	4.61	0.41	4.92	0.46	5.12	0.40	+	4.91	0.50	5.00	0.53	–
18.	Head cir-cumf. (cm)	55.95	1.42	55.01	1.26	56.34	1.18	56.88	1.22	+	56.16	1.33	55.68	1.38	+
19.	Neck cir-cumf. (cm)	32.27	1.62	31.17	1.22	32.17	1.13	33.73	1.31	+	33.04	1.77	31.65	1.22	+
20.	Upper chest circumf. (cm)	84.18	5.43	79.82	3.28	84.04	2.69	90.00	4.78	+	87.13	5.46	81.56	3.63	+
21.	Lower chest circumf. (cm)	76.05	5.93	71.62	3.26	75.33	3.47	82.47	5.69	+	79.33	6.27	73.21	3.24	+
22.	Waist cir-cumf. (cm)	69.54	6.31	65.08	3.81	68.90	4.13	75.93	5.20	+	73.56	6.74	66.12	3.45	+
23.	Pelvis cir-cumf. (cm)	84.69	7.40	79.35	4.07	84.18	4.59	92.03	6.29	+	88.91	7.45	81.09	5.62	+

Table 1. Continuation

No	Variable	Mean		Small n=62		Medium n=52		Large n=52		Statistics	Pycnomorphs n=73		Leptomorphs n=92		Statistics
		$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD		$\bar{x}$	SD	$\bar{x}$	SD	
24.	Hip circumf. (cm)	92.87	7.53	86.78	4.72	92.12	4.81	100.76	5.85	+	86.61	6.96	89.98	6.28	+
25.	Upper thigh circumf. (cm)	58.38	4.97	54.40	2.83	58.74	5.09	63.10	3.42	+	61.47	4.19	55.74	3.27	+
26.	Middle thigh circumf. (cm)	49.57	4.13	45.83	2.84	49.62	2.66	53.81	3.12	+	52.13	3.04	47.63	3.38	+
27.	Upper leg circumf. (cm)	35.92	2.73	33.68	2.13	36.35	2.14	37.88	2.16	+	37.27	2.48	35.00	2.42	+
28.	Lower leg circumf. (cm)	22.50	1.79	21.07	1.07	22.96	2.25	23.45	1.20	+	23.31	1.98	22.03	1.17	+
29.	Arm circumf. (cm)	26.26	2.57	24.53	1.66	26.08	1.41	28.44	2.34	+	28.24	2.49	24.73	1.67	+
30.	Forearm circumf. (cm)	22.78	1.70	21.54	1.15	22.81	1.35	24.19	1.58	+	23.73	1.65	22.03	1.26	+
31.	Wrist circumf. (cm)	15.60	1.02	14.79	0.58	15.64	0.63	16.55	1.54	+	15.86	0.78	15.38	0.65	+
32.	Chin skinfold (cm)	0.69	0.24	0.60	0.17	0.69	0.22	0.82	0.27	+	0.81	0.24	0.59	0.16	+
33	Side skinfold (cm)	0.82	0.30	0.72	0.22	0.78	0.23	0.91	0.31	+	1.04	0.35	0.68	0.23	+
34	Chest skinfold (cm)	1.03	0.49	0.86	0.36	0.90	0.26	1.37	0.52	+	1.38	0.57	0.75	0.23	+

Table 1. Continuation

No	Variable	Mean		Small n=62		Medium n=52		Large n=52		Statistics	Pycnomorphs n=73		Leptomorphs n=92		Statistics
		$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD		$\bar{x}$	SD	$\bar{x}$	SD	
35.	Waist skinfold (cm)	1.43	0.60	1.22	0.46	1.31	0.46	1.87	0.60	+	1.80	0.69	1.09	0.31	+
36.	Suprailiacal skinfold (cm)	1.07	0.48	0.90	0.31	0.95	0.33	1.42	0.54	+	1.38	0.52	0.81	0.29	+
37.	Umbilical skinfold (cm)	1.36	0.60	1.11	0.40	1.28	0.46	1.81	0.68	+	1.71	0.69	1.05	0.28	+
38.	Subscapular skinfold (cm)	1.31	0.61	1.07	0.35	1.19	0.39	1.71	0.66	+	1.77	0.72	0.96	0.28	+
39.	Biceps skinfold (cm)	0.78	0.31	0.65	0.24	0.75	0.25	0.98	0.33	+	0.98	0.33	0.62	0.19	+
40.	Triceps skinfold (cm)	1.58	0.49	1.35	0.39	1.48	0.35	1.88	0.50	+	1.93	0.51	1.33	0.34	+
41.	Thigh skinfold (cm)	2.64	0.71	2.22	0.60	2.59	0.47	3.04	0.71	+	3.11	0.62	2.34	0.62	+
42.	Calf skinfold (cm)	1.49	0.44	1.31	0.40	1.39	0.35	1.70	0.39	+	1.77	0.42	1.33	0.40	+
43.	BMI	21.57	2.70	19.72	1.37	21.54	0.98	23.76	2.36	+	24.23	2.45	19.49	1.30	+
44.	Body surface area (cm^2)	1.68	0.13	1.513	0.053	1.673	0.036	1.870	0.083	+	1.700	0.108	1.660	0.080	+
45.	Body density (g/cm^3)	1.060	0.001	1.061	0.000	1.061	0.000	1.060	0.001	+	1.060	0.001	1.061	0.000	+

Table 1. Continuation

No	Variable	Mean		Small n=62		Medium n=52		Large n=52		Statistics	Pycnomorphs n=73		Leptomorphs n=92		Statistics
		$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD		$\bar{x}$	SD	$\bar{x}$	SD	
46.	Relat. Mass of fat by Siri (%)	16.77	0.28	16.63	0.18	16.72	0.17	16.97	0.29	+	16.99	0.30	16.60	0.15	+
47.	Mean skin-fold (cm)	1.29	0.39	1.09	0.27	1.21	0.24	1.59	0.40	+	1.61	0.39	1.05	0.23	+
48.	Mass of sub-cutaneous adipose tissue (kg)	9.86	3.62	7.436	1.902	9.122	1.903	13.46	3.83	+	12.40	3.66	7.87	1.84	+
49.	Relat. Mass of subcut. Adipose tissue (%)	16.00	3.91	14.59	3.37	15.14	2.77	18.41	3.82	+	18.90	3.77	13.77	2.71	+

Table 2. Differences in consumption of frequently consumed food products in body build classes in young Estonian women (17–23 years) (z-test)

Body build classes	Body build classes												
Food products	Subjects total (frequency 0–5)	Subjects (frequency 3–5)	28. Small n=62		28. Medium n=52		28. Large n=52		28. Pycno-morphs n=73		28. Lepto-morphs n=92		Statistics
			n	%	n	%	n	%	n	%	n	%	
Milk and dairy products													
1. whole milk (3.2%)	328	34.15 % 112	19	17.0%	19	17.0%	16	14.3%	23	20.5%	35	31.3%	1+5, 2+5, 3+5
2. 2.5% milk	322	52.17% 168	30	17.9%	28	16.7%	26	15.5%	32	19.0%	52	31.0%	1+5, 2+5, 3+5, 4+5
3. 1% milk	320	25.0% 80	10	12.5%	13	16.3%	11	13.8%	23	28.8%	23	28.8%	1+4, 1+5, 3+4, 3+5
4. kephir	329	27.68% 91	20	22.0%	17	18.7%	9	9.9%	26	28.6%	19	20.9%	3+1, 3+4, 3+5
5. sour milk	330	7.88% 26	4	15.4%	8	30.8%	0	0.0%	9	34.6%	5	19.2%	–
6. buttermilk	328	12.80% 42	6	14.3%	6	14.3%	2	4.8%	19	45.2%	9	21.4%	4+1, 4+2, 4+3, 4+5
7. sour cream	330	66.97% 221	42	19.0%	39	17.6%	30	13.6%	42	19.0%	68	30.8%	1+5, 2+5, 3+5, 4+5
8. coffee cream	330	22.42% 74	14	18.9%	14	18.9%	9	12.2%	12	16.2%	25	33.8%	1+5, 2+5, 3+5, 4+5
9. whipping cream	327	6.42% 21	3	14.3%	6	28.6%	0	0.0%	4	19.0%	8	38.1%	–
10.youghurt	330	68.48% 226	45	40.2%	35	31.3%	33	29.5%	49	43.8%	64	57.1%	1+5, 2+5, 3+5
11. butter	329	45.29% 149	29	19.5%	21	14.1%	21	14.1%	34	22.8%	44	29.5%	1+5, 2+5, 3+5
12. butter margarine	330	56.06% 185	34	18.4%	32	17.3%	29	15.7%	38	20.5%	52	28.1%	1+5, 2+5, 3+5

Table 2. Continuation

Body build classes	Body build classes												
Food products	Subjects total (frequency 0–5)	Subjects (frequency 3–5)	1. Small n=62		2. Medium n=52		3. Large n=52		4. Pycno-morphs n=73		5. Lepto-morphs n=92		Statistics
			n	%	n	%	n	%	n	%	n	%	
13. cottage cheese	330	59.70% 197	39	19.8%	30	15.2%	28	14.2%	41	20.8%	59	29.9%	1+5, 2+5, 3+5, 4+5
14. cheese	331	73.72% 244	50	20.5%	32	13.1%	38	15.6%	48	19.7%	76	31.1%	1+5, 2+5, 3+5, 1+3
Cereal and flour products													
15. rye bread	329	84.56% 278	54	19.4%	43	15.5%	44	15.8%	59	21.2%	78	28.1%	1+5, 2+5, 3+5
16. wheat bread	327	27.97% 98	20	20.4%	23	23.5%	17	17.3%	18	18.4%	20	20.4%	–
17. whole meal and seed bread	330	55.76% 184	31	16.8%	31	16.8%	31	16.8%	40	21.7%	51	27.7%	1+5, 2+5, 3+5
18. white bread	324	76.23% 247	53	21.5%	36	14.6%	39	15.8%	51	20.6%	68	27.5%	1+2, 2+5, 3+5
19. muesli	326	29.14% 95	16	16.8%	19	20.0%	11	11.6%	21	22.1%	28	29.5%	1+5, 3+5
20. cornflakes and rice flakes	328	27.96% 92	14	15.2%	15	16.3%	12	13.0%	20	21.7%	31	33.7%	1+5, 2+5, 3+5
21. popcorn	328	2.74% 9	2	22.2%	1	11.1%	2	22.2%	2	22.2%	2	22.2%	–
22. buns	328	62.20% 204	41	20.10%	31	15.20%	31	15.20%	36	17.65%	65	31.86%	1+5, 2+5, 3+5, 4+5

Table 2. Continuation

Body build classes Food products	Body build classes Subjects total (frequency 0–5)	Subjects (frequency 3–5)	1. Small n=62		2. Medium n=52		3. Large n=52		4. Pycno-morphs n=73		5. Lepto-morphs n=92		Statistics
			n	%	n	%	n	%	n	%	n	%	
23. pasta (spaghetti, macaroni)	327	65.75% 215	39	18.14%	28	13.02%	31	14.42%	53	24.65%	64	29.77%	1+5, 2+5, 3+5, 2+4, 3+4
24. cereal sprouts	329	8.21% 27	2	7.41%	5	18.52%	5	18.52%	8	29.63%	7	25.93%	–
25. roughage	329	3.65% 12	1	8.33%	2	16.67%	3	25.0%	3	25.00%	3	25.00%	–
26. kama	330	8.79% 29	4	13.79%	5	17.24%	6	20.69%	6	20.69%	8	27.59%	–
Meat products													
27. pork	330	46.98% 155	31	20.00%	25	16.13%	22	14.19%	32	20.65%	45	29.03%	2+5, 3+5
28. beef	329	39.82% 131	32	24.43%	24	18.32%	15	11.45%	22	16.79%	38	29.01%	3+1, 3+5, 2+5, 3+5
29. mutton	329	5.17% 17	6	35.23%	2	11.76%	2	11.76%	2	11.76%	5	29.41%	–
30. poultry	329	38.30% 126	24	19.05%	26	20.63%	15	11.90%	30	23.81%	31	24.60%	3+4, 3+5
31. rabbit	328	1.22% 4	0	0.00%	0	0.00%	0	0.00%	2	50%	2	50%	–
32. game	328	5.79% 19	6	31.58%	3	15.79%	2	10.53%	1	5.26%	7	36.84%	–
33. liver	330	14.55% 48	8	16.67%	11	22.92%	6	12.50%	10	20.83%	13	27.08%	–

Table 2. Continuation

Body build classes	Body build classes											
Food products	Subjects total (frequency 0–5)	Subjects (frequency 3–5)	1. Small n=62		2. Medium n=52		3. Large n=52		4. Pycno-morphs n=73		5. Lepto-morphs n=92		Statistics
			n	%	n	%	n	%	n	%	n	%	
34. offal (kidney, heart, lungs, tripe)	330	3.33% 11	2	18.18%	2	18.18%	3	27.27%	1	9.09%	3	27.27%	–
35. sausage	326	55.85% 182	39	21.43%	25	13.74%	25	13.74%	39	21.43	54	29.67%	2+5, 3+5
36. wiener, sardelli	328	67.07% 220	37	16.82%	33	15.00%	29	13.18%	49	22.27%	72	32.73%	1+5, 2+5, 3+5, 4+5, 3+4
37. smoked sausage, ham	328	57.32% 188	33	17.55%	34	18.09%	26	13.83%	39	20.74%	56	29.79%	1+5, 2+5, 3+5, 4+5
38. meat paste	328	39.33% 129	26	20.16%	17	13.18%	24	18.60%	21	16.28%	41	31.78%	1+5, 2+5, 3+5, 4+5
39. black sausage, black pudding	328	4.27% 14	1	7.14%	3	21.43%	6	42.86%	1	7.14%	3	21.43%	–
40. burgers, meat balls	327	32.72% 107	22	20.56%	15	14.02%	20	18.69%	20	18.69%	30	28.04%	2+5
41. tinned meat	329	14.29% 47	12	25.53%	11	23.40%	7	14.88%	6	12.77%	11	23.40%	–

Table 2. Continuation

Body build classes Food products	Body build classes												
	Subjects total (frequency 0–5)	Subjects (frequency 3–5)	1. Small n=62		2. Medium n=52		3. Large n=52		4. Pycno-morphs n=73		5. Lepto-morphs n=92		Statistics
			n	%	n	%	n	%	n	%	n	%	
Fish products													
42. freshwater fish (bream, carp, pike-perch, vendace)	329	12.77% 42	7	16.67%	8	19.05%	5	11.90%	10	23.81%	12	28.57%	–
43. small herring, brisling	329	17.63% 58	9	15.52%	14	24.14%	10	17.24%	15	25.86%	10	17.24%	–
44. seawater fish (sea perch, silver hake, fresh herring, mackerel)	326	15.03% 49	8	16.33%	12	24.49%	5	10.20%	9	18.37%	15	30.61%	3+5
45. salted fish (herring)	328	10.98% 36	6	16.67%	6	16.67%	6	16.67%	9	25.00%	9	25.00%	–
46. smoked fish	329	14.59% 48	9	18.75%	13	27.08%	7	14.58%	10	20.83%	9	18.75%	–
47. dried fish	329	2.74% 9	2	22.22%	1	11.11%	1	11.11%	3	33.33%	2	22.22%	–
48. fishburgers, fish fingers	329	36.78% 121	22	18.18%	25	20.66%	12	9.92%	29	23.97%	33	27.27%	3+2, 3+4, 3+5
49. tinned fish	329	14.89% 49	8	16.33%	11	22.45%	5	10.20%	13	26.53%	12	24.49%	3+4

Table 2. Continuation

Body build classes	Body build classes												
Food products	Subjects total (frequency 0–5)	Subjects (frequency 3–5)	1. Small n=62		2. Medium n=52		3. Large n=52		4. Pycno-morphs n=73		5. Lepto-morphs n=92		Statistics
			n	%	n	%	n	%	n	%	n	%	
Vegetables													
50. potato	330	98.79% 326	62	19.02%	51	15.64%	52	15.35%	73	22.39%	88	26.93%	1+5, 2+5, 3+5, 2+4, 3+4
51. fresh cabbage	330	67.58% 223	37	16.59%	39	17.49%	32	14.35%	54	24.22%	61	27.35%	1+5, 2+5, 3+5, 3+4
52. sauerkraut	330	28.18% 93	11	11.83%	19	20.43%	12	12.90%	20	21.51%	31	33.33%	1+5, 2+5, 3+5
53. swede, turnip	329	32.52% 107	18	16.82%	21	19.63%	14	13.08%	27	25.23%	27	25.23%	3+4, 3+5
54. carrot	330	73.34% 244	41	16.80%	42	17.21%	35	14.34%	54	22.13%	72	29.51%	1+5, 2+5, 3+5, 3+4
55. beet	329	39.82% 131	24	18.32%	23	17.56%	16	12.21%	31	23.66%	37	28.24%	2+5, 3+5, 3+4
56. radish	329	4.86% 16	3	18.75%	1	6.25%	2	12.50%	4	25.00%	6	37.50%	–
57. celery	327	9.17% 30	6	20.00%	7	23.33%	6	20.00%	7	23.33%	4	13.33%	–
58. parsley	329	18.24% 60	12	20.00%	9	15.00%	9	15.00%	17	28.33%	13	21.67%	–
59. onion	328	70.73% 232	42	18.10%	39	16.81%	37	15.95%	54	23.28%	60	25.86%	1+5, 2+5, 3+5
60. garlic	327	28.44% 93	17	18.28%	20	21.51%	16	17.20%	21	22.58%	19	20.43%	–

Table 2. Continuation

Body build classes	Body build classes											
Food products	Subjects total (frequency 0–5)	Subjects (frequency 3–5)	1. Small n=62		2. Medium n=52		3. Large n=52		4. Pycno-morphs n=73		5. Lepto-morphs n=92		Statistics
			n	%	n	%	n	%	n	%	n	%	
61. pumkin, zucchini	330	12.42% 41	5	12.20%	8	19.51%	7	17.07%	14	34.15%	7	17.07%	–
62. fresh cucumber	329	71.73% 236	41	17.37%	41	17.37%	36	15.25%	54	22.88%	64	27.12%	1+5, 2+5, 3+5, 3+4
63. tomato	330	74.55% 246	45	18.23%	40	16.26%	34	13.82%	54	21.95%	73	29.67%	1+5, 2+5, 3+5, 3+4
64. pepper	329	41.64% 137	25	18.25%	24	17.52%	16	11.68%	31	22.63%	41	29.93%	1+5, 2+5, 3+5, 3+4
65. garden beans	329	18.54% 61	6	9.84%	11	18.03%	9	14.75%	22	36.07%	13	21.31%	1+4, 2+4, 3+4
66. field beans	329	12.46% 41	3	7.32%	10	24.39%	9	21.95%	11	26.83%	8	19.51%	1+2, 1+4
67. green peas	327	29.97% 98	12	12.24%	19	19.39%	16	16.33%	25	25.51%	26	26.53%	1+4, 1+5
68. lettuce	329	42.55% 140	23	16.43%	25	17.86%	19	13.57%	35	25.00%	38	27.14%	1+5, 3+5, 3+4
69. dill	329	56.53% 186	30	16.13%	29	15.59%	27	14.52%	47	25.27%	53	28.49%	1+4, 2+4, 3+4, 1+5, 2+5, 3+5

Table 2. Continuation

Body build classes	Body build classes												
Food products	Subjects total (frequency 0–5)	Subjects (frequency 3–5)	1. Small n=62		2. Medium n=52		3. Large n=52		4. Pycno-morphs n=73		5. Lepto-morphs n=92		Statistics
			n	%	n	%	n	%	n	%	n	%	
Fruits, berries (seasonal)													
70. apples	330	96.06% 317	59	18.61%	51	16.09%	50	15.77%	69	21.77%	88	27.76%	1+5, 2+5, 3+5
71. plums	330	71.52% 236	43	18.22%	38	16.10%	34	14.41%	52	22.03%	69	29.24%	1+5, 2+5, 3+5, 3+4
72. pears	330	67.27% 222	41	18.47%	36	16.22%	30	13.51%	45	20.27%	70	31.53%	1+5, 2+5, 3+5, 4+5
73. cherries	330	58.79% 194	40	20.62%	31	15.98%	28	14.43%	35	18.04%	60	30.93%	1+5, 2+5, 3+5, 4+5
74. strawberries	330	79.09% 261	48	18.33%	40	15.33%	40	15.33%	56	21.46%	77	29.50%	1+5, 2+5, 3+5, 4+5
75. raspberries	328	75.30% 247	47	19.03%	41	16.60%	35	14.17%	52	21.05%	72	29.15%	1+5, 2+5, 3+5, 4+5, 3+4
76. currants	329	74.16% 244	46	18.85%	42	17.21%	39	15.98%	48	19.67%	69	28.28%	1+5, 2+5, 3+5, 4+5
77. gooseberries	329	71.43% 235	44	18.72%	42	17.87%	35	14.83%	50	21.28%	64	27.23%	1+5, 2+5, 3+5
78. wild berries	330	60.30% 199	40	20.10%	37	18.59%	31	15.58%	39	19.60%	52	26.13%	3+5

Table 2. Continuation

Body build classes Food products	Body build classes Subjects total (frequency 0–5)	Subjects (frequency 3–5)	1. Small n=62		2. Medium n=52		3. Large n=52		4. Pycno-morphs n=73		5. Lepto-morphs n=92		Statistics
			n	%	n	%	n	%	n	%	n	%	
79. bananas	327	69.11% 226	37	16.37%	37	16.37%	33	14.60%	49	21.68%	70	30.97%	1+5, 2+5, 3+5, 4+5
80. citrus fruits (orange, lemon, grapefruit etc.)	329	64.44% 212	37	17.45%	37	17.45%	34	16.04%	43	20.28%	61	28.77%	1+5, 2+5, 3+5, 4+5
81. grapes	329	35.26% 116	22	18.97%	19	16.38%	17	14.66%	25	21.55%	33	28.45%	2+5, 3+5
82. raisins	329	35.56% 117	22	18.80%	20	17.09%	16	13.68%	25	21.37%	34	29.06%	2+5, 3+5
83. water melons, melons	329	16.11% 53	11	20.75%	5	9.43%	9	16.98%	12	22.64%	16	30.19%	2+5
84. dried fruits	329	10.64% 35	5	14.29%	6	17.14%	7	20.00%	8	22.86%	9	25.71%	–
Sweets													
85. icecream	330	50.61% 167	34	20.36%	25	14.97%	23	13.77%	35	20.96%	50	29.94%	1+5, 2+5, 3+5
86. sherbet, zephyr	330	4.55% 15	5	33.33%	1	6.67%	4	26.67%	1	6.67%	4	26.67%	–
87. halvah	329	5.47% 18	2	11.11%	3	16.67%	4	22.22%	6	33.33%	3	16.67%	–

Table 2. Continuation

Body build classes / Food products	Body build classes: Subjects total (frequency 0–5)	Subjects (frequency 3–5)	1. Small n=62		2. Medium n=52		3. Large n=52		4. Pycno-morphs n=73		5. Lepto-morphs n=92		Statistics
			n	%	n	%	n	%	n	%	n	%	
88. chocolate	330	75.76% 250	49	19.60%	40	16.00%	35	14.00%	51	20.40%	75	30.00%	1+5, 2+5, 3+5, 4+5
89. caramel sweets	329	22.80% 75	17	22.67%	14	18.67%	10	13.33%	9	12.00%	25	33.33%	2+5, 3+5, 4+5
90. marmalade, jellies	327	9.79% 32	10	31.25%	6	18.75%	3	9.38%	5	15.63%	8	25.00%	3+1
91. jam, compote	330	61.52% 203	40	19.70%	34	16.75%	33	16.26%	39	19.21%	57	28.08%	2+5, 3+5, 4+5
92. nuts	330	30.00% 99	22	22.22%	16	16.16%	12	12.12%	17	17.17%	32	32.32%	2+5, 3+5, 4+5
93. cream cakes	330	11.21% 37	10	27.03%	8	21.62%	6	16.22%	3	8.11%	10	27.03%	4+1, 4+5
94. short pastry products	329	36.17% 119	23	19.33%	22	18.49%	16	13.45%	14	11.76%	44	36.97%	1+5, 2+5, 3+5, 4+5
95. creams, puddings	328	18.90% 62	14	22.58%	13	20.37%	7	11.29%	9	14.52%	19	30.65%	3+5, 4+5

Table 2. Continuation

Body build classes / Food products	Body build classes: Subjects total (frequency 0–5)	Subjects (frequency 3–5)	1. Small n=62		2. Medium n=52		3. Large n=52		4. Pycno-morphs n=73		5. Lepto-morphs n=92		Statistics
			n	%	n	%	n	%	n	%	n	%	
Drinks													
96.fruit juices	330	75.15% 248	52	20.97%	37	14.92%	29	11.69%	53	21.37%	77	31.05%	3+1, 3+4, 1+5, 2+5, 3+5, 4+5
97. berry juices	330	63.03% 208	35	16.83%	34	16.35%	28	13.46%	46	22.12%	65	31.25%	1+5, 2+5, 3+5, 4+5, 3+4
98. citrus fruit juices	330	58.18% 192	46	23.96%	28	14.58%	25	13.02%	36	18.75%	57	29.69%	2+1, 2+5, 3+1, 3+5, 4+5
99. vegetable juices	329	23.40% 77	11	14.29%	15	19.48%	13	16.88%	19	24.68%	19	24.68%	–
100. lemonade	329	19.45% 64	15	23.44%	13	20.31%	8	12.50%	14	21.88%	14	21.88%	–
101. cola drinks	330	28.18% 93	18	19.35%	16	17.20%	9	9.68%	21	22.58%	29	31.18%	2+5, 3+5, 3+4
102. tea	329	84.50% 278	53	19.06%	45	16.19%	47	16.91%	58	20.86%	75	26.98%	1+5, 2+5, 3+5
103. herb tea	327	35.47% 116	25	21.55%	19	16.38%	20	17.24%	26	22.41%	26	22.41%	–

Table 2. Continuation

Body build classes	Body build classes												
Food products	Subjects total (frequency 0–5)	Subjects (frequency 3–5)	1. Small n=62		2. Medium n=52		3. Large n=52		4. Pycno-morphs n=73		5. Lepto-morphs n=92		Statistics
			n	%	n	%	n	%	n	%	n	%	
104. pure coffee	330	48.48% 160	34	21.25%	32	20.00%	21	13.13%	33	20.63%	40	25.00%	3+5
105. grain coffee	328	8.23% 27	2	7.41%	9	33.33%	2	7.41%	9	33.33%	5	18.52%	–
106. cocoa	329	20.06% 66	15	22.73%	11	16.67%	10	15.15%	12	18.18%	18	27.27%	–
107. mineral water	329	47.72% 157	32	20.38%	24	15.29%	22	14.01%	38	24.20%	41	26.11%	2+5, 3+5, 3+4
108. tonics	327	5.81% 19	2	10.53%	4	21.05%	3	15.79%	6	31.58%	4	21.05%	–
109. beer	330	15.76% 52	9	17.31%	8	15.38%	11	21.15%	9	17.31%	15	28.85%	–
110. wine	329	16.41% 54	17	31.48%	8	14.81%	5	9.26%	12	22.22%	12	22.22%	2+1, 3+1
111. mild alcoholic drinks (gin long drink etc.)	329	6.99% 23	7	30.43%	6	26.09%	2	8.70%	4	17.39%	4	17.39%	–
112. strong alcoholic drinks (liqueur, vodka, whisky)	326	4.23% 14	3	21.43%	2	14.29%	3	21.43%	2	14.29%	4	28.57%	–

Table 2. Continuation

Body build classes	Body build classes												
Food products	Subjects total (frequency 0–5)	Subjects (frequency 3–5)	1. Small n=62		2. Medium n=52		3. Large n=52		4. Pycno-morphs n=73		5. Lepto-morphs n=92		Statistics
			n	%	n	%	n	%	n	%	n	%	
Ready-made foods													
113. meat soups	325	49.23% 160	25	15.63%	29	18.13%	22	13.75%	36	22.50%	48	30.00%	1+5, 2+5, 3+5, 3+4
114. milk soups	329	27.66% 91	15	16.48%	15	16.48%	13	14.29%	25	27.47%	23	25.27%	3+4
115. porridges	329	58.66% 193	42	21.76%	30	15.54%	30	15.54%	40	20.73%	51	26.42%	2+5, 3+5
116. meat dishes	329	70.21% 231	50	21.65%	34	14.72%	37	16.02%	43	18.61%	67	29.00%	2+5, 3+5, 4+5
117. fish dishes	328	32.62% 107	25	23.36%	19	17.76%	11	10.28%	24	22.43%	28	26.17%	3+1, 3+4, 3+5
118. vegetable dishes	326	62.27% 203	35	17.24%	37	18.23%	26	12.81%	48	23.65%	57	28.08%	1+5, 2+5, 3+5, 3+4
119. mushroom dishes	329	13.07% 43	7	16.28%	7	16.28%	6	13.95%	11	25.58%	12	27.91%	–
120. macaroni	326	71.78% 234	44	18.80%	34	14.53%	30	12.82%	55	23.50%	71	30.34%	1+5, 2+5, 3+5, 2+4, 3+4
121. pizza, hamburger	326	12.58% 41	12	29.27%	6	14.63%	4	9.76%	7	17.07%	12	29.27%	3+1, 3+5

Table 2. Continuation

Body build classes	Body build classes											
Food products	Subjects total (frequency 0–5)	Subjects (frequency 3–5)	1. Small n=62		2. Medium n=52		3. Large n=52		4. Pycno-morphs n=73		5. Lepto-morphs n=92		Statistics
			n	%	n	%	n	%	n	%	n	%	
122. raw salads	328	86.59% 284	51	17.96%	50	17.61%	40	14.08%	63	22.18%	80	28.17%	1+5, 2+5, 3+5, 3+4
123. egg dishes	329	61.40% 202	34	16.83%	38	18.81%	26	12.87%	48	23.76%	56	27.72%	1+5, 2+5, 3+5, 3+4
124. mixed salads, vinaigrette	328	33.23% 109	22	20.18%	19	17.43%	13	11.93%	24	22.02%	31	28.44%	3+5
125. rice and macaroni salads	329	28.57% 94	19	20.21%	18	19.15%	15	15.96%	20	21.28%	22	23.40%	–
126. salad dressing	329	21.58% 71	13	18,31%	15	21.13%	6	8,45%	17	23.94%	20	28.17%	3+2, 3+4, 3+5
127. mayonnaise	328	38.72% 127	26	20.47%	21	16.54%	13	10.24%	22	17.32%	45	35.43%	1+5, 2+5, 3+5, 4+5, 3+1
128. ketchup	329	58.66% 193	39	20.21%	32	16.58%	31	16.06%	37	19.17%	54	27.98%	2+5, 3+5, 4+5
129. curds dishes	325	60.92% 198	36	18.18%	33	16.67%	27	13.64%	44	22.22%	58	29.29%	1+5, 2+5, 3+5, 3+4
130. desserts (kissels, compotes)	329	41.34% 136	28	20.59%	19	13.97%	21	15.44%	26	19.12%	42	30.88%	2+5, 3+5, 4+5
131. bakings	329	60.18% 198	38	19.19%	33	16.67%	28	14.14%	40	20.20%	59	29.80%	1+5, 2+5, 3+5, 4+5

Consumption of all the food products was assessed in the same body build classes. The results are presented in Table 2. The table shows the frequency of consumption of all the 131 food products belonging to 9 groups in absolute numbers and percentage. For comparison between classes, z-test was used.

As seen from the table, consumption of different food products differed greatly.

The group of dairy products included 14 products. More than 50% of the subjects consumed cheese, yoghurt, sour cream, cottage cheese, butter margarine and milk with 2.5% fat content.

From the group of cereal and flour products (12), more than 50% of subjects consumed rye bread, white bread, pasta, buns, wholemeal and seed bread.

The most frequently consumed among the 15 meat products were wieners, sardelli, smoked sausage, ham, pork and beef.

The most often consumed fish products were fishburgers and fish fingers, small herring, brisling, seawater fish canned fish and smoked fish.

From the group of vegetables, potato, tomato, carrot, fresh cucumber and onion were consumed most often.

Among fruit and berries, seasonal Estonian products were preferred: apples, strawberries, raspberries, currants and gooseberries.

The most frequently consumed sweets were chocolate, jam, compote, ice cream, pastry and nuts.

The most frequently consumed drink was tea (84.50%), followed by pure coffee (48.48%). Juices from local fruits, wild berries and citrus fruits were drunk.

As for ready-made foods, more than 60% of subjects consumed raw salads, macaroni, meat dishes, egg dishes and curds dishes.

When comparing frequency of consumption of food products in body build classes, we found statistically significant differences between classes in the case of most food products. Only 36 products (ca 30%) showed no significant difference. These were mostly the products that were consumed the least often.

The greatest difference appeared between class 5 – leptomorphs – and all the other classes. Leptomorphs ate the greatest number of foodstuffs most often. There also differences between pycnomorphs and other classes.

If we observe frequencies of consumption in classes 1–3, we can notice an interesting difference between classes 1 and 3. Although mostly the differences are not statistically significant, it is noticeable that the girls with biggest weight and height in class 3 consume a smaller number of food products than the smallest girls in class 1. For instance, in the group of dairy products, such a difference between big and small girls was revealed in the case of 10 products, in the group of flour products – 7, in the group of meat products – 10 and in the group of fish products – 5 products.

DISCUSSION

Healthy and rational nutrition is a theme that is in the centre of attention for physicians, health promoters and anthropologists all over the world, including Estonia.

Nutrition recommendations for patients with different diseases and metabolic irregularities have been given by L. Kiisk [8]. Prof S. Teesalu [16] emphasizes that "in conclusion, it is necessary to formulate an adequate nutrition recommendation for each individual depending on his/her age. This recommendation has to take into account the individual peculiarities of each organism that derive from the genetic background."

Constitutional peculiarities of body build can be most easily revealed by using a detailed classification characterizing anthropometric body composition. Unfortunately, in literature no generally recognized constitutional and anthropometric classification can be found. Estonian anthropologists have developed a 5 SD classification of height and weight by which it is possible to systematize length, breadth and depth measurements, circumferences and body composition characteristics. The classification has been successfully applied to classify the body build of schoolgirls, schoolboys, conscripts and young women [6, 7, 11]. As the classification is widely applicable, the types presented in it can also be called morphological types of constitution.

In the present study, this classification was applied for assessment of frequency of consumption of different food products. We found that in all 9 groups of foodstuffs there were statistically significant differences in the case of 2/3 of products. Leptomorphs differ clearly from other classes by their greater frequency of consumption. There are also differences between leptomorphous and pycnomorphous girls. Very interesting differences, although not statistically proven, exist between the smallest subjects in class 1 and the largest ones in class 3.

Predominantly, frequency of consumption of foodstuffs was in inverse proportion to body size.

Considering what has been said above, we have to agree that one of the causes for differences may be different subjective taste, different habits. Still, the systematic difference in frequency of consumption between different body types suggests that it may be caused by different constitutional types of metabolism.

Our findings suggest that this classification can be suitable for studying further problems of nutrition.

REFERENCES

1. Diet, nutrition and the prevention of chronic diseases. Report of a Joint WHO/FAO Expert Consultation. WHO Technical Report Series 916. Geneva 2003, 68–69.
2. Dietary Guidelines for Americans 2005. U.S. Department of Health and Human Services, U.S. Department of Agriculture.
3. Food and health in Europe: a new basis for action, WHO regional publications. European series No 96, 2004.
4. Green papers. "Promoting healthy diets and physical activity: a European dimension for the prevention of overweight, obesity and chronic diseases." Commission of the European Communities. COM (2005) 637 final. Brussels 08.12.2005.
5. Kaarma H. (2005) Complex statistical characterization of women's body measurements. Anthrop. Anz. 53, 239–244.
6. Kaarma H., Veldre G., Stamm R., Lintsi M., Kasmel J., Maiste E., Koskel S. (2001) Regularities of body build structure of Estonian girls and youths. Morphology 120, 80–82 (in Russian).
7. Kaarma H., Stamm R., Kasmel J., Koskel S. (2005) Body build classification for ordinary schoolgirls (aged 7–18 years) and volleyball girls (aged 13–16 years). Anthrop. Anz. 63, 77–92.
8. Kiisk L. (2002) Ravitoitlustamine. Tartu. 223 pp.
9. Knußmann, R. (1988) Anthropologie. Handbuch der vergleichenden Biologie des Menschen. Band I: Wesen und Methoden der Anthropologie. Gustav-Fischer Verlag. Stuttgart / New York, 139–309.
10. Kretschmer E. (1961) Körperbau und Character. Springer Verlag. Berlin / Göttingen / Heidelberg (1. Aufl. 1921).
11. Lintsi M., Kaarma H., Saluste L., Vasar V. (2002) Systematic changes in body structure of 17–18-year-old schoolboys. Homo 53, 157–169.

12. Loolaid K., Loolaid V., Kaarma H., Saluste L. (1999) Dietary intake and body structure of girls from secondary schools of Tartu. Papers on Anthropology VIII, 103–107.
13. Peterson J., Saluvere K. (1998) Systematisation of anthropometric data of 18-year-old girls by statistical model. Biol. Sport 15, 105–112.
14. Peterson J., Kaarma H., Koskel S. Using a height-weight classification for analysis of food energy and main nutrient contents in 24-hours menus of 17–23-year-old Estonian female students. Anthrop. Anz. 2006 (in print).
15. Saluvere K., Peterson J., Saluste L., Koskel S. (1998) Systematization of anthropometric data of 17-year-old schoolgirls from Tartu, Estonia. Anthrop. Anz. 56, 267–280.
16. Teesalu S. (2006) Toitumine tõhusalt ja individuaalselt igas eas. Trükikoda Greif. Tartu. 252 pp.
17. The National Diet and Nutrition Survey Programme. Adults aged 19 to 64. Anthropometry. Volume 4, 2004, London, 15–32.
18. Wilmore J., Behnke A. R. (1970) An anthropometric estimation of body density and lean body weight in young women. J. Clin. Nutr. 23, 267–274.

Papers on Anthropology XV, 2006, pp. 178–184

CHARACTERISTICS OF THE STUDENTS PHYSICAL ACTIVITY AND HEALTH-RELATED BEHAVIOUR

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ABSTRACT

The main principle of the healthy life style is not to harm your health. The good habits and physical activities provide welfare, a good level of working capacity, a pleasant life for long. The healthy life style is related to physical activity, a balanced moderate diet mode, hardening procedures, etc. The level of knowledge and education is very important for understanding the benefit of active physical exercises and a healthy mode of life. Physically active persons keep a balanced adequate diet, do not have bad habits, they rarely become ill and their working capacity is high. The teacher's profession demands from the person not only the knowledge and pedagogical skills but also a good level of physical endurance, physical preparedness and physical development. It is very important that the teacher keeps to the healthy mode of life and has no bad habits. There are three student groups of the Sports and Biology speciality which take part in our investigation. The respondent group includes 27 persons. We have provided a questionnaire and after that we evaluate the data of physical activity. There are 20 positions in the questionnaire. We keep the score and before that divided all the respondents into four groups according to their physical activity level: a high level, a good level, a moderate level and a low level.

The purpose of our research was to analyse and evaluate the level of physical activity of the students, the future sports and biology teachers.

Key words: physical activity, health-related behaviour, students.

INTRODUCTION

Special attention is devoted to the characteristics of physical activity that support the welfare and physical capacity (1, 4, 6, 8). We analyzed the characteristics of physical activity of students (biology and sport speciality) in the Riga Teacher Training and Management Academy. A good level of physical development, physical endurance and physical preparedness are the main basic characteristics that are necessary for the teacher of sports and biology. Keeping and following the healthy life style is very important (2, 5, 7, 9). The target of our investigation is to produce the assessment of physical activity of the students that is based on the questionnaire data.

MATERIAL AND METHODS

Our investigation embraced three student groups (n=27) of the Sports and Biology speciality. The evaluation of physical activity of students was made on the basis of the questionnaire data. In the questionnaire we include the positions concerning physical activity in the weekend, during the week (in free time), morning exercises, public transport use for moving in two directions (home- academy), physical work at home, harmful habits, etc. We used the evaluation mode proposed by M. (Vilenskij and V. Iljin) (3). Physical activity can be divided into four levels: a low level, a middle level, a good level and a high level.

RESULTS

Physical activity is necessary for everybody especially for those whose daily work is connected to the physical endurance and depends on physical preparedness. Our questionnaire helps to evaluate the future teachers' physical activity level. Daily physical activity has an impact on the physical development level and the physical working capacity level

The first question was about morning exercises, the students' attitude to the morning exercise. Such kind of physical activity has a beneficial influence upon working capacity. According to the questionnaire data morning exercises were made by 67–90% of students, but 10% of the respondents made morning exercises regularly and from 64% to 80% of students did morning exercises irregularly (from time to time). Only 10% of the respondents in each students' group avoid such kind of physical activity. Irregular morning exercise are made by 38 to 90% of respondents. In other words, when students have time and are in a high spirit they go in for such physical activity, but when students have time deficiency, they prefer to avoid it.

Every body has his or her duties in at work and at home. Domestic duties also demands some physical work. We have included the position in our questionnaire concerning domestic duties. The results were the following – about 73–90% of respondents take part in domestic physical activities in different groups. Irregularly these tasks were by fulfilled from 10 to 27% of students.

Daily physical activities include various forms of using transportation on the way from home to work and back. Usually students go on foot and/or use transport (public or private). At present people try to use any kind of transport. We include the position in our questionnaire concerning the mode of transport on the way from home to work and back, we try to reveal the student's attitude to physical activity – walking. Young people (students) usually use public transport for moving or go on foot. Our data reflected it: 45–83 % of respondents prefer go on foot from their apartment to work. The first year students prefer walking in 45% of cases, but 4th and 5th year students are more active, they go on foot in 70–83% of cases. About 10–20% of respondents use private transport and do not go on foot.

The most important position in our questionnaire is the question concerning sports activities during the working week and in the weekend. The majority of respondents preferred to be occupied with sports activities during the working week after their lectures and practical classes. In different student groups that number is between 30% and 45%. Some of the students can find time and spirit for physical activities during the weekend regularly, up to 33–36%. About 55-80 % of the respondents avoid physical activities during the working week and do not have sports activities in the weekend. There are 27% of first year students and 10% of the fifth year students without physical activities in the working week (in free time). 10% of the first year students and 20% of the fifth year students do not have physical activities in the weekend.

Unfavourable impact on the health and physical working capacity caused by low physical activity as well as by bad habits (smoking, alcohol consumption). There are some positions concerning bad habits in the questionnaire. There are 10–25% of the respondents who are smokers. Some of the respondents among the first year students smoke some cigarettes from time to time (non-regular smokers), the students in the fifth and the fourth year are non-smokers.

There are some positions concerning alcohol in our questionnaire. 45% of the respondents in the first year do not consume alcohol, in the fourth and the fifth year the number of students who reject alcohol increased twice (up to 70–83%). About 17–30% of students used alcohol from time to time. The most popular kind of alcohol is beer. For keeping physical working capacities, for supporting the health status it is necessary consider nourishment and sleep management which restore body's recourses. We included some positions in our questionnaire concerning nourishment and sleep management. 36–60% respondents have regular meals and a balanced diet. The first year students pointed that sleep duration of 6–7 hours was regular for 27% respondents, 73% of students deviate from it. The sleep duration of about 6–7 hours is regular for 50% of the fifth year students and 83% for the fourth year students.

The questionnaire data were evaluated in balls /points. According the number of points all the respondents were dividend into four groups. About 10% of the respondents have a low physical activity level. 30–45% of the students have a moderate level of physical activity. A good level of physical activity was determined for 18-40 % of students in different groups. 20–50% of respondents have shown a high level of physical activity. The number of students with a good and a high level of physical activity in the group of the first year students is 45%, but in the group of the fourth and the fifth year students – about 60–67%.

CONCLUSION

Students support physical activity and a healthy – mode of life. Regular morning exercises were made by 10–13% students –respondents, but from time to time morning exercises were made by 67–90% of students. Only 10% of respondents in each student group avoid such kind of physical activity. 30–45% students go in for sport activities during the working week in free time and about 33–36% of respondents are physically active in the weekend. About 55–80% of respondents avoid physical activities during the working week and do not have sports activities in the weekend. From 50 to 90% of respondents in different age have domestic physical activities.

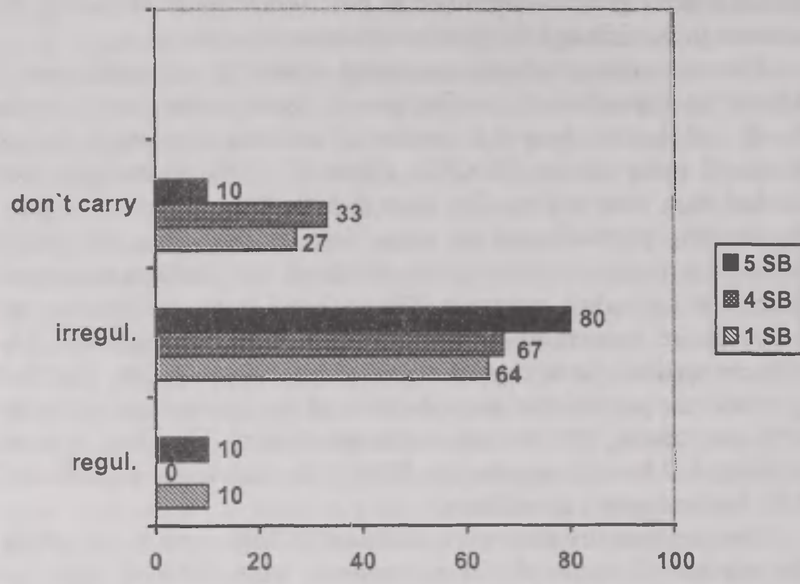

Fig. 1. Respondent division (%) is according their attitude to morning exercises.

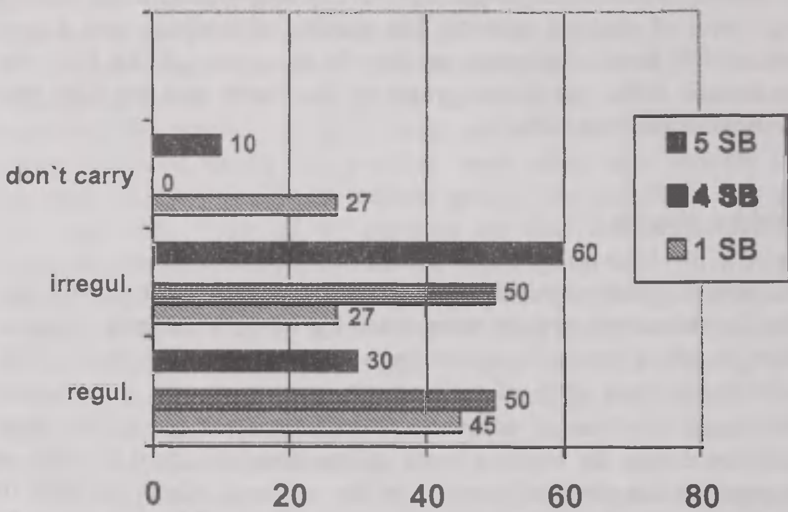

Fig 2. Respondent division (%) according their attitude to sports in the week time (free time)

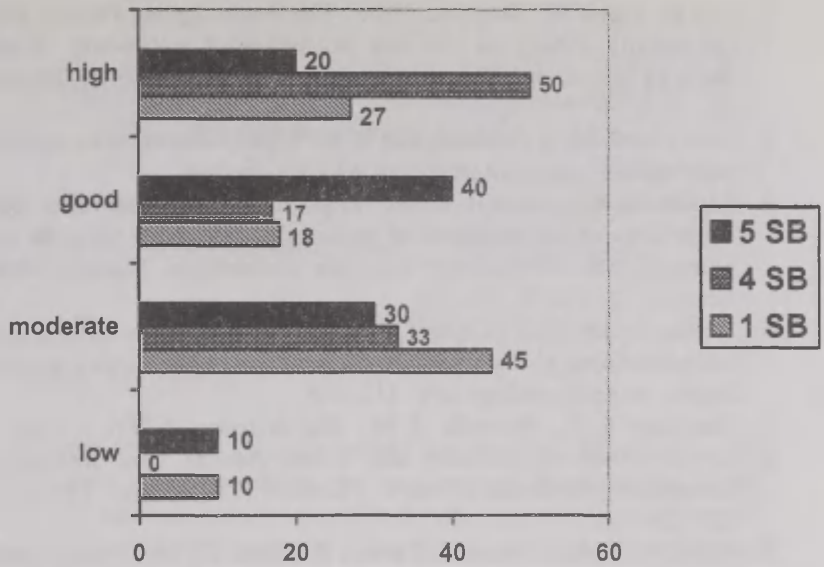

Fig 3. Respondent division (%) according their physical activity level

Only 10% of respondents were smokers, 25% of respondents use alcohol (light alcohol – beer), 13–60% follow the principles of balanced, adequate and moderate diet, and keep sleep management rules.

The questionnaire data have shown that 20% of the first year students have a high level of physical activity, the number of students whose the physical activity level was high in the fourth year is more than two times bigger (50%). A good level of physical activity in the first year characterizes about 18 % students, but in the fifth year the number of students with good physical activity increased two times up to 40%. 30–45% of the responding students have a moderate level of physical activity. Only 10% of respondents have a low level of physical activity in each examined group.

REFERENCES

1. Blair S. N. (2005) The evolution of Physical Activity Recommendations. Abstract Book of 10th Annual Congress of ECSS, 13–16 July 2005, Belgrade, 9–10.

2. Fox K., Davis M., Stathi A. (2005) The Better Ageing Project: Physical activity quality of life and psychological well-being. Abstract Book of 10th Annual Congress of ECSS, 13–16 July 2005, Belgrade, 21.
3. Виленский М. Я., Ильинский В. И. (1987) Физическая культура работников умственного труда. Москва,Знание.
4. Laudanska-Krzeminskal (2003) Physical activity and other health behaviours on the example of working people. New ideas in Sport Sciences. 8th International Scientific Conference. Warsaw-Poznan-Leszno P. 2 ,Vol 15,157–160.
5. Jalakas E., Järvalaid M. (2005) Relationship between practicing sports and performing physical tests at the Estonian public service academy. Papers on Anthropology XIV, 112–116.
6. Maughan R. J., Shirreffs S. M., Baxter-Jones A.D.G. (2000) N. Abstact Book of Nutrition and Young Athlete. 3-rd International Symposium: Medicina Sportiva. – Krakow, 13–14 Sept. Vol 4, EE1, 1,51–58 .
7. Palas N., Breda J., Nunes E.,Taveira R. Nobre T. (2005)Assessment of level and determinants of physical activity in a group of employees Abstract Book of 10th Annual Congress of ECSS, 13–16 July 2005, Belgrade, 292.
8. Prskalo I. (2002) Physiological workload and additional exercising in physical education lessons. Proceedings book: Kinesiology New perspectives. 3rd International Scientific Conference. Opatija, Croatia, Sept. 25–29, 102–104 .
9. Ojamaa M., Landõr A, Ignatjevs N., Maaroos J. (2004) Anthropometric indices and health related behaviours among female university students. Papers on Anthropology XIII, 176–184.

Papers on Anthropology XV, 2006, pp. 185–196

PIPE-SMOKER'S BURIAL FROM ROONKA (SOUTH AUSTRALIA)

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INTRODUCTION (Fig.1)

The archaeological site Roonka, where the skeleton described in the present report was unearthed, lies on the right bank of the River Murray, 120 km NE from Adelaide in South Australia. Initially it was a rescue archaeological research. After the trees were cut on the river flat by a farmer to establish a better pasture for his sheep and as a sequence of a flood in the fifties, human skeletons started to emerge from the soil on a sand dune in the magnitude which indicated an ancient Aboriginal burial place (Fig.2). The farmer Mr. Sandy Armstrong reported this event to the South Australian Museum in Adelaide.

A systematic investigation was started by Mr. Gaeme L. Pretty, an archaeologist from the South Australian Museum in Adelaide, in the year 1968 with the help of the Friends of the Museum, led by the architect Wern Tolcher. After the surface scatter was collected, more than

200 graves were unearthed in the locality from which 111 originated from the best documentated trench A. The age 18 thousand years B. C. was estimated by the C14 method in charcoal from the deepest part of the excavated area (about 3 m) associated with a fragment of a kangaroo bone. Another charcoal from one of the graves showed the age of 7 thousand years B. C., and still another charcoal from a grave 4 thousand years B. C. Mr. Pretty marked the oldest stratum without human bones as level I, the stratum with the oldest human skeleton as II and the more recent stratum III with subsections IIIa, IIIb and IIIc (Pretty, 1977, Prokopec, 1979). Evidence was found that the site had been used as a burial place even after the contact of the local Aboriginals with the European colonists. An example of that is the burial No.20 from trench A, described in this report (Fig. 3).

Figure 1. Skull No.20 with a ceramic pipe set into the hole abraded between the teeth of both jaws by its stem. (Photographed by M. Prokopec).

Figure 2. The Roonka site before the beginning of archaeological excavations, with human bones scattered on the surface of the sand dune. (Photograph Courtesy of the South Australian Museum).

Figure 3. Trench A after the end of excavations. (Photograph Courtesy of the South Australian Museum).

A remarkable find

The bones from the necropolis Roonka were deposited in the South Australian Museum in the boxes marked by the numbers of the individual graves and by letters according to each respective trench. The bones collected from the surface before the excavation started, were deposited in several boxes marked as "surface scatter". Some of the boxes contained a few bones only, others most of the bones of the skeleton. In box No. 14 the lower jaw was found with a rounded abrasion of the second lower incisor and partly of the canine on the left side. There was no cranim in box No. 14. When the bones from skeleton No. 20 were investigated, a skull was there without a lower jaw with the similar rounded abrasion of the left second incisor in the maxilla. The lower jaw was missing in box No. 20. It was evident that the lower jaw from box 14 belonged to the skeleton No. 20 and that it had been put into box No. 14 by accident.

Teeth abraded by a ceramic pipe-stem

When both jaws were put to an anatomical order, a round aperture of a diameter of 8 mm occurred between the teeth of both jaws when they were not fully in contact with each other (Fig. 4). The abrasion of the teeth by the pipe-stem took place in the crown of the second incisor (I2) and of the canine (C) of the lower jaw. Both teeth seemed to be partly displaced forward by the pressure of the pipe-stem.

A search started immediately among archaeological objects found in the graves and deposited separately from the bones. A damaged ceramic pipe with a stem broken into three parts which suited well into the hole between the teeth of the upper and the lower jaws of skull No. 20 was there. The cause of the abrasion of the tooth crowns has been proven.

Figure 4. Rounded hole abraded in the teeth of both jaws of skull No.20 by a ceramic pipe. (Photographed by M. Prokopec).

A series of cases have been reported in the literature (Ubelaker, 1996) of abraded teeth by ceramic pipes from former British colonies and from other countries where such pipes had been imported and/or manufactured. An open question still persists how long it takes before such a rounded abrasion of the hard tooth surface developed. Ceramic material is harder than glass or even steel. The find showed that the burial into grave No. 20 could not have taken place before the

European settlers or soldiers arrived at the Lower Murray area (around 1850) with their culture and the way of life which had been without any doubt shared for some time by the person from grave No. 20.

Evidence of tooth caries

Another peculiarity of skull No. 20 from Roonka was deep caries in both lower second molars (Fig. 5). It is well known and it has also been demonstrated on the teeth of other skulls from Roonka that the Aboriginals were lacking tooth caries. Their native nutrition and their way of life did not support the origin of caries. It may be taken for granted that the Aboriginal smoker of the ceramic pipe lived for some time on a European diet with white flour and sugar and acquired conditions in the mouth supporting the origin of caries. (It is believed that caries is caused by the microbe Streptococus mutans which may be transmitted from person to person by saliva – even by kissing). A further question is how long it was necessary for the Aboriginal person to share the European way of life, including diet, before the deep caries developed in both second lower molars.

Amputation of the left arm

A further surprise when analysing bones from grave No. 20 was a mutilated part of the left humerus (about one half of its expected size) showing considerable bone resorption at its distal end, which had a form of a three-sided wedge. (Fig. 6). The amputation seemed to be made "lege artis", possibly by a professional, because there was no sign of postoperative complications. The acromial joint retained its moving function after the amputation (Prokopec, 1991).

The question is how long the person liveed after the amputation of the left arm so that such atrophy and stage of resorption of the remaining part of the humerus could develop. Was the person right- or left-handed before the amputation? Did the righthandedness develop due to the amputation of the left arm? This should also be kept in mind in connection with the left side of the abraded teeth by the pipe-stem.

Figure 5. Caries on the rear side of the right second molar in the lower jaw of skull No. 20. (Photographed by M. Prokopec).

Figure 6. Comparison of the right humerus with the rest of the left one deformed by amputation. (Photographed by M. Prokopec).

The pipe smoker was most probably a female

When speaking about smoking and especially about smoking a pipe, we usually have a male in mind. Our experience with Aboriginals from Aboriginal reserves and Government stations in the Northern Territory and in South Australia told us that both males and females were smoking either the "native" or imported tobacco. They smoke cigarettes or pipes (in most instances the so-called "short pipes" without the pipe stem). The signs on the skull and postcranial skeleton of No.20 showed that its sex was more likely a female than a male. (Fig. 7), Aerial view of Roonka (Fig. 8).

Some anthropometrical characteristics of the skull from grave No. 20 are as follows (measurements are given in mm):

Maximal Length – 178,
Maximal Breadth – 122,
Basion-Bregma Height – 137,
Nasion-Gnathion Height – 110,
Nasion-Prosthion Height – 67,
Bizygomatic Breadth – 130,
Height of Symphysis – 31,

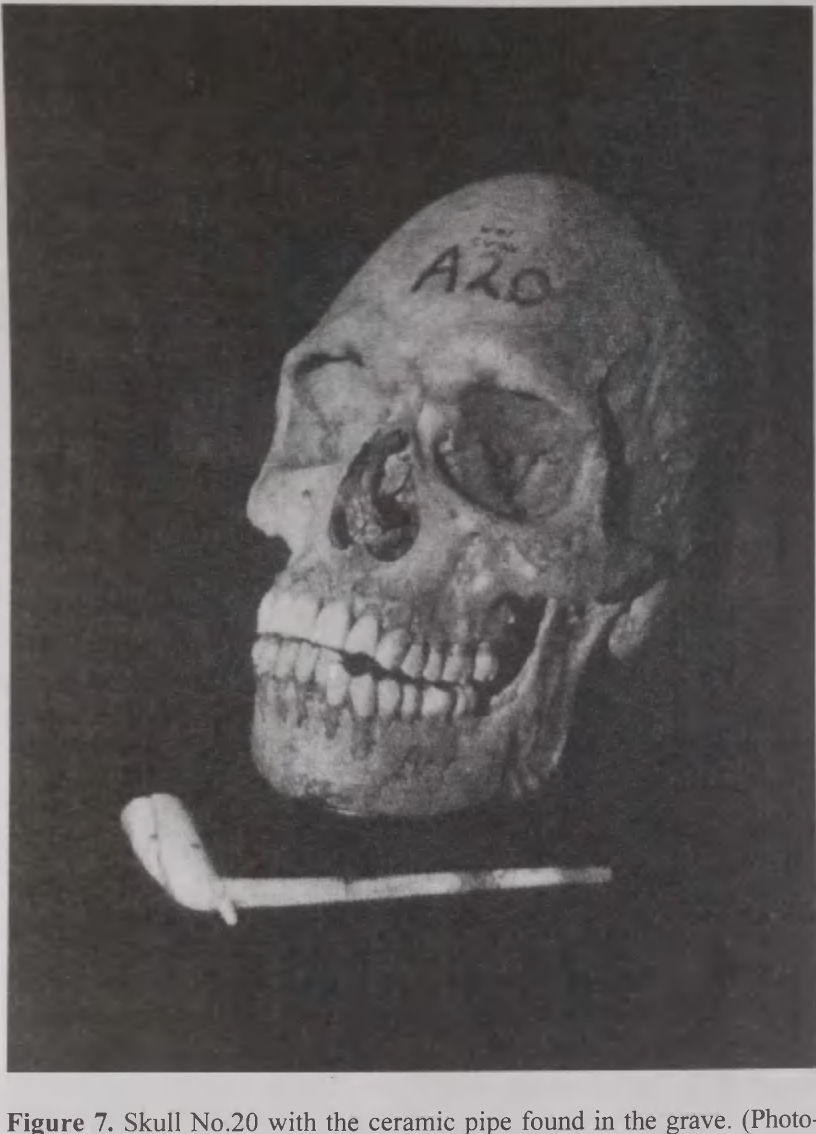

Figure 7. Skull No.20 with the ceramic pipe found in the grave. (Photographed by M. Prokopec).

Figure 8. Aerial view of Roonka flat with trench A at the end of the excavations (Photograph Courtesy of the South Australian Museum).

Nasion-Nasospinale Height – 51,
Max. Breadth of Nasal Aperture – 29,
Max. Palatal Length – 62,
Max. Palatal Breadth – 66,
Minimal Frontal Breadth – 94.

Indices (given in index units):
Cranial Index – 68,5 (Dolichocranic)
Cranial Length-Height Index – 80 (Hypsicranic)
Cranial Breadth-Height Index – 112 .3 (Acrocranic)
Total Facial Index – 84.6 (Euryprosopic)
Upper Facial Index – 51.5 (Mesene)
Nasal Index – 56,9 (Chamaerrhine)
Palatal Index – 106.5 (Brachystaphyline)

Stature 158 cm was assessed according to the length of femur.

DISCUSSION

The skeleton from grave No. 20 from the Roonka burial ground was dated archaeologically by the abrasion of teeth by a ceramic pipe-stem and by the pipe itself found in the grave to the post-contact time of the Aboriginals with Europeans. The deep caries in both lower second molars proved that the person lived for a certain length of time on the European diet (with white flour and sugar). The amputation of the left arm, most probably performed by a professional, could have been indicated by a dangerous wound or a snake bite or it might have also been performed as a punishment for theft in those early times when the Aboriginals used to be heavily punished by the newly arrived European settlers for stealing (mainly cattle). The person was most likely of female sex. Why did the early European settlers or soldiers accept the young girl among themselves? According to the features of the skull she could have been a nice looking girl who could have been hired as a maid. It was also possible that she remained after the amputation of her arm in the care of the hospital disregarding the cause of the amputation either for curative reasons or for punishment. There she lived on the European diet and had the opportunity to smoke the ceramic pipe. Toward the end of her life she lived again among the Aboriginals who used the Roonka sand dune as their burial site. No sign of the cause of death was found on the skeleton. Did the time spent with the Europeans cause her premature death? She could have died of lung TB which does not leave any signs on the bones.

The time which was necessary to cause the abrasion of tooth crowns by a pipe-stem may be estimated to be at least a year. (It depends, of course, on the frequency of smoking and of the movements of the pipe-stem in and out of the mouth. It is also important to know how firmly the pipe was held between the jaws.) Our pipe-smoker could use only his right hand and the abrasion was on the left side of the mouth.. Many smokers put their cigarette or a pipe into their mouth on the other side than is the hand holding the pipe or a cigarette. Ubelaker (1966) described 7 instances from 19 skeletons from Paluxent Point close to Solomons in the State of Maryland in the USA from 1658–1680 in which there were rounded abrasions of teeth caused by ceramic pipes. He also mentioned the first manufacturer of ceramic pipes in London in 1619.

We may estimate the time for developing caries less than a year when consuming sugar and white flour for as much as a year. The atrophy of the arm bone could have developed within two or more years after the amputation.

In the Adelaide Art Gallery there are paintings by the painter Cowthorne from the very early times of the arrival of European settlers at the area of the Lower Murray River. One of his paintings shows a convoy of bark canoes, evidently a burial ceremony, the first of the canoes was carrying the dead body. Thus, any person buried at Roonka could have been brought there by canoe even from a distant place. The reason could be an easier way of digging the grave in a sand dune than elsewhere in the hard soil. The name of the tribe, which inhabited the area including the Roonka flat, was Naiawang. The name Roonka is believed to be given to that place according to a thick worm called "ronk" which was frequently found there and used for food.

The first encounter of local Aboriginals with Europeans took place when the surveyor Chrles Sturt arrived there in 1829 on his voyage in order to prepare a report on the Aboriginals living along the river Murray. Not long after that a small pox epidemic swept the lower Murray area. In 1834 the first cattle breeders led by Charles Bonney arrived and clashes between them and the Aboriginals were frequently reported. Shortly after that Edward John Eyre came with a group of soldiers to establish peace between the Aboriginals and the colonists and to defend the rights of both parties. In 1841 Eyre established a Government station at Moorundee (about 16 km down the stream from Roonka). He reached a peaceful settlement between the two groups but the aims of the cattle breeders were preferred and in the year 1844 the tribe Naiawang was dispersed and the area around Roonka was controlled by the colonists. Starting from 1865, it served exclusively for the purposes of agriculture. Small groups of Aboriginals were observed there until 1870. The Aboriginals were, for example, hired by the farmers to hunt down pigs on their grounds because it was a difficult task.

CONCLUSION

More than 200 graves were unearthed at the archaeological site Roonka on the right bank of the River Murray 120 km northeast of Adelaide in South Australia. The grave No. 20 revealed a round abrasion of teeth partly in the upper and partly in the lower jaw caused by a ceramic pipe found in the grave. The grave was thus dated to post-contact period of the Aboriginals with Europeans. Caries was found in both second lower molars, evidently as a consequence of the European type of diet (white flour and sugar) consumed for some time. The left arm had been amputated at least several years before death because the remaining part of the humerus reveals thinning at its distal end. According to traits on the skull and postcranial bones, the sex was most probably female 18 to 25 years of age. Her estimated body height was 158 cm.

REFERENCES

Prokopec, M. (1979) Demographical and morphological aspects of the Roonka population. Oceania Monograph 22, 161–176.

Prokopec, M. (1991) Observations on health, genetics and culture from analysis of skeletal remains from Roonka, South Australia. In: Ortner, D. J. and A. C. Aufderheide, Human Paleopathology. Current synthesis and Future Options. Washington, D. C.: Smithsonian Institution Press. P.151–158.

Prokopec, M. (1994) Australian Aborigines: Prehistoric South. Variability and Evolution, Vol.4, 23–56.

Pretty, G. L. (1977) The cultural chronology of the Roonka flat –a preliminary consideration. In: R.V.S. Wright (ed.): Stone Tools as Cultural Markers: Change, Evolution and Complexity, 288–331.

Ubelaker, D. H. (1996) Pipe wear: Dental Impact of Colonial American Culture. Anthropologie (Brno) XXXIV/3, 321.

Acknowledgement: The author is indebted to the South Australian Museum in Adelaide and the Australian Institute for Aboriginal and Torres Straight Islanders Studies in Camberra for their support and to Mr. Pavel Chýle, M.D., PhD, for the correction of the English language.

Papers on Anthropology XV, 2006, pp. 197–211

RISK TO MALNUTRITION OF THE ELDERLY POPULATION IN TALLINN

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ABSTRACT

In the randomly chosen cohort of the elderly (aged 65–74 years) in Tallinn the MNA-test was used in 411 cases (228 men and 183 women). All the participants were divided into two groups by the MNA results: (1) the normal – well-nourished group consisted of 178 men (79 %) and 139 women (76%) that were not at risk for malnutrition; (2) the group at the risk of malnutrition consisted of 50 men (21%) and 44 women (24%): with MNA scores 17 to 23.5 as at the risk of malnutrition (18% men and 22% women) and MNA <17 points as undernourished.

The aim of our paper was to analyse and find out which differences exist between the elderly who are well-nourished or at risk of malnutrition in their anthropometrics, biochemical cardiovascular disease (CVD) risk factors, depression (by GDS–15) and nutrition (by 24-hour recall); correlation analyses were used to determine the relationship between variables.

The prevalence of risk to malnutrition estimated by the MNA-test (MNA 17–23.5) reached one fifth of the elderly population (21% men and 24% women). The mean value of the MNA score of the risk-group (20.4 ±2.8) was on average by 7 points lower from the well-nourished elderly (27.6 ±1.6, $p<0.0001$), equally both in men and women. Differences between normal and risk groups (lower values in the risk group) were significant for the body weight (the difference was 17.2 and 15.3 kg for men and women respectively), body fat mass (8.8 and 9.5 kg), skin fold thickness, waist, hip and arm circumference. The decreased muscle mass in the risk group was expressed by a smaller circumference of the

arm muscles and calf circumference, in addition by the lower hands' power.

In the risk group the heart rate was higher and the blood pressure tended to be lower.

In our study depression appeared to be one of risk factors to the malnutrition group (the correlation between MNA and depression scores was positive and highly significant); the mean of depression scores in the risk-group (5.27 ± 3.18) was higher than in the well-nourished group (3.19 ± 2.86); by that most depressive were the elderly women at risk (5.80 ± 3.30).

From correlation analyses with nutrition appeared negative associations of depression scores with food energy, alcohol consumption, animal protein and animal fat intakes (g), dietary cholesterol, vitamins (E, B_1, B_2, PP) and minerals (Mg, P, Fe, Zn) content in the diet; positive associations appeared with vegetable proteins (E%), carbohydrate (E%), starch (E%), dietary fiber (mg/1000kcal). At the same time the MNA score itself had very few associations with nutrition data – the only negative correlation with calories and carbohydrates (per kg body mass).

From the biochemical part of the research: the mean levels of Tg, TC, LDL-C and glucose were significantly lower in the risk group (with low MNA scores), in both in men and women. These indices together reflect the higher risk to the metabolic syndrome and atherosclerosis in the well-nourished elderly with the higher MNA scores.

The comparison of risk and norm groups did not show any difference for the homocysteine level in serum, at the same time depression scale scores had a highly significant correlation to the homocysteine level in the serum of the elderly population. By correlation analyses the values of homocysteine were higher in the elderly with higher BMI, body fat (kg) and serum creatinine, but not with higher or lower MNA scores.

Key words: nutritional assessment, nutritional status, MNA, anthropometrics, body fat, BMI, WHR, serum lipids, albumins, creatinine, glucose, homocysteine, depression, nutrient intake, food consumption.

INTRODUCTION

Malnutrition is a serious problem in the elderly. The notion of malnutrition is defined for the elderly as an inadequate nutritional status or under-nourishment characterized by insufficient dietary intake, muscle wasting and the weight loss leading to poor health and the decreased quality of life, it might be precipitated by the loss of appetite, loneliness, the chronic illness, physical and psychological elements that all together potentially impact morbidity, mortality and the quality of life in the older age. The prevalence to risk of malnutrition among the elderly in different countries in America, Europe and Asia ranges from 10–85% [1, 2]. It is important to detect the risk to malnutrition (under-nutrition) already at the early stages.

For the assessment of the nutritional status different methodologies are available including anthropometrical measurements (for example, weight and height, lean body and fat mass), biochemical analyses (as serum albumins, creatinine), clinical evaluations (skin, hair, eyes, mouth) and dietary intake surveys. With the dietary assessment methods there can be problems, because the study (for example, the 24-hour recall) may not give the real nutrient intakes, but might over- or underreport the consumption of foods. The data of nutrition investigation might give the data only for the large groups or populations, characterising the overall situation, but not for the individuals.

In search for more simple and rapid nutritional assessment "The Mini Nutritional Assessment" tool was designed and validated during the last ten years. The MNA-test is composed of simple measurements and questions on anthropometrics, the diet (meals, the food and fluid intakes), lifestyles, medication and mobility, self-perceptions of health and some others [3]. In present population study of the elderly we used the MNA-test among the other data collection (anthropometrical measures, risk factors, depression, muscle power, biochemical and nutrition data).

The aim of the paper is to analyse and find out which differences exist between the well nourished and the malnutrition risk-group (detected by MNA) of the elderly in the Tallinn population study. The special interest is given to biochemical cardiovascular disease risk factors and nutrition investigation results in the comparable groups. The depression scale also appeared to give interesting results and was added to the discussion.

MATERIALS AND METHODS

The randomly chosen cohort of the elderly (aged 65–74 years) has been formed (from the Population Register 600 persons with birth dates 1928–1937 and living in Tallinn) and had been invited by post: 244 men and 190 women responded (72.3%) and came to investigation.

The nutritional status was estimated by the following procedures and methods of investigation:

- the Mini Nutritional Assessment (MNA) test that consists of some anthropometrical measurements (weight, height, BMI, weight loss during last 3 months; arm and calf circumference); a short dietary questionnaire (related to the number of meals, food and fluid intake, autonomy of feeding); questions related to lifestyles, medication and mobility; subjective assessment of self-perception on health and the nutritional status. The sum of scores of each part, based on the points system, might be a score of 30 points being as maximum. The MNA-test was used in 411 cases (228 men and 183 women).

All the participants were divided into two groups by the MNA results:

- the normal – the well-nourished group consisted of 178 men (79%) and 139 women (76%) that were not at risk for malnutrition: their MNA score was 24–30 points of the sum of all scores,
- the group at the risk of malnutrition consisted of 50 men (21%) and 44 women (24%): with MNA scores 17 to 23.5 as at the risk of malnutrition (18% men and 22% women) and MNA <17 points as undernourished;

Direct anthropometrical measurements consisted of:

- height, weight, body mass index (BMI), hip and waist circumferences, waist-hip ratio (WHR), skin fold thickness over triceps muscle and subscapular, arm and calf circumferences;

Indirect measurements:

- both hands' muscle-power (kg) measurement was done with a dynamometer;
- the body fat mass (in kg and %) was measured with the Omron fat-monitor;

Some other risk factors and health indicators were measured and compared between groups:

- blood pressure – systolic and diastolic (SBP, DBP) – measurement (mm Hg) was done twice on the right arm with a mercury sphygmomanometer; heart rate reading per minute after rest;
- blood glucose and serum cholesterol (TC, HDL-C), triglycerides (Tg), albumins (Alb), creatinine (Cre) and homocysteine (Hcys) determinations have been carried out by enzymatic and routine clinical methods with Immunolite-20000 analyser; Venous blood samples (EDTA) after a fast of 12 hours were taken.
- The short Geriatric Depression Scale (with 15 questions) to determine depression (GDS-15) was used and the sum of scores compared and correlated to other data. The score of 5 or more points was estimated as depression. The data were compared with the prevalence of depression in the older Estonians in another study [4].

Nutrition was investigated in 295 cases (151 men and 144 women) by the 24-hour recall [5]: food energy supply and nutrient intakes were calculated by a special PC-programme; these data will be performed for both groups on the population level and correlations with other indices showing nutritional status or metabolism will be revealed.

The results of the study have been computed by the SPSS with the IBM Compatible PC with standard MS packets. The statistical processing included the calculation of means and standard deviations and errors of the means, frequency percentiles; inter-group comparisons (by the Student's t-test) and Pearson correlation coefficients were used to determine the relationship between variables.

RESULTS AND DISCUSSION

MNA scoring and anthropometrical measures.

In the population of the elderly at the age of 65–74 the mean of MNA score was 25.9 ±3.67 that characterises the average well nourishment of the elderly. The real under nutrition cases (MNA<17 points) were very rare – 3% of men and 2% of women. At the same time the risk to malnutrition estimated by the MNA-test (MNA 17–23.5) reached one fifth of population (21% men and 24% women). The mean value of the MNA score of the risk-group (20.4 ±2.8) was on average by 7 points lower than in the case of the well-nourished elderly (27.6 ±1.6, $p<0.0001$), equally both in men and women.

Differences between normal and risk groups (lower values in the risk group) were significant for the body weight (the difference was 17.2 and 15.3 kg for men and women respectively), body fat mass (8.8 and 9.5 kg), skin fold thickness, and waist, hip and arm circumference. These measurements are at first the best indices for the fat mass accumulation; at the same time the arm muscles and the calf circumference might be taken as indirect lean body mass indicators that were also lower in the risk group. The decreased muscle mass in the risk group was also expressed by the lower hands' power measured with a dynamometer. The height of the risk group had a only tendency to become shorter (difference only 3 cm in men, $p<0.05$).

A large number of the studies of the elderly have shown that changes in weight include both the changes in fat and lean components. With the age the loss of muscle mass begins already at about 40 years of age and accelerates after the age of 65 years. By that sarcopenia may occur in many elderly without a significant weight change, suggesting that the muscle is being replaced by fat. Thus, sarcopenia is a complex age-related process that results in alterations in the body composition that are not always apparent from the measurement of the body mass or body mass index or only of fat mass. Generally, it is assumed that the elderly have a greater percentage of weight that is fat than the younger people at any relative weight or of the level of BMI. This is not due to increased fat mass, but to the loss of lean mass. For that reason the prevalence of obesity may be under- or overestimated in the elderly population in comparison with the younger population [6].

In the correlation analyses the strongest and most significant associations ($n=411$, $p<0.001$) of the MNA scores with anthropometrical indices ranged as follows in the decreasing order of the correlation coefficient values (r): arm circumference ($r=0.511$), BMI ($r=0.508$), waist circumference ($r=0.507$), body weight ($r=0.500$), subscapular skin fold thickness ($r=0.486$), body fat kg-s ($r=0.459$), hip circumference ($r=0.452$), calf circumference ($r=0.451$), WH ratio ($r=0.332$), triceps skin fold thickness ($r=0.296$), right arm muscles circumference ($r=0.266$), body fat % ($r=0.242$), left hand power ($r=0.210$), right hand power ($r=0.183$).

MNA scoring, some physiological data and depression related to nutrition and biochemical indices.

In the risk group the blood pressure tended to be lower (but not significantly) than in the well-nourished, but only the systolic blood pressure measure of women in risk was significantly lower than in well-nourished; at the same time the heart rate was higher per 5 beats/ minute (both in men and women) and the correlation with MNA scores was negative ($r=-0.183$, $p < 0.001$). It might be connected, on the one hand, with stress and depression in the risk group that might partially lead to weight losses and even malnutrition, on the other hand, the reason might be some illnesses or nervous situations. In our study depression appeared to be one of the risk factor to malnutrition (correlation between MNA and depression scores was highly significant, $r=0.376$, $p < 0.001$). The risk group as a whole is characterised as depressive if the estimate by the mean value (5.27 ± 3.18 vs. normal that is under 5 points) and the mean is significantly higher than in the well-nourished group (3.19 ± 2.86); by that the most depressive were the elderly women at risk of malnutrition (5.80 ± 3.30), the average score of men at risk did not reach the depressive level (5points), but was quite near to it (4.8 ± 3.03).

In the whole population of Tallinn the prevalence of depression (by GDS15 scale 5 points and more) reached on average 34.5% being in women (46.4 %) twice higher than in men (24.2%), by that the prevalence of depression increased with the growing of age (from 27.8% in the 65–69-year-olds to 42.2% in 70–75-year-olds); the prevalence of depression differed by the ethnic origin as well being more frequent in Russians (43.4%) than Estonians (28.8%) or other nationalities (30.8%). By another study of older Estonians (investigated 1,000 people aged 65 years and older) the overall prevalence of depressed mood was 40.3% /4/.

At the same time, on the contrary to the depressive hypothesis of the malnutrition risk (discussed above) we can propose that very poor nutrition itself might lead to depression. We tried to analyse it as well. From correlation analyses it became evident that alcohol consumption (during 7 days) was associated with the depression scores inversely ($r=-0.134$, $p < 0.01$), that means the elderly consuming more alcohol were less depressive. Negative significant correlation (r values given if $p<0.001$) of the depression score appeared with food energy ($r=-0.209$), animal protein and fat intakes ($r=-0.209$ and -0.206), dietary cholesterol content ($r=-0.190$) and with magnesium ($r=-0.153$), phosphorus (r=–0.215), iron (r=–0.186) and zinc (r=–0.223) and some vitamins supply, namely E (r=–0.165), thiamine (r=–0.210), riboflavine (r=–0.200), niacine-equivalents (r=–0.218).

The conclusion of the above relationship with nutrition data is that depression might be connected with low food energy and the deficiencies of valuable animal proteins, vitamins and minerals that originate mainly from animal food.

On the other hand, the depression scores had positive associations with vegetable proteins (E%) (r=0.179), carbohydrate (E%) (r=0.182), starch (E%) (r=0.170), dietary fiber (mg/1000kcal) (r=0.173). That means that vegetable food, rich in vegetable proteins, carbohydrates (starch and fiber), may be connected with the depression that has in its own turn some connections with the risk to malnutrition. At the same time the MNA score itself had a few correlations to nutrition data at all: only the negative correlation of calories per kg body mass (r=–0.229) and carbohydrates per kg body mass (r=–0.254) were highly significant. That might confirm that poor nutrition consisting mainly of carbohydrates and having low energetic value leads or is connected with the depressive moods and leads to the malnutrition as the anthropological status. So might arise, in which the elderly already having depressive mood a closed circle for the elderly eat less valuable products and the deficiency of food energy and some nutrients in their turn make the symptoms of depression more profound, which altogether may lead to fragility.

Tables 1 and 2 on the nutrient intake and food consumption illustrate in more details the above-mentioned conclusions as a result of the comparison of data in risk and well-nourished groups:

The animal proteins and fats, vitamins A, thiamine and niacine contents in the diet of the malnutrition-risk-group were really lower due to the lower consumption of some expensive animal products (meat, milk and milk-products); at the same time the risk-group used much cheaper sugar, breads, potatoes, vegetable oils and margarines. The shortage of animal proteins might really have an impact on the muscle rebuilding, but the creatinine measurement did not assure that -there were very low levels of serum creatinine or significant differences between the comparable groups (only in men the mean value of creatinine tended to be lower in the malnutrition risk group (84.6 umol/l) against the well-nourished men (88.1 umol/l; $p < 0.05$). A quite normal level of serum albumins in both groups without any differences speaks that about the fact real under-nutrition in the

Table 1. Differences in the intake of the main nutrients in the group of elderly with the risk to malnutrition (estimated by MNA-test) in comparison with the well-nourished elderly (men and women).

Nutrient	**Well-nourished** men/women n=115/108	Risk group men/women n=36/36	t-value between normal and risk men/women
Proteins, g	79.6 / 53.4	69.5 / 54.6	2.03 / 0.28
animal protein, g	52.8 / 33.6	43.6 / 35.3	2.22 / 0.43
vegetable protein, g	25.4 / 18.3	25.0 / 18.2	0.22 / 0.08
Fats, g	91.6 / 66.1	79.4 / 64.4	1.72 / 0.29
animal fat, g	69.5 / 43.6	55.4 / 46.3	2.26 / 0.55
vegetable fat, g	21.6 / 21.9	23.6 / 17.7	0.68 / 1.55
SFA	34.9 / 23.7	27.4 / 24.6	2.63 / 0.35
MUFA	34.3 / 24.8	30.0 / 23.8	1.41 / o.41
PUFA	13.8 / 10.9	13.8 / 9.8	0.02 / 0.85
Carbohydrates (CH), g	245 / 187	247 / 207	0.09 / 1.76
sucrose	52 / 44	54 / 62	0.21 / 2.93
starch	142 / 100	139 / 99	0.27 / 0.15
lactose	11.2 / 6.7	8.3 / 8.6	1.4 / 1.44
Dietary fiber, mg	18.8 / 14.7	19.4 / 14.5	0.37 / 0.27
Cholesterol, mg	337 / 206	283 / 227	1.41 / 0.86
Alcohol, g in 7 days	53 / 4	39 / 6	0.77 / 0.82
Energy, kcal	2161 / 1560	2005 / 1628	1.22 / 0.73
(MJ)	9.05 / 6.52	8.39 / 6.81	1.22 / 0.73
Energy% of nutrients:			
Proteins (E%)	15.0 / 13.8	14.4 / 13.3	0.96 /0.066
animal proteins (E%)	10.0 / 8.6	9.2 / 8.3	1.13 / 0.36
vegetable proteins (E%)	4.7 / 4.8	4.9 / 4.7	0.84 / 0.34
Fats (E%)	38 / 37	36 / 34	0.82 / 1.57*
animal fats (E%)	29 / 24.5	26 / 24.4	1.25 / 0.04
vegetable fats (E%)	8.9 / 12.3	9.9 / 9.6	0.91 / 2.13
Carbohydrates (E%)	45.5 / 48.9	47.9 / 52.2	1.15 / 1.72
sucrose (E%)	9.5 / 11.1	9.9 / 15.5	0.29 / 3.22
starch (E%)	27 / 26.6	28 / 26.1	0.55 / 0.28
SFA (E%)	14.6 / 13.3	12.8 / 13.07	2.03 / 0.22
MUFA (E%)	14.3 / 13.9	13.9 / 12.6	0.38 / 1.48
PUFA (E%)	5.7 / 6.1	6.1 / 5.2	1.01 / 1.48
Vitamins (mg): A	0.67 / 0.33	0.24 / 0.28	1.49* / 0.34
Beta-carotene	2.00 / 2.60	2.55 / 2.47	0.8 / 1.21
E	16.3 / 12.8	16.9 / 11.8	0.39 / 0.63
C	95 / 103	85 / 103	0.42 / 0

Table 1. Continuation

Nutrient	**Well-nourished** men/women n=115/108	Risk group men/women n=36/36	t-value between normal and risk men/women
B_1	1.54 / 1.02	1.37 / 1.04	1.47* / 0.26
B_2	1.64 / 1.04	1.35 / 1.11	2.14 / 0.89
B_6	2.07 / 1.53	2.01 / 1.57	0.42 /0.35
PP	16.6 / 11.4	15.3 / 11.7	1.07 / 0.33
Niacine-eq.	33.2 / 22.9	29.4 / 23.2	1.87* / 0.14
Minerals (mg): Calcium	653 / 477	531 / 514	1.76 / 0.79
Magnesium	346 / 250	327 / 254	0.81 / 0.29
Phosphorus	1450 / 984	1256 / 1011	2.29*** / 0.44
Iron	18.5 / 12.9	16.9 / 12.9	1.13 / 0
Cupper	2.26 / 1.43	1.89 / 1.41	1.3 / 0.21
Zinc	10.8 / 7.3	9.5 / 7.3	1.93 / 0.06

Table 2. Food intake (g/day) and the percentage of foodstuffs in the food energy distribution

Foodstuff	Grams per day		**Energy %**	
	Well-nourished men/women n=115/108	Malnutrition risk group men/women n=36/36	Well-nourished men/women n=115/108	Malnutrition risk group men/women n=36/36
Milk&milk-products			18 / 15	13***/ 18
Milk, yoghurt	238 / 139	196 / 184	7.1 / 5.8	6.0 / 6.4
butter	19.6 /11.5	12.0** /13.2	6.1 / 5.0	4.2**/ 5.7
cream, cheese	310 / 190	232* / 248*	3.1 / 3.9	2.7 / 3.8
Meat&meat-products	162 /100	147 / 98	21 / 17	22 / 15
.....pork, ham, lard	65 / 36	43 * / 34	10.5 / 8.3	9.3 / 7.8
Fish	27 / 25	25 / 14	1.6 / 2.2	1.9 / 1.4
Eggs	17 / 9	16 / 14	1.4 / 1.0	1.4 / 2.2
Fruit&berries	152 / 170	206 / 187	6.0 / 9.4	7.6 / 8.1
Vegetables+potatoes	308 / 273	351 / 272	5.2 / 5.8	6.3 / 6.5
Vegetable oils, margarines	14 / 15	18* / 12	5.4 / 7.6	7.0* / 5.5
Breads ...rye	97 / 60	65* / 47	11.4 / 9.9	9.7 / 10.5
wheat	91 / 50	83 / 53	10.6 / 8.8	10.9 / 9.2
Cereal, grain	50 / 47	62 / 49	7.2 / 10.0	8.6 / 8.9
Sugar, sweets	56 / 46	51 / 64***	9.5 / 11.1	9.9 / 15.5***

differences significant between the normal and the risk groups (*p≤0.05; **p≤0.01; ***p≤0.001)’ elderly population in Tallinn does not exist. As shown before [7, 8], only in very rare cases from the whole population of the elderly very low albumins levels (36 g/l; 3.4%men and 0.5% women) or low creatinine levels in serum (60 umol/l, 4.7% men and 3.8% women) were detected.

Serum trigycerides (Tg) are associated with the fat accumulation in the body and in our study they had a positive relationship to the MNA scores ($r=0.200$; $p < 0.01$) that means that the persons with the low MNA score have the lower level of triglycerides in the serum as well. As shown in Table 3, the mean levels of Tg, TC, LDL-C and glucose were significantly lower in the risk group (with low MNA scores), both in men and women. These indices together reflect the higher risk to the metabolic syndrome and atherosclerosis in the well-nourished elderly with the higher MNA scores, in other words – the malnutrition is not a risk to CVD as over-weight and obesity are. It is interesting to mention that HDL-C level (and HDL-C percentage from TC as well) that has the preventive value in atherogenesis, was higher particularly in women of the risk-group. It confirms that the elderly men are at the greater atherosclerosis and CVD metabolic risk in both groups than women in the malnourished group.

So altogether the opinion that the risk to malnutrition might also be the risk to cardiovascular disease development in aging is not true, at least on the level of blood lipids in our study. Contrary for the elderly as well for the younger population, the accumulation of fat in body remains the main risk to the development of the metabolic syndrome that is manifested in increased serum lipids (Tg, TC, LDL-C) and glucose levels in the well –nourished elderly group that consisted also of all the elderly with obesity, not only with the normal BMI.

Some studies show that the high levels of homocysteine are associated with the increased risk for CVD /9, 10/, because of that we tried to find some relationship with other biochemical data and malnutrition. No correlation with other biochemical data was found. Comparison in risk and norm groups by MNA did not show any difference in the homocysteine level in serum. The correlation analysis gives evidence that the values of homocysteine were higher in the elderly with higher BMI ($r=0.157$), body fat kg ($r=0.179$) and serum creatinine ($r=0.161$) not with higher or lower MNA scores. Depression scale scores had a highly significant correlation ($r=0.211$; $p < 0.001$) to the homocysteine level in the serum of the elderly population. That means – homocysteine measurement in serum might be a good

Table 3. Anthropometrics, blood pressure, biochemical indices and the depression scale of the elderly in the population study (aged 64–75 years) related to their risk to malnutrition

Indices	Population of the elderly		Men		Women	
	Well-nourished n=317	Risk-group to malnutrition n=94	***Well-nourished*** n=178	Risk-group to malnutrition n=50	***Weil-nourished*** n=139	Risk-group to malnutrition n=44
Age (years)	69.1±3.06	69.2±3.05	68.5±3.07	68.8±3.28	69.9±2.87	69.6±2.75
Height (cm)	167±9.8	165±9.0*	174±6.3	171±6.5**	159±6.5	159±6.05
Weight (kg)	82.4±14.31	65.8±11.8***	86.4±13.39	69.2±12.1***	77.4±13.89	62.1±10.4***
BMI	29.6±4.57	24.1±3.96***	28.7±4.03	23.6±3.95***	30.7±4.94	24.7±3.92***
Waist (cm)	96.2±11.81	81.7±10.61***	99.1±11.27	85.6±10.9***	92.5±11.5	77.2±8.42***
Hip (cm)	106.9±9.35	97.4±7.32***	105.2±7.67	96.8±6.67***	109.1±10.76	98.1±8.01***
Waist/Hip	0.90±0.08	0.84±0.08***	0.94±0.06	0.88±0.07***	0.85±0.06	0.79±0.05***
Calf circumf (cm)	36.4±2.91	33.2±4.23***	36.8±2.77	33.1±5.18***	35.9±3.0	33.3±28.9***
Upper arm (cm)	32.2±3.03	28.4±2.72***	32.5±2.83	28.7±2.67***	31.9±3.23	27.9±2.74***
Arm muscles (cm)	24.6±3.27	22.7±3.09**	26.3±2.62	24.6±2.40***	22.3±2.57	20.5±2.22***
Tric skin fold (mm)	24.7±8.82	18.3±8.40**	20.0±7.54	13.3±6.93***	30.7±6.34	23.9±5.98***
Subscap skin fold	26.3±8.22	16.4±6.81***	25.7±8.47	15.3±7.17***	27.0±7.87	17.6±6.24***
Body fat (%)	34.6±7.56	30.2±7.55***	29.2±4.51	24.4±4.55***	41.5±4.42	36.3±4.63***
Body fat (kg)	28.5±8.29	19.6±6.16***	25.5±7.19	16.7±4.75***	32.3±8.1	22.8±5.95***
MNA score	27.6±1.60	20.4±2.79***	27.7±1.78	20.2±3.12***	27.5±1.81	20.6±2.37***

Table 3. Continuation

Right hand (kg)	32.4±13.01	28.1±11.0**	42.0±8.90	36.2±8.04**	20.4±4.75	18.7±4.58**
Left hand (kg)	30.1±12.2	25.0±10.49**	38.8±8.92	33.0±7.56**	19.0±4.37	16.3±4.83***
SBP (mmHg)	154±25.7	149±24.6	150±24.4	147±24.3	159±26.5	152±24.8*
DBP (mmHg)	85±12.6	83±13.4	86±12.3	84±14.3	83±12.9	81±12.3
Heart rate (per mln)	68±11.0	73±15.4**	68±11.3	72±16.1***	69±10.7	73±14.7***
Total Chol (mmol/l)	5.99±1.03	5.62±1.10**	5.79±0.90	5.55±1.14*	6.18±1.16	5.70±1.08***
HDL-C % of TC	22.3±7.71	26.0±7.55***	22.0±7.89	23.6±7.01	22.6±7.48	28.7±7.29***
HDL-C (mmol/l)	1.28±0.38	1.45±0.43***	1.24±0.41	1.33±0.45	1.32±0.33	1.59±0.35***
LDL-C (mml/l)	3.94±1.03	3.64±0.96**	3.81±0.92	3.74±0.88	4.11±1.14	3.54±1.04**
TG (mmol/l)	1.75±2.35	1.33±0.67*	1.89±3.07	1.41±0.77*	1.60±0.62	1.24±0.53***
Glucose (mmol/l)	6.08±1.74	5.56±1.11***	6.12±1.53	5.67±0.75**	6.03±1.98	5.43±1.40**
Albumins (g/l)	46.1±4.54	45.7±6.62	44.8±4.28	44.2±5.11	47.8±4.3	47.3±7.71
Creatinine (umol/l)	84.8±18.77	82.2±15.39	88.1±19.17	84.6±15.76*	80.4±17.4	79.5±14.7
Homocys (μmol/l)	10.9±6.19	11.1±3.88	10.4±6.68	10.9±4.12	11.4±5.64	11.2±3.42
Depression score	3.19±2.86	5.27±3.18***	2.52±2.47	4.80±3.03***	4.04±3.09	5.80±3.30***

(Means and SD; difference between normal and risk group is significant (*p≤0.05; **p≤0.01; ***p≤0.001) indicator for the detection of depression in the elderly. We tried to find out the nutrients and food items connected with the higher values of homocysteine but there were none found, which is quite understandable, because homocysteine metabolism depends on folate and vitamin B_{12} in the diet, the calculation of these vitamins was not included in the PC-programme.

CONCLUSIONS

- Malnutrition is an actual and complicated problem in aging; in the present population study in Tallinn the prevalence of risk to malnutrition (estimated by the MNA test) was opened in the one-fifth part (21% men and 24% women) of the whole population aged 65–74. The real under-nutrition cases were very rare (3% of men and 2% of women), normal serum albumins and creatinine levels confirmed that.
- Anthropometrical analyses showed that the changes of the body composition in the development of the malnutrition risk include both the changes in fat and lean components of the aging body. The decreased muscle mass in the malnutrition risk group was expressed by the lowering of the hands' power.
- In the risk of malnutrition the heart rate was higher and the blood pressure (SBP) tended to be lower than in well nourishment.
- The mean levels of Tg, TC, LDL-C and glucose were lower in the risk-group with high MNA scores, in both in men and women. These indices together reflect the higher risk to the metabolic syndrome and atherosclerosis in the well-nourished elderly with the higher MNA scores.
- In our study depression was one risk factor to malnutrition and it was connected with lower food energy and the intake of valuable animal proteins, vitamins and minerals that originate mainly from animal food; in the malnourished risk group the diet was richer in vegetable proteins, starch and fiber from vegetable food in comparision with the well-nourished elderly.
- Homocysteine measurement in the serum might be a good indicator in the detection of depression in the elderly; it had a very strong correlation to the depression scale.

REFERENCES:

1. Chen C. C.-HG., Schilling L. S., Lyder C. H. (2001) A concept analysis of malnutrition in the elderly. Journal of Advanced Nursing 36(1), 131–142.
2. Weimer J. P. (1997) Many elderly at nutritional risk. Food review, 20(1), 42–49.
3. Nutritional Assessment: the Mini Nutritional Assessment (1995) (Eds. Vellas. B. J, Guigoz Y., Garry P. J.), Serdi Publishing Company.
4. Saava M. (1997) Toitumise uurimise meetodid. Tallinn.
5. Saks K., Tuet E., Käärik E., Jaanson K. (2002) Depressive symptoms in older Estonians: prevalence and models. J of Am Geriatrics Society 50(6), 1164–1165.
6. Baumgartner R. N. (1995) Body weight and weight change in the elderly: what do the associated risks mean? Facts and Research in Gerontology 1995, no 3 (supplement: Nutrition). Nutritional intervention and the elderly (Eds. Vellas. B. J., Sacket P., Baumgartner R. J.), Serdi Publishing Company.
7. Saava M., Laane P., Abina J., Villo N. (2003) Anthropometrical assessment of elderly men aged 64–69 in relation to some atherogenic metabolic indices (epidemiological study in Tallinn 2002–2003). Papers of Anthropology XII, 219–228.
8. Saava M., Abina J., Laane P., Solodkaya E., Tchaico L: (2005) Anthropometrical assessment of elderly women in relation to the risk of cardio-vascular diseases (epidemiological study of female population aged 65–74). Papers of Anthropology XIV, 295–307.
9. Kario K., Duell P. B., Matsuo T., Sakata T., Kato H., Shimada K., Miyata T. (2001) High plasma homocysteine levels in elderly Japanese patients are associated with increased cardiovascular disease risk independently from markers of coagulation activation and endothelial cell damage. Atherosclerosis 157(2), 441–449.
10. Eikboom J. W., Lonn E., Genest J. Jr., Hankey G., Yusuf S. (1999) Homocysteine and cardiovascular disease: a critical review of the epidemiological evidence. Ann Intern Med 131, 363–375.

ACKNOWLEDGEMENTS

This study was supported by the research grant from the Estonian Science Foundation (N 5720) and has been carried out as a part of the basic research project from the Ministry of Education and Research (no 0302155s02).

Papers on Anthropology XV, 2006, pp. 212–223

EXPERIENCE IN ASSESSMENT OF TEAMS' AND INDIVIDUAL PLAYERS' PROFICIENCY AT ESTONIAN CHAMPIONSHIPS FOR 13–15-YEAR-OLD FEMALE VOLLEYBALLERS

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ABSTRACT

The purpose of the study was to assess the feasibility of using the authors' original computer program *Game* at competitions between young female volleyballers. The data for the study were collected during Estonian Championships for young female volleyball teams of Class C (up to 16-year-old players) in Pärnu from 21–22 May 2004. In all games the performance of both teams was recorded in parallel with two computers. A total of 28 games were played and 56 recordings were made.

During the match, volleyball experts registered each case a technical element of the game (serve, reception, block, feint, attack, dig) was performed by each player of the team and the grade for its performance. Using the data saved in the computer, the computer calculated the individual index of proficiency for all the elements performed by the player. In addition, the program computed: (1) the number of performance of the elements of the game (serve, reception, block, feint, attack, dig) individually and for the whole team; (2) mean indices of proficiency of the elements of the game for the whole team; (3) number of points achieved per player and by the whole team; (4) points yielded from the mistakes of the opposing team. As the computer program performs all these calculations quickly, the results of both teams can be printed out for the coach 3–4 minutes after the end of each set.

The results of the games were further processed by the SAS program; a comparison was made between the winning and losing teams. Summing up of the performance of all the elements of the game by winners as well as losers showed that the winners surpassed the results of the losers considerably; they had a statistically significantly higher index of proficiency and a greater number of points won.

The advantage of this recording system consists mainly in the amount of information given to coaches and the speed at which they get it. Additional statistical comparison with other teams is made after entering the data into the SAS-system.

Key words: young female volleyballers, recording system of the games, index of proficiency

INTRODUCTION

Nowadays the common view is that in order to improve the quality of volleyball games, assess the level of players, help the coach make appropriate decisions and analyze the contribution of each player, games should be recorded [1–3]. Earlier recording methods registered players' activities by paper and pencil, modern methods use specially designed computer programs.

The general principle of all recording systems is similar: they register the player's number, the element of the game performed by the player and evaluate the performance of the element. The main difference between the methods is how wide the evaluation scale for each element is and how many different elements from different situations of the game are recorded. Differences also exist in how the players' activities are summarized and which data are calculated for the report after the game.

In Estonia the oldest recording system was designed by A. Huimerind [4]. Elements of the game performed by players were recorded by pencil and paper. The efficiency of serve and reception was assessed in a four-point system; spike, block, dig and second pass in a three-point system.

The other recording systems used in Estonia have been designed by M. Amalin [5], M. Fiedler [6] and H. Aunin [7], and they differed from one another in how the performance of elements was assessed.

The best-known computer program for recording players' activities and efficiency of performing the elements of the game is Volleyball Win Vis version [8] that was used to record the games of 1998 European men's championships. The program records the performance of all elements in a three-point system, specifying whether the element was performed successfully or not, or the ball remained in play. Calculation of efficiency is based only on elements that were performed successfully. For example, the number of successful spikes is divided by the total number of spikes performed by the player and multiplied by 100.

Among the earlier programs, the most labour-intensive is FIVB Volleyball Information System [9]. Its application needs three networked computers and at least three recording assistants. A novelty of this program is that, by comparing the score, it automatically checks the correctness of recording. For example, if one team makes a reception error, then the other team automatically wins a point.

Differently from the previous one, the Data Volley program [10] requires one recording assistant who has to record both teams' activities during the game, but this program is meant for highly professional teams. The program works in combination with video. For example, when recording the efficiency of an attack, the program differentiates whether the attack took place after the reception of serve or after the ball was played up during the dig, whether the attack was directed into the block of two opponents or one opponent. Block is assessed by five different criteria: (1) the block yielded a point; (2) after the block, the ball remained in play on the team's own side; (3) after the block, the ball went out across the sideline; (4) the ball fell between the block and the net; (5) the blocker touched the net. Such recording methods are most essential for highly professional teams, but for recording matches of local importance and of young players, simpler programs that are easier to handle are more appropriate.

The programs that are applied nowadays use different systems to calculate points for the performance of technical elements, and therefore it is impossible to compare the efficiency of performance of the elements by teams at different competitions.

Until now there have been no programs for adolescents and for games of local importance that would be less expensive and would require a minimum number of recording assistants.

Considering all this, the authors of the article share the experience of applying their original computer program *Game* at Estonian championships with the participation of eight young female volleyball teams.

The program was first presented by R. Nõlvak (Stamm) in 1995 [11] and has been used as a recording system for six Estonian adolescent female teams. It has been presented in several international publications [12–14] and at conferences in Poland, Finland, Estonia, Germany, Greece, France and Britain.

METHODS

The sample consisted of 74 young female volleyballers aged 13–15 years from the eight most successful volleyball teams of Class C (up to 16–year-old players), who participated in Estonian Championships in Pärnu from 21–22 May 2004.

Arrangement of the championships

All the teams played with one another once. They played up to three sets, and to win the whole game, the team had to win at least two sets. A win gave the team two points, a defeat – one point. The teams' ranking was determined by the sum of points.

Recording system by the program Game

The games were recorded by the computer program *Game*. The recording methods and association of players' performance with their anthropometric characteristics, physical abilities and psychophysiological properties have been described in literature earlier [12–14].

In the present study, the program *Game* was applied, for the first time, for parallel recording of the performance of both teams with two computers. Recording was conducted by volleyball experts, the authors of the present paper M. Stamm and R. Stamm. A total of 28 games were played and, thus, 56 recordings were made.

Technically, the assessment of players' proficiency proceeded as follows: during the match the volleyball experts registered each case a technical element (serve, reception, block, feint, attack, dig) was performed by each player of the team. This was done by pressing three keys on the computer keyboard. By doing so, we registered (1) the element of the game that was performed; (2) the grade for its performance; (3) the number of the player who performed it. For all the elements, the program calculated each player's index of proficiency according to the following formula:

$$\text{Index of proficiency} = \frac{\text{number of performances} \times \text{maximum grade} - \text{sum of grades}}{(\text{maximum grade} - 1) \times \text{number of performances}}$$

Proficiency can range from 0 to 1, where 1 means that in all cases the element was performed excellently, and 0 – a failure in all the cases. Next, using the data saved in the computer, the program calculated, in addition to the individual index of proficiency, the following data:
(1) number of elements (serve, reception, block, feint, attack, dig) performed individually and by the whole team;
(2) mean indices of proficiency of the elements of the game for the whole team;
(3) number of points achieved per player and by the whole team;
(4) points yielded from the mistakes of the opposing team.

The computer program performs all these calculations quickly, and 3–4 minutes after the end of each set, the results of both teams can be printed out on paper for the coach. Relying on these data, the coaches could change players if necessary.

As a rule, after each game the technical results of both teams were printed out and given to the coaches.

The results of games were further processed by the SAS program by one of the authors of the article, Säde Koskel MSc. The performance of elements of the game by all the teams was compared statistically; a comparison was made between the winning and losing teams.

Statistical analysis

Using the data on elements performed by individual players, the statistical section of the program *Game* computes the team's essential technical data for a particular set and for the whole game – total number of elements performed and number of points gained.

Statistical analysis of the data was continued after the championships, using the SAS system, in order to compare the technical data of different teams. For this purpose, primary statistical analysis of both teams' technical data was performed, where their $\bar{x}$ and SD were computed and the significance of the differences between the results of different teams was checked by t-test.

RESULTS

General results of the winning and losing teams in all the 28 games are presented in Table 1. The teams' names have been replaced by letters A-H. For all games, the table provides the average index of proficiency in all the technical elements of the game (serve, reception, block, feint, attack, dig), the number of points won by the teams themselves as well as the number of points gained from the mistakes of the opponent, and the relation between sets won and lost.

The table shows that the proficiency of the winning teams is higher than that of the losers. The mean index of proficiency of the winning team is nearly always higher than that of the losing team, with the exception of the losing teams E (in the 3rd game), G (in the 6th game) and F (in the 12th and the 22nd games). (see Table 1).

When summing up the performance of all the elements of the game by both winners and losers, we can say that winners surpassed the results of the losers considerably. The games were won by the ratio between sets 2–0 at 16 times and 2–1 at 12 times.

To find how the winning teams differed from their losing opponents, we observed separately the elements that yielded winning points to either of the teams. These were serve, attack, block and feint. Table 2 presents the average data of the winning and losing teams at the performance of these four elements – the number of serves, attacks, blocks and feint performed, the points received and the teams mean index of proficiency at the performance of these elements.

Table 2 shows that the winning teams mostly gained points from successful serves and attacks. The number of attacks did not differ significantly between winning and losing teams, but their indices of proficiency differed essentially between the two groups.

The number of feints performed, the number of points yielded from them and the team's mean index of proficiency was somewhat higher in the winning teams, but there was no statistically significant difference between winning and losing teams.

The number of blocks, the number of points gained from them and the team's mean index of proficiency was also slightly higher in winners, but there was a statistically significance difference only in the number of points gained from the performance of this element.

Table 1. Average indices of proficiency of all the registered elements of the game (serve, reception, block, feint, attack, dig) and points scored by winning and losing teams for all the 28 games.

Game	**Winners**						**Losers**					
No	Team	Average pro-ficiency	Points won	Points won from opponents' errors	Total points	Relation of sets	Team	Average proficiency	Points won	Points won from opponents' errors	Total points	Relation of sets
1	C	0.641	36	14	50	2:0	G	0.486	17	10	27	0:2
2	B	0.669	31	19	50	2:0	H	0.391	16	14	30	0:2
3	A	0.551	30	20	50	2:0	E	0.584	15	14	29	0:2
4	D	0.554	34	16	50	2:0	F	0.386	18	4	22	0:2
5	A	0.590	48	16	64	2:1	C	0.542	38	15	53	1:2
6	E	0.558	44	33	77	2:1	G	0.577	50	22	72	1:2
7	D	0.610	33	17	50	2:0	B	0.494	26	14	40	0:2
8	F	0.649	50	21	71	2:1	H	0.601	41	20	61	1:2
9	C	0.617	48	22	70	2:1	E	0.500	46	21	67	1:2
10	A	0.597	36	14	50	2:0	G	0.499	28	11	39	0:2
11	D	0.606	37	13	50	2:0	H	0.493	27	9	36	0:2
12	B	0.533	50	17	67	2:1	F	0.546	34	20	54	1:2
13	C	0.676	57	10	67	2:1	D	0.604	39	17	56	1:2
14	F	0.610	50	18	68	2:1	G	0.551	44	15	59	1:2
15	E	0.584	49	22	71	2:1	H	0.490	31	21	52	1:2
16	A	0.592	46	21	67	2:1	B	0.538	41	11	52	1:2

Table 1. Continuation

Game	Winners						Losers					
No	Team	Average pro-ficiency	Points won	Points won from opponents' errors	Total points	Relation of sets	Team	Average proficiency	Points won	Points won from opponents' errors	Total points	Relation of sets
17	D	0.611	49	16	65	2:1	G	0.597	58	10	68	1:2
18	C	0.646	37	13	50	2:0	F	0.491	11	6	17	0:2
19	B	0.673	42	10	52	2:0	E	0.534	22	16	38	0:2
20	A	0.663	41	9	50	2:0	H	0.491	21	7	28	0:2
21	E	0.683	49	16	65	2:1	D	0.583	42	19	61	1:2
22	A	0.534	40	10	50	2:0	F	0.613	21	18	39	0:2
23	G	0.631	32	18	50	2:0	H	0.535	30	13	43	0:2
24	B	0.608	39	11	50	2:0	C	0.547	24	11	35	0:2
25	A	0.663	56	13	69	2:1	D	0.583	49	18	67	1:2
26	E	0.645	33	17	50	2:0	F	0.492	18	16	34	0:2
27	C	0.657	34	16	50	2:0	H	0.421	16	14	30	0:2
28	B	0.637	38	12	50	2:0	G	0.542	20	17	37	0:2
	General average	0.617	41.75	16.21	57.96		General average	0.525	30.11	14.39	44.50	

Among winners and losers teams statistically differ average proficiency points won and total points.

Table 2. Comparison of the perfomance of serve, attack, feint and block by losing and winning teams in 28 games

No	Technical data	Winning teams		Losing teams		p
		$\bar{x}$	SD	$\bar{x}$	SD	
1	Number of serves	56.25	10.11	44.21	14.97	<0.001*
2	Points won	9.07	3.98	5.85	3.12	0.002*
3	Mean index of proficiency	0.45	0.06	0.41	0.06	0.02*
4	Number of attacks	44.50	11.63	39.14	14.38	0.13
5	Points won	20.82	5.16	14.46	7.20	<0.001*
6	Mean index of proficiency	0.66	0.11	0.57	0.11	0.004*
7	Number of feints	15.46	6.95	14.93	9.97	0.82
8	Points won	6.18	3.39	5.70	3.89	0.63
9	Mean index of proficiency	0.67	0.12	0.60	0.16	0.068
10	Number of blocks	17.32	8.72	14.64	10.04	0.29
11	Points won	6.08	2.73	4.29	2.59	0.017*
12	Mean index of proficiency	0.55	0.11	0.49	0.18	0.113
13	Total of points won	42.32	8.47	30.11	12.72	<0.001*

DISCUSSION

The main aim of the coach of each young female team is to prepare his/her team for possibly good performance at competitions. For the coach, not only the place achieved among other teams is important but also detailed analysis of the performance of each player as well as of the whole team in comparison with other teams.

In Estonia, the comparison of players and teams of this age group is possible mostly only at national championships; therefore it is most essential which recording system is applied and how the games are analyzed afterwards.

In the present study, the authors analyzed the experience they gained at the Estonian national championships where 28 games between eight teams of 13–15-year-old female volleyballers were recorded in parallel with two computers using the program *Game*.

The advantage of this recording system consists mainly in the amount of information given to coaches and the speed at which they get it. This helped the coaches to take appropriate decisions after each set.

Additional comparison with other teams could be made after entering the data into the SAS-system.

We have no comparative data from literature about analogous programs being used for adolescent players, therefore we had to limit ourselves to analysis of our own material only.

In summary, two conclusions might be drawn from our study. First, the program *Game* used by us at the championships of adolescent female players might be recommended for use at other similar competitions. Its advantages are cheapness, simplicity, and immediate availability of information for the coach.

Second, we can get the best overview the development of adolescent female volleyballers' ball handling skills if we apply the recording system *Game* devised by us at championships regularly each year.

Entering the data into a database that is being created will enable us to carry out regular longitudinal assessment of individual players as well as whole teams. We can also find the coaches whose players develop fastest and learn from their training methods.

REFERENCES

1. McGown C. (1994) Science of coaching volleyball. Champaign, IL. Human Kinetics.
2. Frohner B. (1995) Aktuelle Computer- und Videotechnologie zur systematischen Untersuchung des technicsh-taktischen Handelns in Volleyball aus individueller und mannschaftischer Sicht. Leistungsport, 3, 4–10.
3. Stamm R, Stamm M. (2004) Individual proficiency of young female volleyballers at Estonian championships for Class C and its relation to body build. Papers on Anthropology XIII, 239–247.
4. Huimerind A. (1971) Võrkpall (Volleyball). Tallinn. Eesti Raamat. (in Estonian)
5. Amalin M. E. (1973) Issledovanie voprosa takticheskoi podgotovki voleibolistov-masterov Avtoref. diss. na soisk. uch. step. kand. ped. nauk. (On the problems of tactical preparation of top-level volleyball

players. Summary of Candidate's dissertation in education) 23 s. (in Russian)
6. Fiedler M. (1978) Volleyball. Leipzig: LVZ-Druckerei Hermann Dunker.
7. Aunin H. (1979) Võrkpallurite resultatiivsusest võistlustel. XX vabariiklik teaduslik metoodiline kehakultuuri alane konverents "Teaduselt spordile" teesid (On volleyballers' proficiency at competitions. Abstracts of the 20th Estonian conference "From Science to Sports"). (in Estonian)
8. Oulo EM & Toimisto Turku TSTO Win Vis version – Volleyball. Match results. European Championships 4–12.9.93. Finland. 38 pp.
9. Volleyball Information System for DOS Software. (1997) Version 2.51, FIVB.
10. Data Project (1982) The official stats software to the European Volleyball Confederation. Italy.
11. Nõlvak R. (1995) A system for recording volleyball games. Papers on Anthropology VI, 171–175.
12. Stamm R, Stamm M, Oja A. (2000) A system of recording volleyball games and their analysis. Int J Volleyball Res, 2(1), 18–22.
13. Stamm R, Veldre G, Stamm M, Kaarma H, Koskel S. (2000) Young female volleyball players' anthropometric characteristics and volleyball proficiency. Int J Volleyball Res, 4(1), 8–11.
14. Stamm R, Veldre G, Stamm M, Thomson K, Kaarma H, Loko J, Koskel S. (2003) Dependence of young female volleyballers' performance on their body build, physical abilities, and psychophysiological properties. J Sport Med Phys Fitness, 43, 1–9.
15. Stamm R, Stamm M, Thomson K. (1999) Prediction of volleyballers' performance on the basis of their physical fitness, anthropometry, technical skills and psychophysiological properties. Proceedings of the IIIrd International Scientific Congress of Modern Olympic Sport. Warszawa, 192–193.
16. Nurmekivi A., Stamm R, Stamm M, Koskel S. (2000) Relationships between anthropometric measurements, body composition indices and physical performance abilities in young female volleyball players. Proceedings of the 5th Annual Congress of the European College of Sport Science. July 19–23, Jyväskylä, Finland, 537.
17. Stamm R, Veldre G, Stamm M, Kaarma H, Koskel S. (2001) Relevance of the anthropometric factor in the performance of young female volleyballers. 7th International Scientific Conference of the International Association of Sport Kinetics in Cooperation with the Faculty of Exercise and Sport Sciences, University of Tartu, Tartu, Estonia, August 31 – September 2. Proceedings in Acta Kinesiologiae Universitatis Tartuensis, vol. 6, 254–257.

18. Stamm R., Veldre G., Stamm M, Nurmekivi A, Loko J. (2001) Volleyballers' performance in relation to their anthropometric characteristics. 6th Annual Congress of the European College of Sport Science, Cologne, 24–28 July, 1210.
19. Stamm R, Stamm M. (2002) Estonian Volleyball Information System *Game*. 7th Annual Congress of European College of Sport Science, Athens, 24–28 July, 01178.
20. Stamm R, Stamm M, Koskel S, Kaarma H. (2003) Testing of Estonian young female volleyball players' physical abilities considering their body constitution. 8th Annual Congress of the European College of Sport Science, Salzburg, July 9–12, 110–113.
21. Stamm R, Stamm M. (2004) Dependence of proficiency at competitions on body build, physical ability, volleyball technical and psycho-physiological tests in young female volleyballers (aged 13–16 years). 9th Annual Congress of the European College of Sport Science. July 3–6. Clermont Ferrand, France, 296.
22. Stamm R, Stamm M. (2005) New improved volleyball recording program *Game*. 10th Annual Congress of the European College of Sport Science, July 13–16, Belgrade, Serbia, 162.

Papers on Anthropology XV, 2006, pp. 224–235

CLINICAL VALUE OF AMBULATORY BLOOD PRESSURE MONITORING IN CHILDREN WITH OBESITY AND TYPE 1 DIABETES

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ABSTRACT

The early detection of and intervention in childhood hypertension is important to reduce long-term health risks. This study attempts to describe the characteristics of blood pressure in children with known cardiovascular disease risk factors- obesity and type 1 diabetes. This study investigated: the prevalence of hypertension and the characteristic (true hypertension; white coat hypertension, masked hypertension) of it in children with obesity and type 1 diabetes; the rate of blood pressure load, variability and profile in the children mentioned above; some correlation between anthropometric data and blood pressure. A total of 72 children (aged 8–18 years) with obesity (28) and type 1 diabetes (44) were investigated in our study. Ambulatory blood pressure (ABP) was recorded within a 24-hour period using a MOBILOGRAPH® recorder. In the investigated obese children the mean office blood pressure (BP) was significantly higher than in those with diabetes, although obese children were younger. The mean systolic and diastolic blood pressure values by obtained blood pressure monitoring (ABPM) were lower than office BP values. The prevalence of office systolic hypertension before the ABPM study was found in 85.2% of obese and 43.2% of diabetic children. The prevalence of systolic/diastolic hypertension (SH/DH) by ABPM was considerably lower than office SH/DH. The difference in office systolic hypertension prevalence between obese and diabetes children retained after ABPM and was for daytime systolic hypertension 2.5 times higher in obese children than in children with diabetes ($p<0.05$). More than half of the children with obesity and one third with diabetes had systolic whitecoat hypertension. Diastolic white-coat hypertension was significantly higher in obese children

(37.0%) than in diabetics children (15.9%). A new characteristic of hypertension – masked hypertension was studied and we found it in 2.3% of children with type 1 diabetes. Masked hypertension has been found in adults in 14.2% by ABPM (12). High blood pressure variability was found almost in half of the studied children. Statsitical difference in high BP variability was found in obese children for nighttime SBP (63.0%) comparing with diabetic children (37.2%). The systolic BP load was significantly higher in children with obesity comparing with children with diabetes. The study demonstrated that many diabetics patients lost their normal nocturnal drop in BP (54.5%) as did obese children (48.1%).

Key words: children, obesity, diabetes, hypertension, ambulatory blood pressure monitoring.

INTRODUCTION

The epidemic of childhood obesity and the increasing number of type 1 and 2 diabetes are known to exert a major impact on a cardiovascular risk. The early detection of and intervention in childhood hypertension is important to reduce long-term health risks; however, supporting data are lacking [4]. The prevalence of hypertension in children is reported to be 1–3 %. In recent years, the prevalence of hypertension in school-aged children appears to be increasing up to 4,5%, perhaps as a result of the increased prevalence of obesity [2]. Muntner's nation-wide study found the significant blood pressure (BP) increase in children 8–12 years old and stated that obesity caused 29% of the systolic and 12% of diastolic blood pressure increases [5]. Isolated systolic hypertension is more common in diabetic persons even at a relatively young age and is an independent risk factor for the cardiovascular and renal disease. Blood pressure tends to be more labile in persons with diabetes, necessitating more measurements to get a handle on mean blood pressure [9].

Obesity and type 1 diabetes are also difficult clinical problems in children in Estonia. The prevalence of obesity in children who are15 years old increased from 6.5% in 1996 to 10.9% in 2003 with increasing diastolic hypertension rate from 10.4% to 12.7% in Tallinn [13]. The prevalence of type 1 diabetes in children has an increasing trend although the exact data were not available in Estonia.

Accurate blood pressure measurement is essential if hypertension in children is not over-diagnosed or under-treated. The casual blood pressure readings, obtained either manually or by an automated device, may not accurately reflect a child's true blood pressure because of the operator error, inaccurate reporting of results, device inaccuracies, white-coat hypertension or simply because of the known lability of children's blood pressure. ABPM is a technique in which a subject's blood pressure can be measured at regular intervals over 24 hours. ABPM offers numerous advantages that could potentially address the difficulties in blood pressure measurement mentioned above. The main factor among these is the ability to objectively record the entire day's blood pressure readings, avoiding the potential problems of the operator error and inaccurate result reporting, avoid the white-coat effect and lessen blood pressure lability. ABPM in children have not yet endorsed its routine use in the evaluation of hypertension in children. The reason of it could be the absence of standards values for the interpretation of pediatric ABPM studies [1]. The hypertension study with using the method of ABPM in children and adolescents has been initiated in Estonia in 2001[11; 12] .

This study attempt to describe the characteristics of blood pressure in children with the known cardiovascular disease risk factors- obesity and type 1 diabetes.

The investigation conformed the principles outlined in the Declaration of Helsinki and was approved by the local ethics committee.

OBJECTIVES

This study investigated :

1) the prevalence of hypertension and the characteristic (true hypertension; white coat hypertension, masked hypertension) of it in children with obesity and type 1 diabetes;
2) the rate of blood pressure load, variability and profile in the children mentioned above;
3) some correlation between anthropometric data and blood pressure .

MATERIAL AND METHODS

A total of 72 children (aged 8–18 years) with obesity (28) and type 1 diabetes (44) were investigated in our study. Before the investigation the family history of cardiovascular disease and some characteristics of health behavior (physical activity, smoking and alcohol use) were obtained by the questionnaire. Anthropometric measurements included height, which was measured to ± 0.1 cm , and weight, to ± 0.1 kg, body fat percentage (BF%) was measured using the method of biolectrical impedance with body fat analyzer BF-905 (MALTRON® -UK). Casual office systolic and diastolic blood pressure (SBP, DBP) were obtained using the sphygmomanometer with an appropriate cuff size. The body mass index (BMI) was calculated by the formula weight(kg) / height (m^2). Ambulatory blood pressure was recorded within a 24-hour period using an MOBILOGRAPH® recorder (I.E.M. GmbH, Germany) with the appropriate cuff size. The complete description of the method ABPM was presented elsewhere [7]. The blood pressure load (usually defined as the percentage of readings greater than a pre-set threshold value) was chosen somewhat higher (30%) than the value used for interpreting ABPM studies in adults (25%) [6]. The BP variability was defined as low if the standard deviation (SD) of the daytime systolic blood pressure was below the mean of the study population, and high variability if the SD of the daytime systolic blood pressure was above the mean of the study population [6]. The adolescents, whose nocturnal BP fell for SBP and DBP was more than 10%, were classified as dippers and those, whose nocturnal fall was less than 10%, were classified as non-dippers. The assessment of casual office blood pressure was performed by after a widely quoted source: the Task Force for High Blood Pressure in Children [14] and ABPM results by the normative data for ambulatory BP published on the ground of multicenter study within the European area [8]

BP characteristics were defined as the following: a) normotension – a patient with casual blood pressure level $\leq 95^{th}$ percentile in a physician's office and by ABPM outside a clinical setting; b) systolic /diastolic hypertension (SH/DH) was defined as average casual systolic/ diastolic blood pressure $\geq 95^{th}$ percentile for gender, age and height [9] and /or ABPM systolic/ diastolic blood pressure $\geq 95^{th}$ percentile for gender and height [10] ; c) systolic / diastolic white-coat hypertension (SWCH/ DWCH) when the patient had casual blood pressure level $\geq 95^{th}$ percentile in a physician's office and normal values by ABPM outside a clinical setting; d) masked systolic/ diastolic hypertension (MSH/MDH) were defined as normal casual office blood pressure ($\leq 95^{th}$ percentile for gender, age and height) and elevated blood pressure using ABPM outside a clinical setting [10].

A SPSS 8.0 for Windows statistical package was used for the analysis. All the data underwent statistical processing with the determination of the mean, standard deviation (SD), correlation coefficient and t-test for the comparison of means. In all the cases the significance level $p<0.05$ was used.

RESULTS

The sample included the total of 72 children (aged 8–18 years) with obesity (28) and type 1 diabetes (44), among them 39 boys and 33 girls. The positive family history of cardiovascular diseases was present in 70.4 % of the patients with obesity and 59.5% with diabetes ($p<0.05$). Hypodynamia – physical activity sessions ≤ 2 times /per week – was found in 76.9% of obese and 74.4% of children with type 1 diabetes ($p<0.05$). 9. 1% of diabetic children and 3. 6% of obese children were smokers. Alcohol was used by 25.0 % children with diabetes and 10.7% of obese children ($p<0.05$).

The main characteristics of patients are shown in Table 1.

Table 1. Characteristics of the studied patients

Variable	Diagnostic group	Mean (SD)	Group difference
Age	Obesity	14.6 (2.7)	
	Diabetes	15.8 (1.7)	p<0.05
Weight (kg)	Obesity	90.9 (21.0)	
	Diabetes	63.6 (8.8)	p<0.05
Height (cm)	Obesity	170.4 (14.6)	NS
	Diabetes	167.3 (8.5)	
BMI (kg/m²)	Obesity	31.2 (4.1)	
	Diabetes	22.6 (3.2)	p<0.05
BF%	Obesity	41.7 (8.8)	
	Diabetes	30.8 (12.6)	p<0.05
Office SBP	Obesity	145.0 (17.7)	
	Diabetes	126.7 (11.0)	p<0.05
Office DBP	Obesity	77.0 (10.7)	NS
	Diabetes	76.3 (9.0)	

p<0.05–difference between diagnostic groups; NS– not significant

Children with obesity were younger, heavier and taller with higher BMI and BF% ($p<0.05$). The mean casual office systolic blood pressure was higher in obese children and no differences in diastolic blood pressure among the two groups were found.

The prevalence of casual office systolic hypertension, measured before the beginning of ABPM , was found in obese children in 85.2% and in 43.2% of the studied persons with diabetes ($p<0,05$). Diastolic hypertension was detected in 37.0% in obese and 18.2% of diabetes children (NS) The results of the mean ABPM data are shown in Table 2.

Table 2. Data on ambulatory blood pressure monitoring by diagnostic groups

Variable	Diagnostic group	Mean (SD)	Group difference
24-hour SBP (mmHg)	Obesity Diabetes	123.0 (8.8) 115.9 (8.5)	p<0.05
24-hour DBP (mmHg)	Obesity Diabetes	67.6 (5.3) 65.4 (5.4)	NS
24-hour PP (mmHg)	Obesity Diabetes	55.5 (5.2) 50.5 (6.0)	p<0.05
Daytime SBP (mmHg)	Obesity Diabetes	128.0 (9.9) 119.7 (9.4)	p<0.05
Daytime DBP (mmHg)	Obesity Diabetes	71.9 (6.4) 68.9 (6.3)	P= 0.052
Daytime PP (mmHg)	Obesity Diabetes	56.0 (6.6) 50.9 (5.8)	p<0.05
Nightime SBP (mmHg)	Obesity Diabetes	114.6 (8.1) 108.8 (9.2)	p<0.05
Nighttime DBP (mmHg)	Obesity Diabetes	60.2 (4.8) 58.8 (5.9)	NS
Nighttime PP (mmHg)	Obesity Diabetes	54.4 (6.5) 49.9 (7.0)	p<0.05

PP– pulse pressure; p<0.05–difference between diagnostic groups; NS– not significant

The children with obesity had a higher 24-hour, daytime and night-time SBP and PP ($p<0, 05$) with no differences in diastolic pressure variables comparing with the children with type 1 diabetes.

The measures of the associations of blood pressure showed that 24–h SBP, 24–h PP, daytime SBP and PP and nighttime SBP depended on the gender ($p<0,05$) and tended to be dependent on the from diagnostic group (p=0,062). The prevalence of the different characteristics of hypertension are described in Table 3.

Table 3. Prevalence of hypertension, white-coat hypertension and masked hypertension by diagnostic groups

Variable	Obesity group	Diabetes group	Group difference
Daytime SH	33.3%	13.6%	$p<0.05$
Daytime DH	0.0%	4.5%	NS
Nighttime SH	18.5%	6.8%	NS
Nighttime DH	3.7%	2.4%	NS
SWCH	51.9%	34.1%	NS
DWCH	37.0%	15.9%	$p<0.05$
MSH	0.0%	2.3%	NS
MDH	0.0%	2.3%	NS

$p<0.05$–difference between diagnostic groups; NS– not significant

On the basis of the ABPM threshold values we found that the children with obesity had a higher SWCH than those with diabetes but with no statistical significance. DWCH was significantly higher in the children with obesity comparing it with those with diabetes ($p<0.05$). The prevalence of masked hypertension was low and found only in the children with type 1 diabetes.

The additional analyzis of the prevalence of WCH by the gender did not show any statistical difference in variables between the patients' groups.

To account the blood pressure variability the mean data of BP standard deviation of the studied children were found and shown in Table 4.

Table 4. Data on mean blood pressure standard deviation in the studied children

Variable	Mean SD
Daytime SBP	12.0
Daytime DBP	9.9
Nighttime SBP	11.3
Nighttime DBP	9.1

The prevalence of high and low blood pressure variability, was found by comparing the individual's BP standard deviation with the mean data of the studied group and the data are shown in Table 5.

Tabel 5. The prevalence of day-and nighttime high and low blood pressure variability by dignostic groups

Variable	Obesity	Diabetes	Difference
High daytime SBP variability	44.4%	51.2%	NS
Low daytime SBP variability	55.6%	48.8%	NS
High daytime DBP variability	59.3%	48.8%	NS
Low daytime DBP variability	40.7%	51.2%	NS
High nighttime SBP variability	63.0%	37.2%	P<0.05
Low nighttime SBP variability	37.0%	62.8%	NS
High nighttime DBP variability	51.9%	44.2%	NS
Low nighttime DBP variability	48.1%	55.8%	NS

p<0.05–difference between diagnostic groups; NS– not significant

It was found that only the high night-time systolic blood pressure variability differed significantly between the children with obesity and type 1 diabetes.

The prevalence of blood pressure load over 30% of BP normative is shown in Table 6.

Table 6. The prevalence of blood pressure load over 30% by diagnostic groups

Variable	Obesity	Diabetes	Difference
Daytime SBP	48.1%	20.5%	p<0.05
Daytime DBP	11.1%	4.5%	NS

p<0.05–difference between diagnostic groups; NS– not significant

The systolic blood pressure load was significantly higher in the children with obesity comparing it with the children with diabetes ($p<0.05$).

The assessment of day-night BP changes is the only practical way how to find out the day-night rhythm of BP. The prevalence of non-dippers was somewhat higher in the children with type 1 diabetes

(54.5%) than in obese children (48.1%) but without statistical significance ($p>0.05$).

The statistically significant correlation at the 0.01 level between BP and some anthropometric data was found and it is shown in Figure 1.

Bivariate correlation coefficients showed that the most significant relationship was between the office SBP and the children's weight and height, the office DBP and age. The daytime SBP correlated best with the office SBP and weight and the daytime DBP with the daytime SBP, the office SBP and DBP.

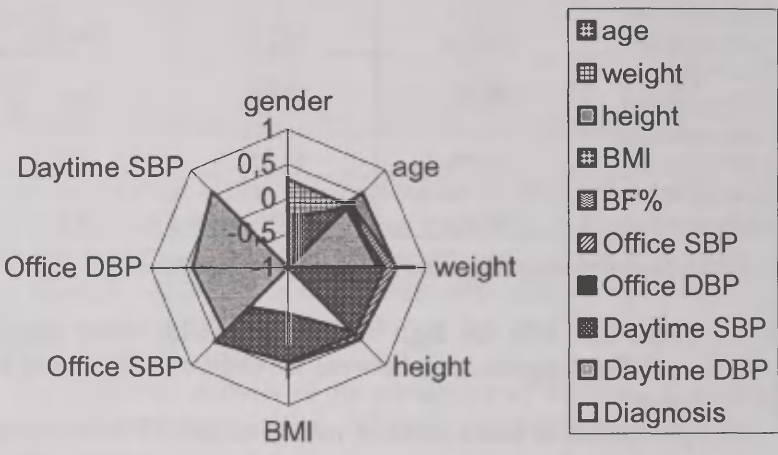

Figure 1. Correlation between antropometric data and blood pressure variables

DISCUSSION

Hypertension has been known to be associated with obesity and type 1 diabetes. In the past decade, there has been an explosive growth of ambulatory blood pressure monitoring for research and clinical purpose. Several studies have been published about the use of the ABPM in children [3; 11; 12].

The aim of the study is to illustrate the characteristics of blood pressure in children with obesity and type 1 diabetes. In the investigated obese children the mean office BP was significantly higher than in those with diabetes, although obese children were younger. The mean systolic and diastolic blood pressure values obtained by ABPM were lower than the office BP values. The prevalence of the office systolic hypertension before the ABPM study was found in 85.2% of obese and 43.2% of diabetic children. These data were in concordance with the literature where in more than 80% of obese adolescents elevated systolic and/or diastolic BP were found [7]. The prevalence of systolic /diastolic hypertension by ABPM was considerably lower than the office SH/DH. The difference in office systolic hypertension prevalence between obese and diabetes children retained after ABPM and was for the daytime systolic hypertension 2.5 times higher in obese children than in children with diabetes ($p<0.05$). More than half of the children with obesity and one third with diabetes had systolic whitecoat hypertension. Diastolic white-coat hypertension was significantly higher in obese children (37.0%) than in diabetics (15.9%). A new characteristic of hypertension – masked hypertension was studied and found in 2.3% of children with type 1 diabetes. Masked hypertension has been found in adults in 14.2% by ABPM [12]. The high blood pressure variability was found almost in half of the studied children. Statistical difference in the high BP variability was found in obese children for the nighttime SBP (63.0%) comparing it with diabetic children (37.2%). The systolic BP load was significantly higher in the children with obesity comparing with the children with diabetes. The study demonstrated that many diabetics patients lost their normal nocturnal drop in BP (54.5%) as did the obese children (48.1%). These data are not in conflict with the data presented in literature.[4;6].

The limitation of the study was caused by a limited number of persons, only one ABPM session and the absence of the analysis of ABPM data considering the complications in diabetic children. The correlation between ABPM results and other markers of hypertensive end-organ damage, such as the developement of rethinopathy and microalbuminuria, still need to be studied in children [6].

Conclusion. ABPM is a useful technique that can potentially overcome many shortcomings of using casual BP data in evaluating hypertension in the children with known cardiovascular risk factors. A further study is needed with respect to pediatric ABPM standards and correlation outcomes. Widespread adoption of this technique should be encouraged.

REFERENCES

1. Flynn JT. Application of ambulatory blood pressure monitoring to the evaluation of hypertensive children (2000). Current Concepts in Hypertension, 4, 2,1–6.
2. Gulati S (2006) Childhood Hypertension 43, April 17,326–333.
3. Khan I. A., Gajara M., Stephens D., Balfe J. W. (2000) Ambulatory blood pressure monitoring in children: a large center's experience. Pediatric Nephrology, 14,802–805.
4. Luma GB, Spiotta RT (2006) Hypertension in Children and Adolescents,73, 9,1–11.
5. Muntner P; Jiang He, Cutler, JA ;. Wildman, RP ; Whelton PK. (2004) Trends in Blood Pressure Among Children and Adolescents. The Journal of the American Medical Association, 291,2107–2113.
6. Pierdomenico S. D., Lapenna D., Bucci A., Manenet B. M., Mancini M., Cuccurullo F., Mezeti A. (2005) Blood pressure variability and prognosis in uncomplicated mild hypertension. American Heart Journal 149,5, 934–938.
7. Rocchini A. P. (2000) Adolescent obesity and hypertension. Current Concepts in Hypertension,4, 2,5–6.
8. Soergel M, Kircshstein M, Busch C, Danne T, Gellerman J, Holl R., et al (1997) Oscillometric twenty-four-hour ambulatory blood pressure values in healthy children and adolescents: A multicenter trial including 1141 subjects. The Journal of Pediatrics, 130(2),178–184.
9. Sowers JR (1999) Diabetes and hypertension. Current Concepts in Hypertension 3,4,3–4.
10. Stergiou G. S., Salgami EV, Tzamouranis DG, Roussias LG. (2005) Masked hypertension assessed by ambulatory blood pressure versus home blood pressure monitoring: is it the same phenomenon. American Journal of Hypertension, 18, 6,772–778.
11. Suurorg L. (2002) Ambulatory blood pressure monitoring in adolescents. Papers on Anthropology XI, Tartu, 289–296.
12. Suurorg L. (2003) Ambulatoorne vererõhu monitooring pediaatrias. Eesti Arst 82,1,10–15.
13. Tur, I., Suurorg L., Tomberg E., Kasuri K. (2004) Tallinna 9. klassi kooliõpilaste tervise ja käitumise uuring. Tallinn, 33.
14. Update on the 1987 Task Force Report on High Blood Pressure in Children and Adolescents: A Working Group report from the National High Blood Pressure Education Program (1996). Pediatrics 98,4, 649–658.

Abbreviations

ABP–ambulatory blood pressure
BP –blood pressure
ABPM– ambulatory blood pressure monitoring
SH/DH–systolic /diastolic hypertension
SWCH/ DWCH–systolic / diastolic white-coat hypertension
BF%–body fat percentage
BMI– body mass index
SD–standard deviation
PP–pulse pressure

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SOMATIC ASYMMETRY OF SCHOOLCHILDREN AGED 14 YEARS

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ABSTRACT

The aim of this study was to determine the degree of somatic left/right asymmetry in schoolchildren. A group of 28 boys and 17 girls, aged 14 years, were studied. Elbow, wrist and knee widths, palm length, and circumferences of arm, forearm, thigh and calf in contracted and relaxed states were measured on the right (R) and left (L) sides. Relative asymmetry was defined by the formula 100 × (L–P)/P.

Boys did not differ significantly from girls with respect to body height or mass. Significant left-sided asymmetry was found for palm length in boys and girls, for elbow width in girls and for calf circumference (relaxed state) in girls, and the right-sided one – for forearm circumference (contracted state) in boys and girls. Mean asymmetry was below 2% in every case. The circumferences in contracted state correlated highly with those in the relaxed state with the exception of forearm – in boys the correlation was relatively low and in girls non-significant. It was concluded that somatic asymmetry was rather weakly expressed due to the young age of boys and girls studied.

Key words: somatic asymmetry, anthropometric measurements, schoolchildren

INTRODUCTION

Three kinds of asymmetry are widely known: morphological, functional and dynamic. Morphological asymmetry pertains to the left/right differences in the size and/or shape of body parts, functional asymmetry is associated with the domination of one brain hemisphere (usually left) and is reflected by manipulatory movements of one hand (usually right), and dynamic asymmetry pertains to left/right differences in the ranges of movement, muscle strength, solidity and elasticity.

The degree of morphological asymmetry depends primarily on genetic factors but the environmental ones also play some role, mainly through locomotor functions, workloads and nutrition. The effects of mechanical (i.e. environmental) factors are reflected by greater lengths and girths of the dominating hand [7, 13] and of the left leg, irrespectively of domination [2, 5], the latter being due to supporting body weight by the left leg by most people. That asymmetry is not congenital but develops gradually [9], which additionally indicates the impact of environmental factors. Moreover, the asymmetry of extremities was reported to be much higher in adults [7] than in children; in those aged 7 – 9 years no left/right differences were observed [6]. Those facts prompted us to determine the degree of asymmetry in schoolchildren.

MATERIAL AND METHODS

A group of 28 schoolboys and 17 schoolgirls, aged 14 years, volunteered to participate in the study. Standard anthropological procedures were used in measuring palm length, knee, elbow and wrist widths, and circumferences of lower leg, thigh, arm and forearm in contracted and relaxed states. Relative asymmetry (A) was defined by the formula: $A = 100 \cdot \frac{L-P}{P}$, where L and P are the measurements of the given body part for the left and the right side, respectively.

The data were subjected to two-way ANOVA (measurements × gender) with *post-hoc* t-test. The relations between various measurements were expressed as Pearson's correlation coefficients. Chi-square function was used to analyse the frequencies of left/right-handedness. The level of $p \leq 0.05$ was considered significant.

RESULTS AND DISCUSSION

Mean values (±SD) of anthropometric variables recorded in male and female schoolchildren are presented in Table 1.

No significant differences were found between boys and girls, regarding body height or mass; therefore between-gender differences in other measurements would not be body height-related. As compared with boys, girls had significantly lower elbow and wrist widths and forearm circumference in contracted state (Table 1). Other authors [8, 11, 12] have reported, however, that men exhibit greater asymmetry than women in upper extremities due to greater transversal dimensions induced by higher physical loads they are subjected to.

Mean relative left/right asymmetry, i.e. differences related to the right side values, is presented in Fig. 1. Significant left-sided asymmetry was found for palm length in boys and girls, for elbow width in girls and for calf circumference (relaxed state) in girls, and right-sided one – for forearm circumference (contracted state) in boys and girls. Mean asymmetry was below 2% in every case.

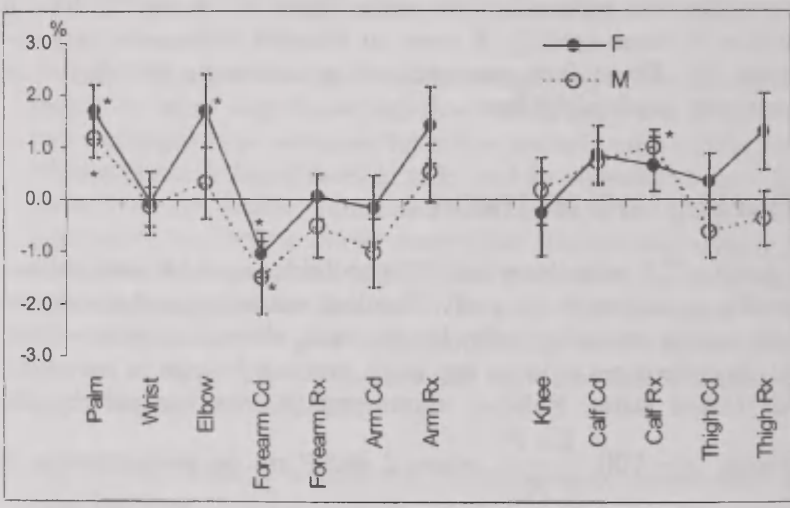

Fig. 1. Mean (±SE) relative asymmetry in anthropometric variables in male (M; n = 28) and female (F; n = 17) schoolchildren aged 14 years. Positive asymmetry means that values for the left side are greater than for the right side.

Legend: Cd – Contracted; Rx – Relaxed; * Significant asymmetry ($p<0.05$)

Table 1. Mean values (±SD) of anthropometric variables recorded in male (M) and female (F) schoolchildren aged 14 years

Variable	M (n = 28)		F (n = 17)	
	R	L	R	L
Body height (cm)	157.9 ± 9.7		158.1 ± 5.0	
Body mass (kg)	45.5 ± 7.8		46.9 ± 7.7	
Palm length (mm)	173.1 ± 11.1	175.0 ± 10.3**	167.3 ± 7.0$^{(o)}$	170.1 ± 6.5**
Knee width (mm)	104.8 ± 8.2	105.0 ± 9.6	104.9 ± 8.3	104.5 ± 7.2
Elbow width (mm)	82.0 ± 7.2	82.2 ± 6.5	78.3 ± 4.4$^{(o)}$	79.6 ± 4.3*
Wrist width (mm)	55.8 ± 4.0	55.7 ± 3.7	52.4 ± 2.7^{oo}	52.4 ± 2.4^{oo}
Circumferences (mm)				
Thigh, Cd	463.0 ± 47.6	460.0 ± 47.4	471.6 ± 28.9	473.2 ± 30.2
Thigh, Rx	459.0 ± 47.2	457.1 ± 46.3	465.8 ± 31.0	471.6 ± 30.6
Calf, Cd	330.6 ± 28.7	332.9 ± 28.9	332.4 ± 21.8	335.0 ± 20.4
Calf, Rx	329.2 ± 29.5	332.3 ± 28.3*	331.7 ± 22.0	333.8 ± 21.5
Arm, Cd	248.8 ± 25.5	246.4 ± 27.7	240.4 ± 20.7	239.9 ± 20.4
Arm, Rx	228.3 ± 25.8	229.5 ± 28.1	224.5 ± 21.5	227.4 ± 19.2
Forearm, Cd	232.7 ± 18.3	229.0 ± 16.3*	221.9 ± 12.6^{o}	219.5 ± 12.1*^{o}
Forearm, Rx	224.6 ± 18.2	223.1 ± 15.6	216.6 ± 13.3	216.6 ± 12.6

Legend: R – Right; L – Left; Cd – Contracted; Rx – Relaxed
Significantly different from the right side by Student's t-test for paired values: * $p<0.05$; ** $p<0.01$; significantly different from the respective value in boys by Student's t-test for independent data: $^{(o)}$ $p = 0.06$; ^{o} $p<0.05$; ^{oo} $p<0.01$

It has been presumed that human beings exhibit crossed symmetry, i.e. in right-handed subjects the right hand and the left leg are better developed than the contralateral extremities and *vice versa* in left-handed ones [12]. Thus, greater circumferences of the right hand [13] and of the left leg [2,5] were reported compared with the respective contralateral extremities. In contrast, Moreno *et al.* [6] have reported greater circumferences of the left than of the right arm in children aged 7–9 years. In the early school age no asymmetry is to be expected; it develops with age, most likely due to greater physical loads experienced by the dominating extremity [4, 6, 14].

Upper extremities are expected to show greater asymmetry than lower ones for the former are more unevenly loaded than the latter [1, 3], but the results of this study are not so unequivocal, maybe because of the young age of our subjects.

The relationships between asymmetries of circumferences of upper and lower extremities in the contracted and relaxed states are shown in Fig. 2 and the corresponding correlation coefficients in Tables 2 and 3. Those tables also contain other relevant correlations.

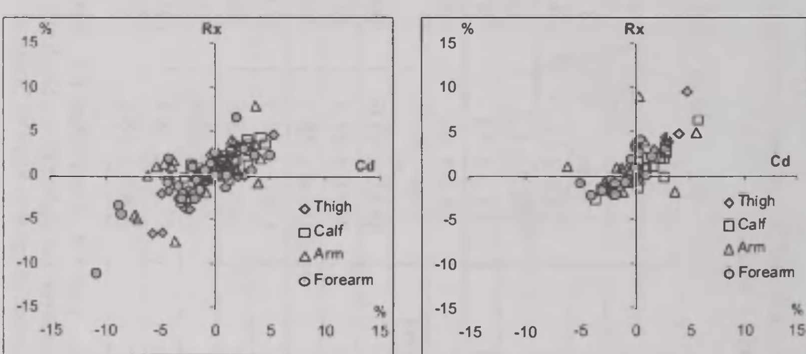

Fig. 2. Relationships between relative asymmetries of circumferences of upper and lower extremities in the contracted (Cd) and relaxed (Rx) states in boys (n = 28; left) and girls (n = 17); right) aged 14 years

Circumferences, measured in contracted and relaxed states, were highly correlated for the thigh and calf, somewhat lower for the arm. The correlation for the forearm was low and in girls non-significant (see Tables 2 and 3). As for other correlations, only that between arm circumference (contracted) and elbow width was significant but weak in boys.

Table 2. Pearson's coefficients of correlation between selected asymmetry variables recorded in boys aged 14 years (n = 28)

Correlated variables	Knee	Wrist	Elbow	Calf Cd	Thigh Cd	Arm Cd	Forearm Cd
Calf Cd	0.030						
Calf Rx	–0.094			0.820*			
Thigh Cd	0.121						
Thigh Rx	0.108				0.856*		
Arm Cd			0.393*	0.211	0.166		
Arm Rx			0.275			0.590*	
Forearm Cd		–0.217	0.004	0.160	0.011	0.061	
Forearm Rx		–0.098	0.033				0.772*

Legend: Cd – Contracted; Rx – Relaxed; * p<0.05

Table 3. Pearson's coefficients of correlation between selected asymmetry variables recorded in girls aged 14 years (n = 17)

Correlated variables	Knee	Wrist	Elbow	Calf Cd	Thigh Cd	Arm Cd	Forearm Cd
Calf Cd	–0.139						
Calf Rx	–0.153			0.898*			
Thigh Cd	0.059			0.218			
Thigh Rx	0.004				0.943*		
Arm Cd			–0.058	–0.189	0.327		
Arm Rx			0.191			0.350	
Forearm Cd		0.263	0.213	0.383	0.436	0.019	
Forearm Rx		–0.166	0.080				0.720*

Legend: Cd – Contracted; Rx – Relaxed; * p<0.05

Summing up, the left/right asymmetries in extremity measurements were rather small and no clear side domination was found, probably due to the young age of subjects.

REFERENCES

1. Auerbach B. M., Ruff C. B. (2006) Limb bone bilateral asymmetry: variability and commonality among modern humans. J. Hum. Evolution, 50, 203–218.

2. Chhibber S. R., Singh I. (1970) Asymmetry in muscle weight and one-sided dominance in the human lower limbs. J. Anat., 106, 553–556.
3. Čuk T., Leben-Seljak P., Štefančič M. (2001) Lateral asymmetry of human long bones. Variability Evol., 9, 19–32.
4. Little B. B., Buschang P. H., Malina R. M. (2002) Anthropometric asymmetry in chronically undernourished children from Southern Mexico. Ann. Hum. Biol., 29(5), 526–537.
5. Macho G. A. (1991) Anthropological evaluation of left-right differences in the femur of southern African populations. Anthropol. Anz., 49(3), 206–216.
6. Moreno L. A., Rodriguez G., Guillen J., Rabanaque M. J., Leon J. F., Arino A. (2002) Anthropometric measurements in both sides of the body in the assessment of nutritional status in prepubertal children. Eur. J. Clin. Nutr., 56(12), 1208–1215.
7. Neumann S. (1992) Handedness in comparison with the asymmetry of the upper extremities. Z. Morphol. Anthropol., 79(2), 183–195.
8. Parker D. F., Round J. M., Sacco P., Jones D. A. (1990) A cross-sectional survey of upper and lower-limb strength in boys and girls during childhood and adolescence. Ann. Hum. Biol., 17, 199–211.
9. Peters M. (1988) Footedness: asymmetries in foot preference and skill and neuropsychological assessment of food movement. Psychol. Bull., 103, 179–192.
10. Plochocki J. H (2004) Bilateral variation In limb articular surface dimensions. Am. J. Hum. Biol., 16, 328–333.
11. Round J. M., Jones D. A., Honour J. W., Nevill A. M. (1999) Hormonal factors in the development of differences in strength between boys and girls during adolescence: a longitudinal study. Ann. Hum. Biol., 26, 49–62.
12. Ruff C. B., Jones H. H. (1981) Bilateral asymmetry in cortical bone of the humerus and tibia-sex and age factors. Hum. Biol., 53, 69–86.
13. Schell L. M., Johnston F. E., Smith D. R., Paolone A. M. (1985) Directional asymmetry of body dimensions among white adolescents. Am. J. Phys. Anthropol., 67, 317--322.
14. Steele J., Mays S. (1995) Handedness and directional asymmetry in the long bones of the human upper limb. Int. J. Osteoarchaeol., 5, 39–49.

The paper is based on the BSc thesis in physical education presented by Mr D. Kokoszko at Pawel Włodkowic University College, Plock

Papers on Anthropology XIV, 2006, pp. 243–256

PROFESSOR OF NEUROSURGERY LUDVIG PUUSEPP

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INTRODUCTION

The article, devoted to Ludvig Puusepp's 130th birth anniversary, is not meant as an in-depth account of his achievements in neurosurgery but as at attempt to introduce him to the reader as a versatile scientist whose aim was to help people.

THE FORMATIVE YEARS

Ludvig Puusepp was born in Kiev on 3 December 1875 (21 November 1875 Old Style). His paternal ancestors had lived in Estonia – grandfather Karl had lived and gone to school in Tallinn. His son Martin Puusepp, a shoemaker, lived in Rakvere. From there, he migrated to St. Petersburg and later moved on to Kiev. In Kiev Martin Puusepp met his future wife Victoria-Stephania Goebel, a nanny of Polish-Czech origin. The family had seven children; two of them died before Ludvig was born. Ludvig's brother Eduard became a professor of mathematics, sister Karoline – an engineer, sister Maria – a doctor, and brother Alexander committed suicide.

The education of somewhat capricious Ludvig began as early as at the age of six. He was taught by a student of the local school for medical assistants. The next year, his tutor was one of the second-year pupils of Kiev German school, Reinke, and instruction was given in Russian, German and arithmetic. At the age of eight, L. Puusepp entered the German school and completed its three-year curriculum in two years, although he was the youngest among the pupils. After leaving the German school, he entered the preparatory class

of Kiev 1st Secondary School and thereafter the Secondary School itself. This was a heavy burden for the family. Ludvig tried to be a good student to be exempted from the tuition fee. In the preparatory class already, he started to give lessons and do translations. Supervised by Dr. Troitsky, he translated from Greek into Russian

[15]. He had to support his family financially as his father was in poor health and the siblings needed money for education. The strict regime at school, giving lessons to the children of the rich, humiliation of applying for subsidies often drove the young man to depression and led to suicidal thoughts. He was kept back only by the obligation to help his parents. Having grown up in straitened circumstances, Puusepp felt sympathy for people's sufferings. As he could not find any way out at present, he could only dream about the future. Young Ludvig became increasingly interested in the career of a scientist: he saw the glory of fame and opportunities to help people. At all costs, he attempted to rise higher than those who judged people only according to their financial status. He made great efforts to complete the secondary school with a gold medal. He read a lot – among philosophers, he liked Socrates; as for fiction, he appreciated the books by Nekrasov and Goncharov. On 25 November 1893 L. Puusepp wrote: "Aesthetic pleasure is not a passive feeling. To listen to a symphony means to create. Taste is a real art. The artist can move only what is enclosed in our soul, and to enjoy a work of art means to create it in oneself. How I would like to be skilful in some kind of art, but that is not meant to be" [15]. L. Puusepp had no talent for music, and nothing is known about his achievements in art, but he has written a few poems and kept a diary. There are, however, no talentless people in the world, although sometimes it may be difficult to recognize one's abilities.

Being a secondary school student, L. Puusepp also practised sports; he liked horse riding, cycling and skating. He left secondary school in 1894 with a gold medal and proceeded to St. Petersburg Academy of Military Medicine.

IN ST. PETERSBURG

Ludvig Puusepp began his studies in St. Petersburg on 1 September 1894. New challenges were waiting ahead, but his old companion – poverty – did not leave him in St. Petersburg either. He shared a flat with the Estonian Vahtrik and the Russian Khusarov and had his meals at a charitable canteen at minimum cost. He and Vahtrik attended heavy athletics workouts of Dr. W. E. Krayevsky where his training partners were the famous Estonian wrestlers G. Lurich and A. Aberg. Krayevsky reportedly told Puusepp that even if he turned out to be a bad doctor, he would definitely make a good wrestler [15].

Ludvig did not become a wrestler after all, because of heart impairment caused by overstrain. Later he practised track-and-field athletics and skating. In St. Petersburg he also continued giving lessons. His pupils lived in different parts of the city and Ludvig had to walk almost 10 kilometres daily. As a senior student, he transcribed professors' lectures, which were sold as lithographed copies. Constant strain gave rise to gloomy thoughts in St Petersburg too – on a diary page from 1898 we can find the sentence: "I feel that, but for my unhappy family, I would have long ago settled the accounts with my existence…" [15]. Nonetheless, L. Puusepp found the strength to carry on.

During his studies, his interests changed repeatedly – once he was fascinated by anatomy, then by chemistry and pathology. As a fourth-year student, he decided to become a surgeon. An argument about the treatment of General Ratkin's daughter, which he overheard on 11 December 1898, induced him to choose neurosurgery. L. Puusepp's teacher V. M. Bekhterev was of the opinion that the same person should make the diagnosis and operate.

L. Puusepp became engaged in research as a fourth-year student when he published the article "On the effect of X-rays on the stimulation of the cerebral cortex" in the journal *Vrach* (*Doctor*). In December 1898, his prize essay "Effect of binding and compression of the abdominal aorta on blood circulation in the brain" received a gold medal. These studies were based on animal experiments. In parallel with carrying out experiments in the laboratory, he practised in hospitals. As a fourth-year student, he started working at the Hospital for Mental and Neurological Diseases of St. Petersburg Academy of Military Medicine. He also worked at the surgical hospitals of V. A. Ratimov and N. Kruglevsky, and from 1898 as a teacher at a school affiliated to the Baltic Shipyards and Mechanical Plant where he taught anatomy, zoology, hygiene and physiology. On 13 November 1899, having passed the compulsory final exams in 12 subjects, he received the diploma of a physician. By the resolution of the Conference of the Academy, the names of Puusepp and three fellow graduates – Yurevich, Petrov and Kondratovich – were inscribed on a marble plaque. For his achievements in research, L. Puusepp was awarded the Ivanov Prize.

Having passed a contest, L. Puusepp remained at the Academy to train to become a professor. Initially, his specialized in neuropathology and, after two years of work, chose surgery as a second speciality. His principal supervisor was Academician V. M. Bekhterev.

L. Puusepp continued working at the hospital of St. Petersburg Academy of Military Medicine in neuropathology and at V. A. Ratimov's surgical hospital. As he wanted to become a neurosurgeon, and such a speciality was not taught yet, he had to be trained separately in neuropathology and surgery. For half a year, he had to operate on haemorrhoids, hernia, appendicitis and kidneys before he was trusted to operate on a neurosurgical patient. In his second year of work, he already operated on all the patients with cerebral traumas. To master the operating technique on corpses, he worked at the Chair of Operative Surgery under the supervision of Prof. N. Kruglevsky twice a week. At the end of his 1901 speech he said, "Let's hope that we can meet our teachers' expectations and combine precise diagnosing of neurological diseases with effective methods of the surgical art. We are responsible for the recognition of diseases as well as for their treatment for the benefit of the suffering humanity" [12]. Along with being an actively practising surgeon, L. Puusepp also dealt with experimental problems. Supervised by V. M. Bekhterev, he studied sexual physiology and pathology by means of animal experiments. On 11 May 1902 he defended his doctoral dissertation *Cerebral Centres Governing the Erection of Penis and Ejaculation* at St. Petersburg Academy of Military Medicine. After completing the doctoral dissertation, L. Puusepp worked as an assistant at the Hospital for Neurological Diseases of Women's Medical Institute until the outbreak of the Russian-Japanese War in 1904. In the field of sexual physiology, he published a study on the innervation of the prostate gland (Russkii Vrach, 1902, No. 49), "Effect of the sexual act on cerebral blood supply of the male animal" (Russkii Vrach, 1903, No. 5), "Comparison of masturbating school students' mental work with normal mental work" (Russkii Vrach, 1904, No. 14).

In 1900, the Baltic Shipyards sent L. Puusepp abroad to study light therapy. His journey took him to Vienna, Paris, Berlin, London, Hamburg and Copenhagen. During his trip, he took refresher courses in neurology in Paris under the supervision of neurologists J. J. Déjerine and F. Raymond, and in surgery with surgeons Faure and Mancaire. Having returned, he dealt with light therapy for some time, but at the 9th Pirogov Congress in 1904, along with the presentation "Light therapy of neurological diseases", he also made another presentation "Indications and contraindications to trepanation in epilepsy and idiocy". He also proposed that Pirogov Congresses could hold joint sessions of neuropathologists and surgeons; the proposal was met with approval. Another trip abroad took L. Puusepp to an international medical congress in Madrid.

L. Puusepp was also interested in psychology and participated in the work of the Russian Society for Experimental Psychology, being its secretary from 1901–1906.

IN THE BATTLEFIELD

During the Russian-Japanese War, L. Puusepp was at the front from February 1904 to June 1905. He was the senior physician of the First Red Cross Flying Squad (2 doctors, 4 students, 1 medical assistant, 14 orderlies and 1 guard). Under hostile fire, he had to give medical aid to up to 600 wounded. There was no time for asepsis or antisepsis; transport was difficult to get, and the stupidity of officials was annoying. The Russian army was mostly retreating, and the severely wounded were left with the enemy. In 1906 he wrote: "The moans of the wounded sounded to us like lashes to a tired horse… Tiredness disappeared and even the earlier sleepless nights that had been spent working were forgotten. After evacuation we fell into deep sleep like the dead, on the same floor where before us the wounded had lain and moaned in torture." [15] L. Puusepp tried to do his best to improve the situation but had to fight numb bureaucracy. Sometimes only disobedience in service saved him from repressions. People had turned into animals. Some doctors considering suicide; others were crying like children. L. Puusepp wrote: "And this happened in the 20th century, in the heyday of science and art. No! Hypocritical old hag Europe – your civilization is bought at a dear price! Damned war! Those who unleashed it, be damned!" [13]

He tried to do everything within his power. He devised a method for transporting three wounded on one cart, which became widely used. During the last battles of Mukden he had a concussion, which turned the doctor into a patient. L. Puusepp was awarded a medal for service in the Russian-Japanese War; he also received a medal from the Russian Red Cross.

IN THE OPERATING ROOM AGAIN

After the war, L. Puusepp generalized the experience gained in the war. He was considered an expert and was elected a special reviewer of dissertations in field surgery. He took up a post at the Hospital for Neurological Diseases at Women's Medical Institute again. He could practise neurosurgery under V. M. Bekhterev at the Hospital for Mental and Neurological Diseases at St. Petersburg Academy of Military Medicine, which had a specialized unit for 20 patients and an operating room. He also assisted V. M. Bekhterev in neuropathology. In 1906 V. M. Bekhterev allowed Puusepp to lecture as a *privatdozent* at the Chair of Neurological and Mental Diseases of the Institute of Psychoneurology. L. Puusepp's request to be allowed to deliver lectures on neurosurgery at the Academy of Military Medicine was turned down by the Conference of the Academy. The Council of the Institute of Psychoneurology, however, influenced by Academician V. M. Bekhterev, adopted a resolution on 4 September 1907 to open a Chair of Neurosurgery with a hospital. Practical work began on 3 February 1908, when the Institute gave L. Puusepp a hospital with 25 beds [14]. The Institute of Psychoneurology was a private educational institution with V. M. Bekhterev as its president. It taught pedagogy, criminalistics, psychology and medicine. The Department of Medicine taught 18 subjects, including neurosurgery. Thus, the world's first Chair of Neurosurgery and neurosurgical hospital had been created, with L. Puusepp at their head. In 1910, the Institute of Psychoneurology elected L. Puusepp Professor of Surgical Neuropathology and he became the first professor of neurosurgery in the world.

He could now concentrate on clinical research; along with neurosurgery, he dealt with pathological anatomy, experimental pathology and psychiatry. He published nearly a hundred research papers and several textbooks. The best-known are "On the importance of injecting alcohol in the case of trigeminal neuralgia" (1909), "On surgical treatment of spinal cord tumours" (1910), "On surgical treatment of hydrocephalus" (1911), "Removal of *Ganglion Gasseri* in trigeminal neuralgia" (1911), and "Physiological enucleation of cerebral tumours" (1913). He summarized his research and experience in his original work *Foundations of Surgical Neuropathology* (first volume 1917). In his practical work, L. Puusepp was a researcher and experimenter with growing international fame. He became a correspondent and member of editorial boards of several internationally renowned journals (*Folia Neuro-Chirurgica*, *Rivista di Patologia Nervosa e Mentale*, *Obozrenie psikhiatrii i nevrologii*).

In addition to academic journals, he also published articles in newspapers to educate people.

L. Puusepp's great organizational achievement was the new building for the N. I. Pirogov Neurosurgical Hospital of the Institute of Psychoneurology. When treating Countess Bobrinskaya, he made acquaintance of Princess Pashkevich who was engaged charity. The cornerstone to the hospital was laid on 14 September 1912, and the building was completed in 1913. L. Puusepp was also an excellent lecturer. As early as in his student days, he delivered lectures at the Baltic Shipyards and Mechanical Plant, later at the Workers Society for Self-Development; under the auspices of the Russian Society for Normal and Pathological Psychology, he was the chairman of the board of popular scientific lectures. Several times, L. Puusepp spoke on the harmfulness of tobacco and alcohol. In 1910 N. Pirogov Society of Surgeons organized popular scientific lectures for the citizens of St. Petersburg with L. Puusepp as one of the lecturers again. He lectured at refresher courses for doctors and university lecturers. L. Puusepp was a member of a number of societies: N. I. Pirogov Society of Russian Surgeons, Association of Psychiatrists and Neuropathologists, Russian Society for Normal and Pathological Psychology, St. Petersburg Society of Russian Hospital Physicians, Russian Society for Public Health, St. Petersburg Institute of Archaeology, Russian National Automobile Association. Sponsored by societies and institutions, he participated in several international conferences.

On 28 September 1906, L. Puusepp married Maria Kocubei. One of his numerous congratulators was I. P. Pavlov [15].

In 1909 he travelled to the United States to acquaint himself with the organization of women's medical education. He visited hospitals and schools in several cities, attended outpatient clinics and watched operations. As a conclusion of his trip, he wrote, "A woman is capable of leading a large institution and working for it zealously no worse than a man" (Russkii Vrach, 1909, No. 29).

During his St. Petersburg period, L. Puusepp held a number of posts. As a practising doctor, he worked at the Hospital for Mental and Neurological Diseases of St. Petersburg Academy of Military Medicine (1904–1914). As a lecturer, consultant and practising doctor he also worked at the Baltic Shipyards and Mechanical Plant (1898–1912) and the industrial school affiliated to it (1901–1904), French Hospital of St. Mary Magdalene (1907–1911), Institute of Psychoneurology (1907–1920), Institute of Orthopaedics (1908–1917), N. I. Pirogov Hospital of Neurosurgery (1914–1917). He was assistant director of the Experimental Institute for Alcohol Research (1908–

1914) and consultant to St. Trinity Sisters' Society (1911–1917). To achieve full recognition as a neurosurgeon, he needed more than ten years of strenuous work as a researcher, doctor and organizer. One of his most important helpers was his teacher and friend V. M. Bekhterev.

THE TURBULENT YEARS OF WORLD WAR I AND THE OCTOBER REVOLUTION

The mobilization order arrived on 18 July 1914, and L. Puusepp had to join the bandaging unit. His work at the front ended with a concussion again, namely of the right knee joint, which he got near the village of Ratsk.

Having returned to St. Petersburg, L. Puusepp made a proposal in 1915 to name the Neurosurgical Hospital of the Institute of Psychoneurology, which was completed in 1913, in honour of his role model N. I. Pirogov. The hospital was called Petrograd N. I. Pirogov Military Hospital, and L. Puusepp was appointed its director. By the end of the war, the hospital had 900 patients and more than 200 staff.

L. Puusepp worked as the chief doctor of Petrograd N. I. Pirogov Military Hospital until 1918. After the Great October Revolution he was elected vice-president of the Institute of Psychoneurology. In 1920 the Medical Faculty of the Institute of Psychoneurology was reorganized into the State Institute of Medical Sciences, and L. Puusepp became its director. From 1919 he also worked as a consultant neurologist for the People's Commissariat of Social Welfare and a member of the medical examination board of injured military personnel. In 1917 he published the research paper "Nervous system and war" where he dealt with surgery of the nervous system and options of conservative treatment, paying great attention to military psychiatry. In 1916, to sum up his war experience, he published the paper "Traumatic war neurosis".

COMING TO ESTONIA

As working as a Soviet scientist had become dangerous to life and, according to the peace treaty concluded between Soviet Russia and the Republic of Estonia in 1920, Estonians residing in Russia were allowed to repatriate to Estonia, L. Puusepp also decided to settle in

Estonia. On 24 July 1920, he sent the Estonian embassy in Moscow an application where he expressed his wish to start working for the University of Tartu. He enclosed a letter with his requirements for the post and his CV. The embassy sent an enquiry to the rector of the University of Tartu on 5 August 1920. L. Puusepp was granted the citizenship of the Republic of Estonia on 6 August 1920.

Initially, L. Puusepp worked at Tallinn 1st Military Hospital as a consultant on neurology. On 2 December 1920, however, he took up the post of Professor of Neurology at the University of Tartu. A few months later, he was also appointed Medical Major General and consultant to the Estonian army [6].

On 10 February 1929, his wife Maria died of pulmonary tuberculosis. In the same year, he married Maria Küppar, who had been his patient, and on 2 February 1932 their daughter Liivia was born, who later also became a doctor at the neurological hospital.

Neurological diseases were then taught at the University of Tartu within the course of psychiatry, and patients were treated either at the psychiatric or the therapeutic hospital. Neurosurgical treatment was limited to skull trepanations, removal of bone splinters in the case of traumas, and other minor operations. L. Puusepp set out to reorganize the Neurological Hospital of the University of Tartu. He was given rooms in the building of Tartu Clinical Hospital; there was an operation block and rooms for the laboratory, later also an X-ray room. The first patients were admitted on 18 January 1921, and the first brain operation was performed by L. Puusepp on 9 April 1921. At the beginning, there were 45 beds, a year later, however, 75. Tartu Neurological Hospital was the only centre of neurosurgical aid in the Baltic States. The hospital also got a histology laboratory.

In 1923 the Society of Estonian Neurologists was founded, and L. Puusepp was its chairman to the end of his life.

The fame of L. Puusepp as a neurosurgeon spread, and patients from foreign countries came to be operated by him. He made several innovations in operation methods. In 1926 he devised an original method for surgical treatment of the brain cavity. Another original method, physiological enucleation of brain tumours had been adopted by him as early as 1913. Puusepp's reflex (1923) also became widely known [2, 15]. It manifested itself in patients with epidemic encephalitis and consisted in abduction of the little toe on stimulating the external part of the sole of the foot with the neurological hammer. L. Puusepp also had ample experience in surgical treatment of epilepsy. He was among the pioneers of surgical treatment of compression syndromes caused by protrusions of intervertebral discs. The description of his first successful operation of this kind was published in 1933 (*Chirurgische Neuropathologie*, B. II: 419–420). Colleagues from many foreign countries came to work with L. Puusepp and learn from his experience.

L. Puusepp wrote his most significant works in Tartu: in 1929 *Die Tumoren des Gehirns* (*Brain Tumours*), which he devoted to this teacher V. M. Bekhterev who was killed by order of Stalin 1927 [7], and in 1932–1939 two and a half volumes (1400 pages) of *Die chirurgische Neuropathologie* (*Surgical Neuropathology*); the last volumes remained unfinished. L. Puusepp's last major work was *Peaaju, tema töö ja tervishoid* (*Brain, Its Functions and Hygiene*, 1941), his last published paper, however, was "*Septum pellicidum*'i arenguanomaaliad ja haigestumised" ("Development Anomalies and Diseases of *Septum pellicidum*").

In the field of mental hygiene, he recommended not to overburden children; he was also against top-level sports and criticized severely the activity of the press during an influenza epidemic. He also dealt with the problems of mentally retarded children and proposed to found a special school for children with learning difficulties.

POPULARIZER OF SCIENCE

L. Puusepp as a famous scientist was often invited to many countries to deliver lectures or present demonstrations and reports. Besides the Baltic countries he repeatedly visited Poland, Czechoslovakia, Italy, Romania, Belgium, Germany, Hungary, Finland, Sweden, Yugoslavia, Switzerland, Spain, Portugal and Bulgaria, and even travelled to the United States, Palestine and Egypt. During his travels, he did not forget his students – many of them could continue their studies abroad namely thanks to the contacts of L. Puusepp. He shared his travel impressions in the press as well as with his colleagues in the hospital.

L. Puusepp was widely known for his popular scientific lectures. Besides his own speciality, he lectured on hypnosis, heredity, sexual problems and parapsychology. He was one of the founders of the journal *Eesti Arst* (*Estonian Doctor*). From 1923, the neurological journal *Folia Neuropathologica Estoniana* was published in Tartu. The journal enabled Estonian scientists to present their works abroad and published articles by most internationally renowned neuropathologists from Europe and America. L. Puusepp was also an active contributor to several foreign journals.

L. Puusepp was an active anti-alcohol campaigner. He was responsible for medical activities in the Estonian Temperance Society. In 1936, initiated by him as a committee member of the Estonian Chamber of Doctors, an anti-drug board was founded; the journal *Questiones Alcogolismi et Narcomaniac* was published. In 1934, L. Puusepp founded the Estonian Anti-Cancer Society. The energetic professor also found time to deal with problems of rejuvenation and suicide. He can be considered an ardent propagator of occupational treatment. He was the chairman of the Estonian Psychotechnology Association and one of the initiators of founding the vocational guidance bureau. He was also interested in eugenics, was a member of Tartu Naturalists Society (1926) and Estonian Association of Friends of Culture (1935). In 1922 L. Puusepp was elected honorary doctor of Padua University, in 1929 honorary doctor of Vilnius University; he was also an honorary member of several foreign academies of science and societies.

Many organizations tried to benefit from L. Puusepp's fame and extensive contacts, and used his help to promote their activities. Many organizations asked for public lectures, the revenues from which they could keep for themselves.

L. Puusepp was also a promoter of international cooperation. Greatly thanks to him, the French Institute was founded in Tartu in 1922 [23, 24]; he was its president until 1930. Twice a year, young doctors were sent to France for six months; French classes were given. The Institute's French library was the second in size in Europe outside France; four or five times a year French scientists visited the Institute. In 1930, L. Puusepp laid the foundation to the American Estonian Committee with the aim to develop scientific and cultural contacts between the two countries. He also reached an agreement on Rockefeller stipends for his students [3]. L. Puusepp was the chairman of the Estonian-Belgian Friendship Society from its foundation. He contributed greatly to the development of cultural contacts between the Baltic States. He was also active in the Society of Mental Cooperation between Scandinavia and the Baltic States and a permanent delegate to the International Society of Mental Cooperation. L. Puusepp had close contacts with scientists of the Soviet Union. It was on Puusepp's initiative that the University of Tartu elected I. P. Pavlov its honorary doctor.

TO SUM UP

E. Raudam and I. Soomere, using W. Ostwald's classification, have placed L. Puusepp among romantic scientists who are enthusiastic, full of ideas and open to everything new [15]. In his everyday life, he did not like to do the same things over a long time; in St. Petersburg he is said to have moved house ten times. L. Puusepp had a wonderful memory; at lectures he spoke without notes and, if necessary, drew diagrams of great precision. He liked to illustrate his lectures with slides, patient demonstrations or films. L. Puusepp was a talented speaker and writer. L. Puusepp was the first to get the title of a merited scientist and a lifelong pension. He was among the first twelve members of the Estonian Academy of Sciences (1938). His activities were spurred on by constant ambition; he never wanted to be a loser. Still, on 19 October 1942 he had to surrender to cancer. Although his glorious personality faded, great recognition remained after his death.

We are different branches of the same tree grown from the stony ground of Estonia, and this article dedicated to Ludvig Puusepp's birth anniversary was written in remembrance of one of the most brilliant members of this kin.

REFERENCES

1. Heinsoo, E. (1971) Ludvig Puusepp neuroröntgenoloogia arendajana. Nõukogude Eesti Tervishoid, 4, 290–295.
2. Kaasik, A.-E. (2000) A former medical journal. Comments on the Folia Neuropathologica Estoniana (1923–1939). In: Ludvig Puusepp 125. Ed. by Ü. Linnamägi. Tartu-Tallinn: Estonian Academy Publishers, 22–30.
3. Kalling, K. (2000) Professor Ludvig Puusepp and the Rockefeller Foundation. In: Ludvig Puusepp 125. Ed. by Ü. Linnamägi. Tartu-Tallinn: Estonian Academy Publishers, 44–53.
4. Kalnin, V., Raudam, E. (1976) Tartu Riikliku Ülikooli arstiteaduskond 1802–1975. Tartu.
5. Kalnin, V. V., Leonov I. T. (1977) O svazjah Voyenno-Meditsinskoi Akademii i meditsinskogo fakulteta Tartuskogo universiteta. Tartu Ülikooli ajaloo küsimusi VI, 14–24.
6. Käbin, I. (1986) Die medizinische Forschung und Lehre an der Universität Dorpat/Tartu 1802–1940. Ergebnisse und Bedeutung für die

Entwicklung der Medizin. Verlag Nordostdeutsches Kulturwerk, Lüneburg, 421, 424, 478, 479–482, 485–497, 500, 5005, 511

7. Käbin, I. (1998) Ludvig Puusepp – neurokirurgia teerajaja. Eesti ajalugu arsti pilgu läbi. Ilmamaa, 107–116.
8. Linnamägi, Ü. (2000) Ludvig Puusepp 125. Tartu-Tallinn: Estonian Academy Publishers, 62 pp.
9. Luts, L. (1956) Professor Ludvig Puusepp. Nõukogude Naine, 1, 7
10. Mironovich, N. I. Kratkii ocherk razvitiya otechestvennoi neirokhirurgii. M., 1964, p. 35.
11. Perk, J. (1931) Die chirurgische Behandlung von Nervenkrankheiten in der Universitäts-Nervenklinik zu Tartu während des letzten Dezennius (9. IV 21– 1. I. 31) In: De laboribus et studiis Clinicae Neurologicae Universitatis Tartuensis per decem annos (1921–1931) susceptis. Mällo. Tartu.
12. Puusepp L. M. (1901) Hirurgia v lechenii nervnykh boleznei. Vrach, 10, 8.
13. Puusepp L. M. (1907) Iz nablyudenii i vpetshatlenii v Russko-Japonskuyu voinu 1904–1905. SPb, p. 15.
14. Puusepp, L. (1939) Zum 30. Jahrestage der Begründung eines Lehrstuhls für Nervenchirurgie am Psycho-Neurologischen Institut zu St. Petersburg. Folia neuropath. Eston., 17, 56–63.
15. Raudam, E., Soomere, I. (1977) Ludvig Puusepp. Tallinn: Valgus.
16. Raudam, E. (1957) 30 aastat syringomyelia kirurgilist ravi Puusepa järgi. Tartu Riikliku Ülikooli toimetised. Neuroloogia-alaseid töid, 3–15.
17. Raudam, E. (1956) Ludvig Puusepp (80. sünni-aastapäevaks). Nõukogude Eesti Tervishoid, 20–26.
18. Raudam, E. (1975) Sada aastat professor Ludvig Puusepa sünnist. Nõukogude Eesti Tervishoid, 18, 467–471.
19. Riives, J. (1943) Ludvig Puusepp neurokirurgina. Eesti Arst 22, 23–28.
20. Talvik, S. (1924) Prof. Dr. Ludvig Puusepp. Eesti Arst, III, 252.
21. Tartu Ülikooli ajalugu, III (1982).
22. Tikk, A. (1979) Ludvig Puusepp seljaajukirurgia arendajana. Tartu Ülikooli ajaloo küsimusi IX. 152–157.
23. Varik, A. (2000) Tartu Prantsuse Teaduslik Instituut 1922–1941. Akadeemia 7, 1392–1417.
24. Varik, A. (2000) Professor Ludvig Puusepp as a promotor of scientific contacts between Estonia and France. Ludvig Puusepp 125. Ed. by Ü. Linnamägi, Tartu-Tallinn: Estonian Academy Publishers, 54–61.
25. Üprus, V. (1943) Prof. Dr. med. Ludvig Puusepp. Eesti Arst, 22, pp. 1–22.

Papers on Anthropology XV, 2006, pp. 257–270

SECULAR CHANGES OF THE SKINFOLD MEASUREMENTS AND THE BMI IN HUNGARIAN CHILDREN BASED ON THE KÖRMEND GROWTH STUDY

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ABSTRACT

Determining the Body Mass Index and skinfold measurement are, in the human biological and clinical practice, the most widespread methods for assessing the nutritional status. The Körmend Growth study was launched in 1958 in Hungary by Professor Ottó Eiben. Afterwards, the survey was repeated in regular 10-year intervals. The latest measurement was performed by the author together with professor Eiben in 1998 at Körmend. Out of the Körmend Growth Study results, characteristic secular changes of the BMI and skinfold data in Western Hungary are highlighted in this study.

***Key words*: Körmend Growth Study; Hungary; BMI; Skinfolds; Secular changes**

INTRODUCTION

After the political/social/economic liberalization in 1989/90, poverty increased also in Hungary. Some indicators of the health status, like morbidity and mortality, life expectancy at birth, increased the role of risk factors, crowned with the increased rate of criminality, etc. indicate poor health status of the population. All these are to be considered as unwanted attendant phenomena of a newborn democracy. How do children grow up under those circumstances? Growth studies try to answer these emerging questions, too [4].

As it is usually said nowadays, the secular trend is one of the most attractive human biological phenomena of the twentieth century. The data of such investigations confirm this statement. It really is a world phenomena: long-term systematic changes in a wide variety of human biological traits, in successive generations, living in the same territory. The secular trend has some part-phenomena, those in newborn babies, in growing children, in young adults, and on the population level [2, 3, 5].

The growth and maturation of children is a complex process, influenced by genetic and environmental factors. As a consequence, growth patterns tend to change by time. This also applies to the twentieth century, especially for the second half of it, as the secular growth changes markedly appeared in Hungary, too. The secular trend is a world phenomenon, of long-term, systematic changes in a wide variety of human biological traits, in successive generations, living in the same territory [2]. These changes can be exceedingly traced in the case of the Hungarian town, Körmend, as well.

THE KÖRMEND GROWTH STUDY (KGS)

Dr. Ottó G. Eiben was professor and Head of the Chair at the Department of Anthropology of the Eötvös Loránd University, and after his retirement a fellow of the Churchill College in Cambridge. He is considered to be the most dominant figure in the Hungarian human biology. The principal field of his scientific research activity was the growth and maturation of children and the secular trend. In this aspect, his most significant contribution is the Körmend Growth Study [7]. His favourite lifelong work, was undoubtedly the KGS. The present paper gives an insight into the results of this half-a-century series of investigations, the last measurements of which were performed by the author together with professor Eiben in 1998 at Körmend [14].

The Körmend Growth Study is a chain of repeated cross-sectional growth studies and so it is a suitable tool for studying some aspects of the secular trend as well as the differences between generations [6].

Körmend is a small town in Western Hungary. Professor Eiben carried out the first complete investigation in 1958, and thereafter he repeated his investigations in every tenth year, i.e. in 1968, in 1978, in 1988 and in 1998. His intention was to involve all the healthy, 3–18 year-old boys and girls of the town, i.e. all the pre-school and school children (Table 1). The representation was usually over 95%. The only exception was K-98 in 1998, when several parents, exercising their personality rights, refused cooperation. Therefore, the representation rate in the K-98 was no more than 76%. Apart from K-98, the sample size increased from time to time.

Table 1. Samples of the Körmend Growth Study (KGS)

Year of investigation	Study	Number of children investigated
1958	K-58	1656
1968	K-68	1736
1978	K-78	2420
1988	K-88	2867
1998	K-98	2079

Over this period of half a century, the small settlement developed from an agricultural village into a moderately industrialized town. Its population increased and its infrastructure improved remarkably.

The anthropometric programme of the KGS is an extensive one. Fifteen body measurements and 10 head and face measurements were taken in K-58. In K-68 21 body measurements were taken, while during K-78, K-88 and K-98, on the basis of the same principle, the anthropometric programme consisted of 23 body measurements.

The aim of the KGS was [8] to get knowledge of the body measurements of the Körmend children and to answer the following questions:

(1) Have these body measurements changed over the last five decades? (2) If yes, how and in what direction? (3) Which are the main factors explaining these changes? (4) Do these phenomena observed in Körmend correspond to the general trends, especially the secular growth changes taking place in Hungary?

Professor Eiben has published several papers about the KGS. He has summarized the results of the investigations in a monograph [7].

Comparative tables concerning skinfold values and the Body Mass Index are presented in this paper. It is widely accepted that these two parameters are suitable for assessing the nutritional status [1].

RESULTS

Skinfolds

Measuring skinfolds is based on the fact that one can lift the subcutaneous fat from the muscles; so in this way skin and subcutaneous fat are measurable together. Calculating total body fat [11] is made possible by the evaluation of the skinfold data gained from the measurements taken with the Lange-calliper.

Skinfold measurements started in Hungary not earlier than in the 1960s [15].

The facts quoted below are worth mentioning: (1) The means of skinfold values increase with the age first, then, after puberty, they decrease again in boys. In girls, however, skinfold values continue growing also postpubertally. (2) Most body measurements of boys exceed those of girls. However, skinfold values are often higher in boys than in girls of the corresponding age group. (3) The above statements reveal the fact that the somatic development of boys considerably differs from that of girls. This revelation is also supported by high SD-values.

Skinfold biceps: The means of the skinfold values, measured on the front-side of the upper arm, constantly increased through K-68, K-78, and K-88. In K-98, however, smaller values were measured. Means of boys and girls differ only slightly in early childhood. However, after prepuberty (shall we say, about 10 years of age), remarkable differences can be observed: values of the girls are getting greater: 8–13 mm in girls, while only 4–8 mm in boys (Table 2).

Skinfold triceps: Just like in the case of biceps skinfold: the mean values increase until the K-88, while smaller means could be calculated in K-98. In this case, however, the marked sexual differences can also be observed in early childhood: mean values in boys are 7–11 mm, while in girls 15–18 mm (Table 3).

Skinfold sub-scapula: In early childhood, the girls' mean values do not differ much from those of boys. In puberty, however, the girls' values exceed those of boys. At the age of 18, the mean value of boys is 8–15 mm, that of girls is 13–21 mm. The means in K-98 are usually smaller than in K-88 (Table 4).

Skinfold supra-iliaca: In this region, the girls' mean values are greater than those of boys. In the pubertal phase, however, this difference gets even more pronounced: the boys` mean values are 8–12 mm, while those of girls are 13–20 mm. K-98 means are smaller than those of K-88 also in this regard (Table 5).

Skinfold umbilical: Developing with age, the means get greater and greater in both genders. This parameter represents the marked sexual differences, too: at the age of 18, the boys' mean values are 11–20 mm, while those of girls are is 20–28 mm (Table 6).

Skinfold calf: This parameter gives important information about the body build (see somatotyping). The values of boys and girls seem to differ already in early childhood. This difference increases with age then (Table 7).

Compared with the previous two surveys, the values of all the six skinfolds proved to be smaller in K-98. The low values of skinfolds could possibly be explained by the lack of sufficient physical activity, and not by healthy nutrition and active lifestyle.

Body Mass Index

For a long while, human biology has been endeavoured to create a special calculus allowing an easy assessment of several somatic parameters. In human biological and medical practice the new form of the BMI is widely used [11, 12]. In medical practice, the BMI is frequently used for assessing the body composition, although this parameter is not suitable for that purpose [13]. Doctors usually declare "overweight" when the BMI value is exceeds 25. Over the BMI value of 30, obesity is diagnosed [16].

It is worth having a look at the BMI values of the Körmend boys and girls, too. The BMI means of Körmend youth increase over the four decades of the survey. The only exception is K-98. Then, however, all the body measurements proved to be smaller than earlier. In early childhood, there are no remarkable differences in the BMI-means between boys and girls. After puberty, however, the mean value of the girls' BMI is greater than that of boys. At the age of 18, the boys' BMI = 20–21, that of girls is 20–22 (Table 8).

Table 2. Skinfold biceps in Körmend boys and girls (Means and *SD*, mm)

Age (y)	K-58		K-68		K-78		K-88		K-98	
Boys										
3			5.8	*1.5*	7.4	*2.4*	9.7	*3.1*	5.6	*1.7*
4			5.7	*1.4*	6.8	*2.2*	9.3	*3.6*	5.6	*2.3*
5			5.4	*1.2*	6.8	*2.3*	8.5	*2.6*	5.9	*2.8*
6			5.4	*1.5*	5.9	*2.2*	8.2	*2.6*	5.5	*3.0*
7			4.9	*1.2*	5.2	*2.7*	8.0	*3.4*	6.0	*3.7*
8			5.4	*1.4*	5.3	*2.7*	8.6	*3.8*	7.1	*5.5*
9			5.7	*2.2*	6.3	*2.9*	9.3	*4.6*	6.2	*4.3*
10			4.4	*1.7*	6.4	*3.5*	9.9	*4.5*	7.2	*5.4*
11			4.8	*1.7*	6.8	*4.1*	10.9	*5.0*	10.0	*7.2*
12			4.4	*1.8*	7.0	*4.4*	11.5	*5.4*	8.0	*5.6*
13			4.8	*2.0*	7.0	*4.0*	10.0	*4.9*	7.4	*4.3*
14			4.4	*1.5*	6.4	*3.5*	9.8	*4.5*	8.1	*6.0*
15			3.0	*1.0*	5.5	*2.5*	9.4	*3.8*	5.7	*4.1*
16			4.3	*1.1*	5.3	*2.6*	9.2	*4.2*	4.7	*2.7*
17			4.2	*2.7*	5.1	*2.8*	8.6	*4.2*	6.2	*4.7*
18			3.9	*0.7*	5.2	*2.7*	8.6	*3.5*	4.2	*2.3*
Girls										
3			5.7	*1.7*	7.9	*2.4*	8.6	*2.2*	7.5	*2.9*
4			5.6	*1.4*	7.3	*2.0*	10.3	*2.8*	7.5	*3.1*
5			5.4	*1.2*	7.3	*2.2*	9.6	*2.8*	6.8	*3.1*
6			5.4	*1.5*	7.3	*2.5*	9.9	*3.2*	6.7	*3.3*
7			4.9	*1.2*	6.9	*3.3*	9.2	*3.3*	7.6	*4.0*
8			5.4	*1.4*	6.5	*3.1*	9.9	*3.6*	8.4	*4.8*
9			5.7	*2.2*	7.8	*2.9*	10.6	*4.1*	9.4	*5.0*
10			6.5	*2.1*	7.6	*3.3*	12.1	*4.5*	9.0	*5.8*
11			6.2	*2.5*	8.0	*3.7*	12.6	*4.4*	10.2	*5.0*
12			6.2	*1.9*	9.4	*4.3*	12.2	*5.6*	9.1	*4.6*
13			6.9	*2.3*	8.5	*3.8*	12.6	*4.7*	10.8	*5.7*
14			7.1	*2.2*	8.8	*3.6*	13.3	*4.5*	10.4	*5.2*
15			8.2	*3.0*	8.8	*4.5*	13.8	*5.4*	9.9	*4.7*
16			8.0	*3.1*	10.9	*4.0*	13.9	*4.9*	10.6	*4.6*
17			7.6	*2.4*	10.4	*3.8*	12.4	*4.1*	9.7	*3.5*
18			8.0	*1.9*	8.6	*3.6*	13.2	*4.7*	11.9	*5.6*

Table 3. Skinfold triceps in Körmend boys and girls (Means and *SD*, mm)

Age (y)	K-58	K-68		K-78		K-88		K-98	
Boys									
3		10.4	*1.6*	11.9	*2.7*	13.4	*3.4*	10.8	*2.4*
4		9.2	*1.4*	10.9	*2.9*	12.9	*3.2*	11.6	*3.0*
5		8.6	*1.5*	9.7	*2.2*	11.7	*2.6*	10.9	*3.3*
6		8.3	*1.7*	9.6	*2.6*	11.3	*2.8*	10.5	*3.5*
7		7.3	*1.7*	9.0	*3.2*	11.9	*3.9*	10.7	*4.7*
8		7.9	*1.9*	9.5	*4.0*	12.5	*4.1*	11.7	*5.4*
9		7.4	*1.7*	10.4	*4.0*	13.4	*5.0*	11.5	*4.7*
10		7.8	*2.3*	10.2	*4.5*	13.6	*5.3*	12.7	*5.6*
11		8.4	*2.7*	10.5	*5.1*	14.5	*4.9*	14.5	*5.7*
12		7.4	*2.1*	10.7	*5.1*	15.5	*6.0*	13.8	*6.6*
13		8.0	*2.7*	10.1	*5.2*	12.4	*4.6*	14.3	*5.3*
14		7.7	*1.9*	10.1	*5.4*	12.4	*4.8*	13.2	*5.6*
15		7.0	*1.9*	8.9	*3.7*	11.9	*4.8*	9.5	*3.9*
16		7.1	*2.2*	8.6	*4.0*	12.3	*5.0*	8.7	*4.1*
17		6.9	*1.8*	8.1	*4.1*	11.1	*4.5*	11.1	*5.4*
18		6.8	*2.1*	8.2	*3.2*	11.1	*4.0*	8.8	*3.5*
Girls									
3		10.1	*2.3*	12.1	*2.6*	12.3	*1.9*	12.6	*2.6*
4		10.1	*1.6*	11.6	*3.1*	14.1	*3.0*	13.2	*3.6*
5		8.5	*1.1*	11.2	*2.6*	12.9	*3.8*	12.1	*3.7*
6		8.6	*1.9*	11.7	*4.4*	13.6	*3.9*	12.3	*4.1*
7		8.5	*2.1*	11.8	*4.3*	13.4	*3.9*	12.4	*4.1*
8		9.4	*2.2*	10.6	*3.7*	14.0	*3.9*	13.3	*4.2*
9		9.3	*2.6*	12.0	*4.1*	14.6	*4.5*	15.0	*5.4*
10		10.3	*3.0*	12.1	*4.2*	16.3	*5.4*	15.7	*6.2*
11		10.7	*3.0*	11.4	*3.9*	16.3	*5.3*	16.6	*6.0*
12		10.0	*2.4*	12.4	*5.3*	15.8	*5.8*	15.0	*5.1*
13		10.5	*2.9*	12.9	*5.6*	16.9	*5.9*	16.4	*5.9*
14		10.3	*3.0*	14.8	*5.1*	17.8	*5.3*	16.8	*6.5*
15		14.6	*3.7*	14.7	*4.9*	19.1	*6.3*	14.8	*4.8*
16		13.8	*4.9*	17.2	*5.6*	19.2	*5.4*	15.9	*4.7*
17		13.7	*4.2*	17.2	*5.9*	18.2	*5.1*	15.1	*4.4*
18		14.7	*3.3*	15.6	*5.0*	18.6	*5.3*	17.5	*5.3*

Table 4. Skinfold sub-scapula in Körmend boys and girls (Means and *SD*, mm)

Age (y)	K-58	K-68		K-78		K-88		K-98	
Boys									
3		6.2	*1.2*	5.9	*1.7*	9.2	*3.5*	5.5	*2.5*
4		5.4	*1.1*	6.2	*2.7*	8.2	*2.8*	5.8	*1.9*
5		5.0	*0.9*	6.0	*2.1*	7.5	*2.4*	5.8	*3.5*
6		5.1	*1.2*	5.9	*2.5*	7.6	*2.6*	5.4	*3.7*
7		5.0	*1.2*	5.3	*2.6*	9.0	*4.3*	6.9	*4.2*
8		4.4	*1.3*	6.7	*5.2*	9.0	*4.5*	8.0	*6.5*
9		5.3	*1.3*	7.0	*4.4*	10.3	*6.4*	7.2	*4.5*
10		5.8	*1.5*	7.8	*5.5*	10.5	*6.1*	8.3	*5.9*
11		6.5	*2.3*	8.5	*5.8*	12.4	*8.0*	12.1	*6.7*
12		6.1	*2.0*	8.9	*5.9*	14.3	*8.5*	11.2	*6.1*
13		6.5	*2.3*	9.2	*6.8*	12.6	*6.5*	10.4	*6.1*
14		6.5	*2.4*	9.6	*5.9*	13.5	*5.5*	13.4	*6.3*
15		7.0	*1.5*	8.8	*3.7*	14.1	*6.6*	10.1	*5.8*
16		7.5	*1.9*	9.7	*4.1*	14.9	*7.0*	9.9	*4.9*
17		8.0	*2.0*	9.5	*4.3*	14.6	*5.5*	13.3	*6.4*
18		8.2	*1.6*	11.3	*5.1*	15.3	*5.7*	11.3	*4.5*
Girls									
3		6.2	*1.3*	7.0	*2.5*	8.3	*2.6*	6.9	*2.2*
4		6.4	*1.4*	6.5	*2.5*	9.7	*3.5*	7.4	*4.3*
5		6.1	*1.5*	7.1	*2.2*	10.0	*4.2*	6.8	*4.5*
6		5.9	*1.3*	7.3	*3.1*	10.2	*4.0*	6.8	*4.2*
7		5.8	*1.5*	7.7	*4.8*	10.0	*5.4*	8.8	*4.9*
8		6.8	*2.3*	7.9	*5.1*	11.1	*5.7*	10.4	*5.8*
9		6.9	*2.6*	9.1	*5.3*	11.3	*5.9*	11.4	*6.9*
10		8.1	*2.5*	9.4	*5.2*	14.1	*7.5*	12.1	*7.8*
11		9.2	*4.0*	9.7	*6.1*	15.6	*7.8*	13.1	*7.5*
12		8.5	*2.1*	11.9	*6.1*	17.0	*8.0*	12.9	*6.3*
13		9.6	*2.9*	12.4	*6.5*	17.5	*7.7*	15.1	*7.0*
14		10.9	*3.2*	13.7	*6.2*	18.9	*7.2*	16.6	*7.9*
15		13.4	*3.6*	13.8	*5.9*	22.0	*8.0*	14.7	*5.9*
16		13.7	*4.2*	15.1	*6.3*	22.5	*8.2*	14.8	*5.5*
17		13.3	*3.7*	16.3	*6.6*	20.4	*6.8*	14.6	*6.1*
18		13.4	*4.0*	14.9	*5.3*	21.8	*8.3*	18.5	*8.1*

Table 5. Skinfold supra-iliaca in Körmend boys and girls (Means and *SD*, mm)

Age (y)	K-58	K-68		K-78		K-88		K-98	
Boys									
3		6.3	*2.6*	6.6	*1.7*	10.1	*4.5*	6.5	*2.0*
4		5.5	*2.0*	6.7	*2.8*	9.7	*3.7*	6.8	*2.8*
5		4.8	*2.1*	6.7	*2.5*	9.6	*3.7*	7.2	*4.6*
6		4.8	*1.4*	7.2	*3.2*	9.9	*4.4*	8.1	*4.6*
7		4.7	*2.5*	6.9	*3.8*	11.3	*6.5*	9.6	*7.4*
8		5.6	*2.7*	8.8	*7.6*	11.5	*6.0*	10.9	*8.7*
9		5.0	*2.1*	10.3	*7.7*	13.5	*8.5*	10.5	*7.1*
10		5.5	*2.1*	11.3	*9.0*	13.4	*8.7*	12.7	*10.4*
11		6.4	*2.8*	12.8	*9.5*	16.2	*10.4*	18.0	*12.8*
12		6.1	*2.7*	12.7	*9.0*	17.3	*11.1*	16.6	*11.9*
13		6.7	*3.0*	13.2	*9.9*	14.3	*8.7*	15.5	*9.6*
14		6.5	*2.4*	13.3	*8.8*	15.6	*8.0*	20.2	*13.9*
15		6.9	*2.5*	11.8	*6.6*	16.8	*10.0*	15.2	*9.2*
16		7.2	*2.3*	12.9	*7.4*	17.4	*9.8*	13.5	*7.0*
17		8.2	*3.1*	12.1	*7.3*	17.4	*8.4*	17.6	*9.5*
18		6.9	*2.1*	14.7	*7.8*	19.1	*7.5*	15.7	*7.9*
Girls									
3		7.3	*2.7*	7.9	*2.6*	9.8	*3.3*	8.8	*2.9*
4		7.5	*2.2*	8.1	*3.1*	11.9	*5.0*	9.8	*5.6*
5		7.0	*2.7*	9.0	*3.2*	11.8	*6.0*	9.1	*6.0*
6		6.7	*2.1*	9.3	*4.0*	12.7	*5.6*	9.7	*5.5*
7		6.4	*3.1*	10.3	*6.2*	12.9	*6.0*	11.5	*5.8*
8		7.2	*2.5*	10.0	*6.2*	14.3	*6.9*	13.3	*6.2*
9		7.7	*2.9*	12.7	*6.6*	14.8	*8.2*	15.9	*8.1*
10		9.5	*3.2*	13.1	*6.7*	17.6	*8.6*	16.7	*9.9*
11		9.1	*3.3*	13.8	*7.6*	18.7	*8.9*	18.1	*8.5*
12		8.8	*2.5*	16.5	*10.0*	19.7	*9.4*	17.7	*8.4*
13		10.5	*3.6*	16.4	*8.3*	19.7	*8.9*	20.0	*9.3*
14		10.9	*3.2*	17.4	*8.0*	21.7	*8.4*	21.2	*9.7*
15		16.1	*4.0*	17.8	*7.5*	24.0	*9.1*	19.8	*7.8*
16		17.7	*4.8*	19.2	*8.1*	24.8	*8.8*	20.1	*7.2*
17		15.1	*4.4*	21.5	*8.9*	22.0	*6.4*	20.1	*7.1*
18		20.6	*4.9*	18.6	*7.0*	23.1	*7.6*	22.9	*9.4*

Table 6. Skinfold umbilical in Körmend boys and girls (Means and *SD*, mm)

Age (y)	K-58		K-68		K-78		K-88		K-98	
Boys										
3			8.5	*3.3*	5.8	*2.3*	8.6	*3.2*	6.1	*3.4*
4			8.3	*2.2*	6.0	*2.9*	8.5	*3.9*	5.9	*3.0*
5			5.7	*1.5*	5.4	*2.3*	7.5	*3.2*	7.1	*6.0*
6			6.1	*1.8*	6.2	*3.7*	8.1	*4.3*	6.3	*4.0*
7			5.3	*1.8*	5.9	*3.9*	10.3	*6.5*	7.4	*6.8*
8			6.7	*3.4*	7.3	*6.6*	10.5	*6.1*	9.4	*6.6*
9			6.1	*2.5*	9.0	*7.2*	11.9	*8.3*	10.1	*6.3*
10			6.7	*2.8*	10.1	*8.6*	13.0	*9.9*	12.3	*8.8*
11			8.4	*4.3*	10.4	*8.7*	16.0	*11.5*	18.4	*9.9*
12			7.9	*2.8*	11.2	*9.4*	18.2	*12.5*	15.6	*9.6*
13			9.2	*3.9*	11.5	*8.8*	15.3	*9.9*	15.6	*9.1*
14			10.1	*3.8*	11.8	*8.3*	15.9	*8.6*	18.7	*9.5*
15			9.2	*3.1*	11.9	*6.5*	17.7	*10.6*	13.7	*9.5*
16			10.2	*3.1*	12.7	*7.2*	18.6	*11.2*	12.0	*8.3*
17			10.9	*4.3*	12.0	*7.9*	17.9	*10.2*	16.2	*9.7*
18			11.0	*3.1*	13.8	*8.5*	20.3	*10.0*	13.4	*8.1*
Girls										
3			7.3	*1.6*	8.3	*3.6*	7.8	*2.7*	9.2	*3.0*
4			7.5	*3.4*	7.2	*2.6*	9.7	*3.9*	9.1	*5.3*
5			6.4	*2.3*	7.1	*3.4*	9.9	*5.6*	7.7	*4.9*
6			8.1	*3.4*	8.0	*4.1*	10.7	*6.0*	8.7	*6.1*
7			6.7	*2.1*	8.5	*5.8*	11.9	*7.1*	10.4	*6.8*
8			8.3	*3.2*	8.5	*5.5*	13.2	*7.2*	12.2	*7.3*
9			8.8	*3.0*	11.0	*7.4*	14.1	*9.0*	15.6	*9.5*
10			10.6	*3.6*	11.2	*6.1*	18.5	*9.8*	15.4	*9.9*
11			10.2	*3.4*	13.0	*7.8*	19.9	*10.9*	17.8	*9.5*
12			13.3	*4.6*	15.9	*9.5*	21.4	*12.6*	17.5	*8.6*
13			15.4	*4.5*	16.6	*8.2*	23.5	*10.4*	19.2	*9.2*
14			18.9	*6.0*	19.1	*8.1*	26.6	*10.7*	19.4	*9.9*
15			22.1	*4.2*	19.9	*7.8*	29.5	*11.2*	18.9	*7.3*
16			22.8	*5.0*	21.6	*8.8*	31.7	*9.6*	19.4	*8.4*
17			17.8	*4.6*	23.0	*9.0*	29.0	*8.3*	17.6	*7.6*
18			24.3	*4.7*	19.7	*7.3*	28.5	*9.5*	21.9	*9.8*

Table 7. Skinfold calf in Körmend boys and girls (Means and *SD*, mm)

Age (y)	K-58		K-68		K-78		K-88		K-98	
Boys										
3			10.4	*2.3*	10.9	*2.6*	12.7	*3.6*	9.1	*2.7*
4			9.9	*1.9*	10.1	*4.1*	12.7	*4.3*	10.1	*2.7*
5			8.6	*1.6*	9.3	*2.5*	10.5	*3.0*	10.7	*3.6*
6			8.1	*1.9*	9.7	*5.3*	11.4	*6.1*	10.6	*3.8*
7			8.3	*2.0*	9.5	*3.8*	11.5	*4.4*	11.3	*4.3*
8			8.5	*1.9*	10.4	*4.7*	12.2	*4.9*	12.4	*6.8*
9			9.4	*2.7*	11.9	*5.6*	13.0	*6.0*	12.2	*5.7*
10			9.8	*3.1*	11.6	*5.8*	12.9	*6.2*	13.2	*6.2*
11			10.4	*3.2*	12.6	*6.4*	14.4	*7.3*	16.6	*8.6*
12			10.4	*3.8*	13.2	*6.4*	15.8	*8.9*	15.5	*8.1*
13			11.0	*3.7*	13.3	*5.9*	13.5	*6.6*	15.7	*6.7*
14			10.9	*3.5*	12.7	*6.1*	13.4	*6.3*	14.9	*7.5*
15			10.7	*3.4*	12.0	*4.5*	13.8	*8.0*	11.0	*5.5*
16			10.3	*3.7*	11.1	*4.3*	13.0	*5.7*	10.1	*4.2*
17			10.9	*3.3*	10.3	*4.4*	13.3	*8.9*	11.8	*6.5*
18			9.8	*3.1*	9.8	*3.6*	11.7	*6.1*	9.3	*4.3*
Girls										
3			10.1	*2.3*	12.1	*2.6*	11.9	*2.8*	13.0	*2.3*
4			10.1	*1.6*	12.0	*2.3*	14.2	*3.4*	12.3	*3.6*
5			8.9	*1.2*	11.9	*3.3*	13.0	*4.0*	12.0	*4.0*
6			8.9	*2.0*	11.4	*3.6*	12.6	*4.5*	12.0	*4.7*
7			8.8	*2.1*	12.2	*5.1*	13.7	*4.8*	13.6	*5.5*
8			10.1	*2.5*	12.1	*4.7*	16.5	*6.4*	14.1	*5.3*
9			10.1	*3.0*	14.0	*5.3*	15.4	*4.7*	15.1	*5.7*
10			11.0	*3.2*	13.3	*5.1*	17.5	*6.3*	16.1	*6.6*
11			11.0	*3.3*	14.1	*4.9*	17.7	*6.8*	17.4	*5.8*
12			10.9	*2.9*	16.0	*8.2*	21.0	*7.5*	16.5	*5.6*
13			10.9	*3.1*	15.7	*5.8*	19.2	*8.8*	18.6	*6.5*
14			11.4	*3.6*	16.7	*6.0*	19.9	*7.6*	18.5	*7.0*
15			14.2	*3.7*	17.9	*7.6*	22.1	*9.6*	17.1	*4.7*
16			13.9	*5.0*	18.6	*5.5*	22.0	*8.1*	20.1	*5.7*
17			14.5	*4.7*	19.6	*5.9*	20.3	*7.4*	17.7	*5.2*
18			15.1	*4.4*	18.4	*5.9*	21.7	*7.9*	21.6	*6.9*

Table 8. BMI in Körmend boys and girls (Means and *SD*)

Age (y)	K-58		K-68		K-78		K-88		K-98	
Boys										
3	16.6	*1.7*	15.3	*1.3*	15.4	*1.2*	16.2	*1.4*	15.7	*1.3*
4	16.7	*1.2*	15.8	*2.6*	15.1	*1.4*	15.3	*1.2*	15.3	*1.2*
5	15.9	*1.9*	15.1	*1.3*	14.6	*1.2*	15.1	*3.1*	15.3	*1.8*
6	15.1	*1.4*	15.4	*1.4*	14.6	*1.3*	15.2	*2.1*	15.2	*1.9*
7	14.4	*1.4*	14.9	*1.1*	15.4	*1.6*	15.3	*1.7*	15.2	*1.9*
8	15.6	*2.0*	15.3	*1.4*	15.9	*2.0*	15.5	*1.3*	16.1	*2.5*
9	15.2	*1.8*	15.2	*1.3*	16.1	*1.9*	16.0	*3.1*	16.0	*2.0*
10	15.9	*2.1*	15.5	*1.5*	16.4	*2.3*	16.3	*2.1*	15.6	*2.6*
11	16.3	*1.9*	16.3	*1.5*	17.0	*2.4*	17.0	*2.5*	18.1	*3.4*
12	16.4	*1.9*	16.9	*1.7*	17.7	*3.5*	17.6	*2.7*	17.7	*3.5*
13	16.9	*1.7*	17.0	*1.8*	17.7	*3.3*	18.0	*2.4*	18.2	*2.7*
14	17.5	*2.2*	19.1	*1.7*	19.0	*2.8*	19.0	*2.5*	20.2	*3.5*
15	19.2	*2.3*	18.8	*1.9*	19.3	*2.0*	19.6	*2.8*	20.1	*3.4*
16	19.9	*2.0*	19.9	*2.3*	20.3	*2.1*	20.7	*2.8*	19.6	*2.4*
17	20.4	*2.3*	20.5	*1.9*	20.1	*2.3*	21.2	*2.9*	21.8	*3.5*
18	21.3	*1.7*	20.5	*1.6*	21.3	*2.4*	21.4	*2.7*	20.9	*2.4*
Girls										
3	16.3	*1.2*	15.7	*2.3*	15.5	*1.6*	14.8	*1.0*	15.2	*1.0*
4	15.7	*1.1*	15.5	*1.5*	14.8	*1.1*	14.8	*1.4*	15.4	*1.6*
5	15.9	*1.5*	14.4	*1.1*	14.9	*1.8*	15.1	*1.8*	15.2	*1.7*
6	15.9	*2.0*	15.7	*1.7*	14.6	*1.5*	14.8	*1.5*	15.1	*1.9*
7	14.9	*1.6*	14.8	*1.0*	15.3	*1.9*	15.2	*1.7*	15.2	*2.3*
8	14.9	*2.1*	15.2	*1.2*	15.4	*1.7*	15.3	*1.7*	15.6	*2.2*
9	16.3	*1.9*	15.5	*1.7*	16.2	*2.3*	15.6	*2.1*	16.2	*2.1*
10	15.6	*1.8*	16.5	*1.7*	16.2	*1.7*	16.6	*2.6*	16.3	*2.8*
11	16.3	*2.2*	16.9	*2.7*	16.7	*2.5*	17.3	*2.6*	17.5	*2.8*
12	16.9	*2.4*	17.4	*2.2*	18.2	*3.2*	18.1	*3.3*	17.7	*2.7*
13	17.3	*2.1*	18.4	*2.4*	18.3	*2.7*	18.7	*3.2*	18.7	*2.7*
14	18.6	*2.4*	19.4	*2.4*	19.4	*3.1*	19.7	*3.2*	19.9	*2.9*
15	19.8	*2.3*	20.5	*3.0*	19.7	*2.7*	20.4	*4.2*	20.5	*3.0*
16	19.7	*2.0*	20.5	*2.4*	20.2	*2.6*	20.9	*3.1*	20.0	*2.6*
17	19.9	*2.0*	21.2	*3.5*	21.2	*3.0*	20.5	*2.2*	20.3	*2.9*
18	20.7	*3.2*	21.7	*1.7*	20.3	*2.0*	21.0	*2.9*	21.0	*3.4*

As it is well known, growth and maturation of children, influenced by genetic and environmental factors, is a dynamic process: the growth pattern changes over time. Therefore, it is necessary to investigate the somatic developmental status of children repeatedly [6].

Over time, the Körmend children became taller and a bit fatter. These changes are mostly due to the environmental factors covered by the concept of the secular trend. Growth of Körmend children, demonstrated with body measurements, reacted upon to the changes of environmental factors very soon and sensitively [10]. These consecutive investigations highlight tendencies in successive generations (6) and the secular changes of sexual differences in height during puberty [9].

REFERENCES

1. Bodzsár, É. (2003) Életkorok biológiája. A pubertáskor. ELTE Eötvös Kiadó, Budapest.
2. Eiben, O. (1988) Szekuláris növekedésváltozások Magyarországon. Humanbiologia Budapestinensis, Suppl. 6, Budapest.
3. Eiben, O. G. (1994) Genetic aspects and/or effects of the environmental factors in human growth. In: Singh, J. R. (Ed), Human genetics. Ess Ess Publisher, New Delhi, 253–258.
4. Eiben, O. G. (1998a) Growth and maturation problems of children and social inequality during economic liberalization in Central and Eastern Europe. In: Strickland, S. S., Shetty, P. (Eds.), Human biology and social inequality. Cambridge University Press, Cambridge, 76–95.
5. Eiben, O. G. (1998b) Growth and physical fitness of children and youth at the end of the 20th century. International Journal of Anthropology 13, 129–136.
6. Eiben, O. G. (2002) The "Körmend Growth Study". Tendencies in generations. Humanbiologia Budapestinensis 27, 39–46.
7. Eiben, O. (2003) Körmend ifjúságának biológiai fejlettsége a 20. század második felében. Körmendi Füzetek, Körmend.
8. Eiben, O. G., Tóth, G. (2000a) Half-a-century of the "Körmend Growth Study". Collegium Antropologicum 24, 431–441.
9. Eiben, O. G., Tóth, G. (2000b) Secular changes of sexual differences in height during puberty. In: Bodzsár, É. B., Susanne, C., Prokopec, M. (Eds.), Puberty: variability of changes and complexity of factors. Eötvös University Press, Budapest, 177–181.
10. Eiben, O. G., Tóth, G. A. (2006 in press) Data to secular growth changes. Körmend Growth Study: the Hungarian case. The Indian Journal of Physical Anthropology and Human Genetics.

11. Heyward, V. H. Wagner, D. R. (2004) Applied body composition assessment. Human Kinetics. Champaign.
12. Kirchengast, S., Schober, E., Waldhör, T., Sefranek, R. (2004) Regional and social differences in Body Mass Index, and the prevalance of overweight and obesity among 18 year old men in Austria between the years 1985 and 2000. Collegium Antropologicum 28, 541–552.
13. Ross, W. D., Eiben, O. G. (2002) BMI: A critique of its use in human biology and the health professions. Humanbiologia Budapestinensis 27, 47–56.
14. Tóth, G. A. (2005) The "Körmend Growth Study". In: Tóth, G. A. (Ed), Auxology. To the memory of Professor Ottó G. Eiben. Savaria University Press, Szombathely, 61–66.
15. Tóth, G. A., Eiben, O. G. (2004) Secular changes of body measurements in Hungary. Humanbiologia Budapestinensis 28. Budapest.
16. WHO (1998) Obesity: preventing and managing the global epidemic. Geneva.

Papers on Anthropology XV, 2006, pp. 271–293

CHARACTERISTICS OF RIGA SCOOLCHILDREN'S STATURE, LONGITUDINAL PARAMETERS AND POSTURE AT THE TURN OF THE CENTURY

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INTRODUCTION

Indices of a child's morphological development are at the same time the criteria of the child's health status. Physical development of children and teenagers is one of the indices of the state's welfare. One's physical development, as well as the development of the locomotor apparatus, is demonstrated by the posture. From the physiological point of view, the posture is a dynamic stereotype which is being forming as a result of one's individual development and growth. In order the children would develop a normal posture, one needs a motivation, as well as an interest in the children's health. An irrational adaptation of a growing child to long-term static postures (by sitting in a chair unadapted for his/her height, spending a lot of time at TV or a computer) provokes the development of locomotor disorders. At the same time, functional disturbances of the passive and active locomotor apparatus delay the child's physical development, cause the deterioration of cardiovascular, nervous, respiratory and digestive functions. Such children develop reduced adaptation capacities to cope with stress situations and harmful ecological factors. On starting school, children make use of only 50% of the envisaged motion range. The most unfavourable posture which is the reason for posture disorders is the sitting position, exceeding the physiological norms for their age by 4–5 times.

When sitting in a bent position, standing or sitting with a crooked back, etc., asymmetries develop in the active and passive locomotor apparatus, changes in the backbone curvature and the distribution of the foot load. Initially these changes are only functional which are easier to correct, while, with time, they become irreversible and cause deformities. Thus, it is important to diagnose posture disorders and initial deformities of the feet timely.

Physical health indices, alongside with mortality and morbidity indices, describe the population health as a whole. One of the most topical problems today in human biology and anthropology is the change concerning various indices of children and teenagers' development through centuries. With the progress of sciences, the volume and content of subjects acquired by schoolchildren increase. 14% of schoolchildren in Riga are in the register of computer-addict risk group (the statistical data of the Riga Centre of Drug Abuse Prevention, October, 2004). There are fewer and fewer children who are spending their time outdoors. The children's physical activity decreases, general hygienic norms are ignored, namely, about the admissible weight of a satchel (especially in primary and elementary classes), clothes (the so-called repers' style, children wearing the adults' shoes), junk food (crisps, cola, etc.). There are many other unfavourable factors which deteriorate the health of children and teenagers, decrease the body's protection.

The growth and development processes of children are esentially affected by the changes in the state's social and economic factors.

The posture and feet parameters are significant indices for the physical development of children and teenagers, which depict the real situation of the functioning of the locomotor system. As to Latvia, the most comprehensive studies, concerning the feet and the posture, were carried out at the beginning of the 1960s of the 20th century. This was the reason to start the investigation of the posture of schoolchildren at various ontogenetic stages, to determine the age and sex specificities of these parameters. So far the frequency and intensity of the posture of scoolchildren and feet parameters had not been studied. There are very little literature data on the connection between the posture and the feet development. This has also been the reason to do the study of this topical problem.

AIM OF THE STUDY

To investigate and to assess various anthropometrical, posture parameters of Riga schoolchildren at the turn of the century.

OBJECTIVES OF THE STUDY

1. To analyze the mean values of developmental parameters by age and sex.
2. To study the occurrence of posture parameter asymmetry and intensity at the frontal plane.
3. To define types of the posture of scoolchildren according to the age and sex.

MATERIALS AND METHODS

1700 schoolchildren (888 girls and 812 boys) from various schools of Riga districts and the 1st year university students were involved in the study, aged 7–19 years.

Filling in the inquiry forms, the examination and measurements of children were carried out from October 1998 to December 2003.

The programme of the study has been elaborated taking into account the aim and objectives of the research. The programme contained several stages:

Investigation of the morphological status.

Determination of posture parameters.

Statistical processing of the acquired data.

For the final result analysis, all the schoolchildren involved in the study, were divided into the age groups in correspondence with the affirmed "age-period scheme in ontogenesis" which has been recommended by the anthropologists L. Tegako and O. Marfina, 2003).

METHODS OF THE STUDY

All anthropometrical measurements were done according to the methodological recommendations by R. Martin (1914; 1928), K. Saller (1957–1966) and J. Prīmanis (1937), using the Swiss company's *Silber-Hagner & Co* instruments – the Martin's anthropometer with the help of which one could determine the height of the projection points of any part of the body above the support area; the slide gauge, measuring- tape. A wooden rectangular ruler and a simple ruler were used as well.

The posture parameter measuring was done using the methods A. Biezinš (1966), E. Martirosova (1982), A. Vološčuka, E. Vainruba (1988), G. Makarova (2003) methods, which were rather similar for all the above-mentioned authors. Measuring of the posture was done in well-lit rooms with a child standing in a routine position without any evident muscles overstrain.

The posture was determined in 3 planes: frontal – from the front and the back, and the sagittal plane.

The mathematical statistics analysis was carried out by the computer programme SPSS, MS Excel, at Riga Stradins University Institute of Anatomy and Anthropology and Physics Department.

RESULTS

Longitudinal parameters of the body.

The height is one of the anthropometrical parameters which is characterizing the child's physical development.

The average height in 7-year-old boys is 125.3±5.7 cm which makes 69.6% of the mean value of the height parameters of 17-year-old boys. 13-year-old boys are on average 158.4±8.4 cm tall, with the highest year's increase – 7.9 cm. At 17 the average height has increased within a year by 2.8 cm and is on average 180.4±5.5 cm (Figure 1).

The observation showed that adolescents stop growing at the age of 17 years.

Accelerated growth periods in boys has been observed from 8 to 9 years with an average year increase by 7.7 cm and from 12 to 13 years, when the average year height increase is at maximum – by 7.9 cm. The absolute average height increase in boys from 7 years to 17 years is 55.1 cm.

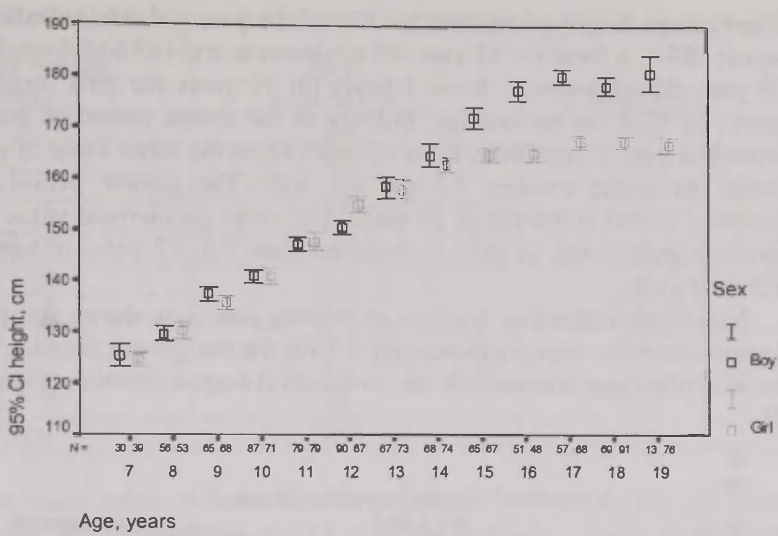

Figure 1. Schoolchildren's height by age and sex.

The height of the girls under study at the age of 7 years was on average 124.8±4.6 cm, which makes 74.3% height parameters of 17 years old girl.

The tendency for the decrease of absolute and relative body growth at the age of 16 and 17 years was observed (Table 1).

Table 1. Average yearly increase of absolute and relative height of boys and girls.

Age (years)	Boys		Girls	
	Increase (cm)	%	Increase (cm)	%
7 – 8	4.3	7.7	5.6	13.1
8 – 9	7.7	14.0	5.1	11.9
9 – 10	3.5	6.4	5.5	12.8
10 – 11	7.3	13.3	6.7	15.6
11 – 12	3.4	6.2	7.3	17.1
12 – 13	7.9	14.4	3.0	7.0
13 – 14	6.3	11.5	4.9	11.4
14 – 15	7.4	13.5	2.1	4.9
15 – 16	5.5	9.0	0.1	0.2
16 – 17	2.8	4.0	2.5	5.8
In total	55.1	100.0	42.8	100.0

The average height parameter for 17 and 18 year old adolescents is equal: 167.6±6.0 cm for 17 year old adolescents and 167.6±5.6 cm for 18 year old adolescents. From 7 years till 17 years the girls' height grows by 42.8 cm on average. Puberty as the fastest period of body growth in girls is seen from 11 to 12 years when the mean value of the height parameter reaches 7.3 cm per year. The growth period is observed to end at the age of 17 years. The mean geometrical value of absolute growth rate in girls is observed from 7 to 17 years of age – 3.3 cm a year.

Non-linear regression analysis of various functions shows that the biggest determination coefficient (R^2>0,99) for the growth function at the described age interval belongs to the third degree function (Figure 2).

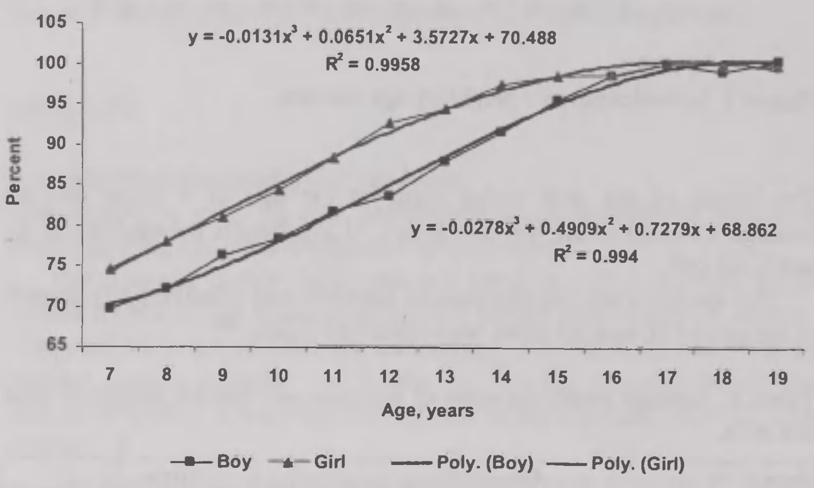

Figure 2. Schoolchildren's mean relative growth curves.

Length of the backbone

Similarly to the growth of the body height, the growth of the backbone at school age for children and adolescents is uneven. 7-years-old boys' backbone is 47.7±3.3 cm tall. From 7 till 17 years the growth of the backbone increases on average by 22.9 cm (Table 2), but in girls by 19.0 cm.

Table 2. Absolute growth rate of the backbone for boys and girls a year.

Age interval (years)	Boys	Girls
	Increase (cm)	Increase (cm)
7 – 8	2.1	2.4
8 – 9	4.0	2.0
10 – 11	0.6	2.0
11 – 12	0.0	4.2
12 – 13	4.4	1.9
13 – 14	3.8	2.3
14 – 15	3.6	1.4
15 – 16	2.2	0.2
16 – 17	0.6	0
17 – 18	0	0.3
In total	22.9	19.0

The mean value of the backbone parameter in 7 to 10-year-old boys and girls is equal. At 12 and 13 years the backbone of girls is growing faster than that of boys. After 15 years, the average backbone of boys exceeds the average backbone parameter in girls (Figure 3).

Checking the results by independent selection t test hypothesis on the ratio of the backbone value and the mean height value in boys and girls, we found out, that statistically confident these indices are for 12, 13 and 15 years old adolescents (Figure 4).

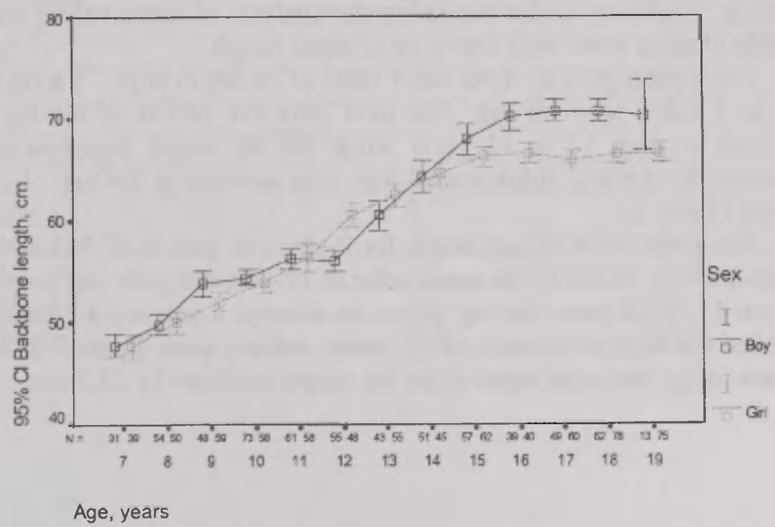

Figure 3. Mean value of backbone length and 95% confidence interval depending on the age and sex.

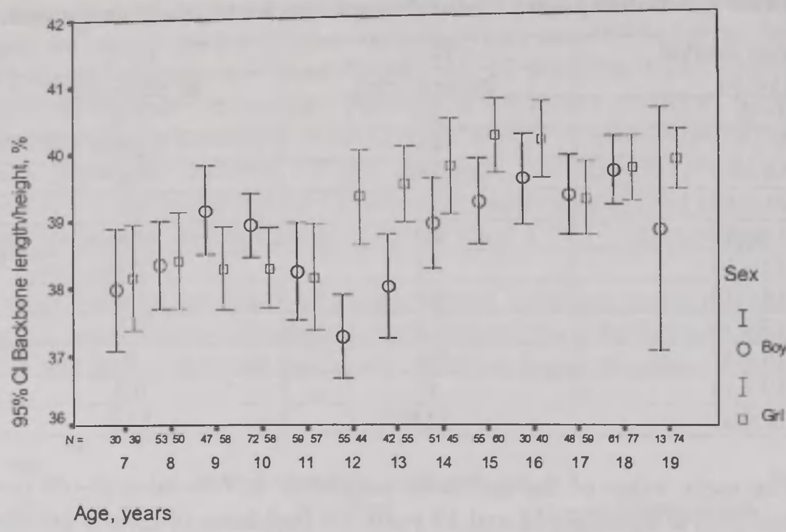

Figure 4. Ratio of the backbone length to the mean value of the height and 95% confidence interval depending on the age and sex.

Length of the leg

The length of the right and left leg for boys and girls was measured. No essential differences were found between the right and left leg length. Therefore, at the beginning the analysis of mean values was made of cases when both legs were of equal length.

The highest growth of the mean value of the leg in boys – 5.8 cm is from 8 till 9 years of age. The next intensive period of the leg's growth is from 12 to 13 years when the leg length increases on average by 4.6 cm. Adolescents' legs stop growing at the age of 17 years (Table 3).

The mean value of leg length for 7-year-old girls is 67.5±3.2 cm which makes 74.3% of the mean value of 17-year-old girls' leg length. From 11 to 12 years the leg grows on average a year by 4.3 cm. It makes the highest increase of the mean value a year. From 7 to 17 years of age the mean value of the leg length increases by 23.3 cm.

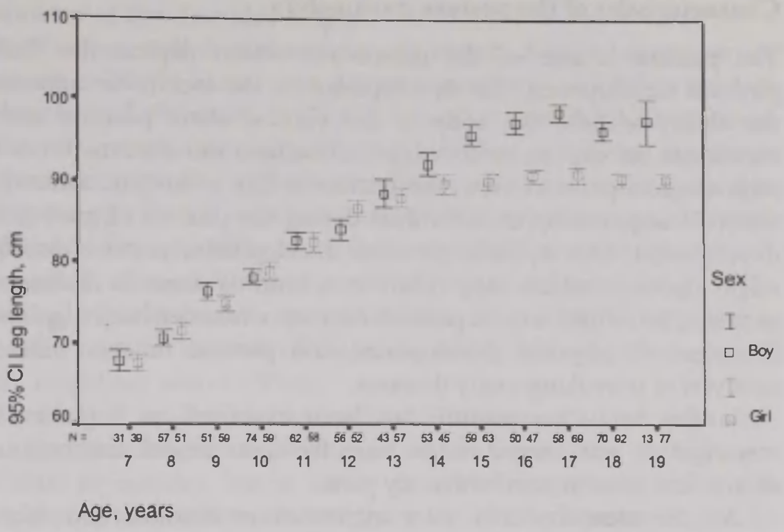

Figure 5. Average leg length and 95% confidence interval depending on the age and sex.

Table 3. Average increase in the leg length a year in boys and girls in absolute numbers.

Age interval (years)	Increase (cm)	
	Boys	Girls
7 – 8	2.8	3.8
8 – 9	5.8	3.4
9 – 10	1.7	4.0
10 – 11	4.5	3.6
11 – 12	1.3	4.3
12 – 13	4.6	1.3
13 – 14	3.7	1.6
14 – 15	3.7	0.6
15 – 16	1.6	0.4
16 – 17	1.1	0.3
In total	30.8	23.3

Characteristics of the posture parameters.

The posture is one of the parameters which depicts the child's physical development, the development of the locomotor apparatus, the ability to hold the body in the vertical static position and in movement, as well as performing professional movements. From the physiological point of view, the posture is like a dynamic stereotype, which is acquired by an individual during the process of growth and development. Due to poor physical development, posture disorders might develop, which may result in a kind of somatic disease, for example, bronchial asthma patients develop a rounded back.
Disorders of physical development and posture function like the catalysts in provoking many diseases.

In this study the posture has been examined at 3 planes, the investigation was carried out to learn the symmetrical distribution of anatomical structures in both body parts.

All the measurements were expressed in absolute and relative numbers. The difference in parameters from 0 to ±0.5 cm between the left and the right side is considered to be a norm or symmetry. The difference from ±0.50 to ±1.0 cm is considered to be a slight asymmetry, the difference from ±1.0 to 2.0 cm – a moderate asymmetry, but the difference > ±2.0 cm – a marked asymmetry.

Analysis of posture parameters at the fontal plane from the front. Form of the thorax.

In 85.6% boys the form of the thorax is normal, 8.0% – rounded, 2.8% – flat. In 23 boys (3.6%) were found the deformity of the thorax. In 94.0% girls the form of the thorax is normal, 2.7% – rounded, 1.7% – flat. In 12 (1.7%) girls the deformity of the thorax was found.

The pearson's chi-square test shows that the distribution of the form of the thorax between boys and girls is statistically a confident difference ($\chi^2 = 27.77$; $p < 0.01$).

Symmetry of the shoulder height.
In 64.4% boys both shoulders are symmetrical. A slight asymmetry is observed in 24.3% cases, a moderate asymmetry – 12.5%, a marked asymmetry – 2.5% cases. In 25.6% boys the right shoulder is placed lower, 10% cases – the right shoulder is higher. Analyzing the shoulder location symmetry in boys according to the age, one can see, that during the age from 7 – 10 years, no distinct asymmetry is observed. 10-year-old boys in 4.0% cases show a marked asymmetry and it is observed in all senior boys as well. More evident asymmetry of the shoulder height appears in teenage children from 13 to 14 years which coincides with the increase of the mean value of the maximum growth of the height per year – 7.9 cm.

In the girls involved in the study, 64.5% cases showed a symmetrical shoulder height, in 24.3% – a slight asymmetry, in 13% – a moderate asymmetry, but in 1.8% – a marked asymmetry. In 25.6% girls, the right shoulder is lower than the left. In 7-year-old girls no moderate or marked asymmetry of the shoulder height was observed. In 8-year-old girls, the moderate asymmetry was already seen and it remained such also in the groups of all senior girls as well. The first more evident asymmetry appears already at the age of 11 years (1.7% cases).

This age for the girls coincides with the most intensive yearly increase of the mean value of the body height by 7.3 cm.

The Pearson's chi-square test shows that the distribution of the levels of the shoulder height in boys and girls do not show any difference ($\chi^2 = 0.002$; $p = 0.999$).

Symmetry of the nipple level.
In boys 68.1% cases both nipples are located symetrically, in 23.5% cases the right nipple is lower, but in 8.5% – higher than the left one.

In girls involved in the study, the nipple level in 70.1% cases is equal, in 22.6% – the right nipple is lower, in 7.3% cases – higher than the left one.

The Pearson's chi-square test shows that the distribution of the nipple level in boys and girls do not show any difference ($\chi^2 = 0.917$; $p = 0.632$).

Symmetry of the pelvis.
In 93.0% of boys the position of the upper frontal iliac spine on both sides is equal, i.e., the pelvis is symmetrical. In 25.4% cases – slight

asymmetry, but in 6.9% – moderate asymmetry by 1 – 2 cm difference. The most evident asymmetry is seen in 12-year-old boys.

The symmetry of the pelvic position is seen in 91.9% girls. A slight asymmetry – 6.1%, moderate – 1.7%, but marked asymmetry – 0.3% girls.

A slight pelvic asymmetry is seen in all age groups. The average sign of asymmetry appears at the age of 10 years. A marked asymmetry is seen in 15 to 16-year-old teenage girls; it is more evident in 16-year-old girls.

Posture parameters at the frontal plane from the backside. Rhomb symmetry by Maškov.

The rhomb as defined by Maškov is the distance from the sharp projection of VII cervical vertebra till the lower angles of scapula, and from the lower angles of scapula to the sharp projection of V lumbar vertebra.

The symmetry of the upper part of the rhomb is seen in 67.7% boys, a slight asymmetry – 25.4%. No moderate asymmetry in 6.9% boys. In 7-year-old boys a slight asymmetry of this parameter is seen, moderate asymmetry in this age group boys is not observed. Moderate asymmetry appears in boys at the age of 8 years, most commonly seen in 14, 16 and 17-year-old teenagers and adolscents.

The symmetry of the lower part of the rhomb (the distance from the lower angles of both scapulae to the sharp projection of V lumbar vertebra) is seen in 64.9% boys, slight asymmetry – 28.4%, moderate – 6.4% and marked – 0.3% cases. Slight and moderate asymmetry of this parameter is seen in boys at all age groups. Moderate asymmetry is more common in 9, 12, 14, 16, and 17-year-old boys, marked asymmetry is at the age of 11 years.

The girls involved in the study showed the symmetry of the upper part of the rhomb in 71.2% cases, slight asymmetry – 22.2%, moderate – 6.6% cases. Similarly to boys, the girls too, at the age of 7 years, most commonly showed the symmetry or a slight asymmetry of this parameter. Starting from the age of 8 years, moderate asymmetry appears as well, which is most commonly seen at the age of 10, 13, 14, 16 and 17-year-old girls. The symmetry of the lower part of the rhomb in girls is seen in 66.7% cases. A slight asymmetry is seen in 24.4% cases, moderate – 8.4%, marked – 0.5 % cases. 7-year-old girls show symmetry or a slight asymmetry. From the age of 8 years, the girls show asymmetry of 1–2 cm difference in the distance from the right and left side. Most commonly it is seen at the age of 10, 14, 17 and 18-year-old girls, but at the age of 11, 16, 18 and 19 years, the girls show also a marked asymmetry of this parameter.

The upper part of the Mashkov`s rhomb points to the symmetrical location of the spinal cervical and superior thoracic anatomical structures. The lower parameters of the rhomb point to the location of lower spinal thoracic and lumbar part anatomical structures.

Distance of the scapulae from the backbone.

For boys the distance of the scapulae from the backbone in 69.5% cases is symmetrical. Sometimes a slight (19.5%), moderate (9.7%) or marked (1.2%) asymmetry was seen. At the age of 7 years, the scapulae are located symmetrically or slightly asymmetrically. In 9-year-old boys one can see moderate or marked asymmetry. Moderate asymmetry is more commonly seen from 9 – 10, 12 – 14 and 16-year-old boys and teenagers. More marked asymmetry is seen at the age of 9 years, as well in 15 and 18-year-old boys and adolescents.

In girls the symmetry of scapular location in relation to the backbone is observed in 71.3% cases, slight asymmetry 17.7%, moderate – 10.6%, but marked – 0.3% cases. In 7-year-old girls the symmetry of this parameter is observed in 100%. From 8 years of age a slight or moderate asymmetry is observed. Moderate asymmetry (difference 1 – 2 cm) is more common in 10-year-old girls, 14, 16 and 18-year-old girls. Marked asymmetry (difference more than 2 cm) is observed in 11, 15 and 16 years old girls and teenage girls.

Both boys and girls have a larger distance between the scapula and the backbone in the left body side.

Height of the scapulae.

The location distance of the lower corners of the scapulae from the supportive area in the left and right side was established. This parameter in a symmetrical, normal posture was equal on both sides. In the study the scapulae of 7-year-old boys were located symmetrically in 96.8% cases. From the age of 8 years, the occurrence of scapular location asymmetry is gradually increasing. Most commonly, 22.7% of the asymmetry of this parameter is observed in 10-year-old boys, at the age of 13 and 14 years, 29.0% and 29.4% cases correspondingly. In all the age groups the boys had the left scapula located higher.

7-year-old girls had both scapulae located symmetrically in 97.4% cases, at the age of 14 years – 73.3%, but at the age of 16 years –

72.9% cases. In girls these signs were observed more often at the age of 10 years (25.4%), 14 years (26.7%) and 16 years (27.1%).

Slight asymmetry (up to 1 cm) was observed in girls at all ages, most commonly at the age of 12, 17, 18 and 19 years. Moderate asymmetry (from 1 to 2 cm) is more common in 10, 14, 16 and 18-year-old girls. Marked asymmetry (difference more than 2 cm) was seen in 14, 17 and-19 year- old teenage girls and adolescent girls. In girls the left scapula was also seen to be higher.

Backbone status at the frontal plane.

Analyzing the posture parameters, the backbone was assessed at 2 planes – frontal and sagittal. In a normal posture the backbone at the frontal plane is forming a vertical vertebral column, sharp projections of the vertebrae do not make a decline sideways. When diagnosing the deviation of the sharp projection of the vertebrae in the children under study, they were asked to bend forwards: in such a position the declince of the sharp projection of the vertebrae from the vertical line was seen more distinctly. The vertebral decline was considered to be the beginning of torsion. We defined the decline in absolute numbers. Most commonly the mean value of the vertebral decline or torsion was 5 – 10 mm. The vertebral torsion in boys and girls was mainly seen at the level of XI and XII thoracic vertebrae and I–II sharp projection of lumbar vertebrae. Sometimes the rib hump was diagnosed, in our case for 16 boys and 27 girls of various age. The backbone torsion is a serious morphological posture defect: it is often considered to be the sign of scoliosis. Unfortunately, such defects were observed at all age groups for boys and girls.

At the age of 7 years the straight back at the frontal plane was seen in 77.4% cases, torsion – 22.6%. Most commonly the torsion was seen in 14-year-old teenagers – 36.8%, at 16 years – 33.3% and at 17 years – 34.5% cases.

In girls at the age of 7 years the torsion was seen in 5.1% cases. From 12 years the frequency of these signs increases: in 18 years old girls it was seen in 30.8% cases, but in 19-year-old girls – 41.6% cases. The rate of torsion signs in absolute and relative numbers is shown in Table 4.

Adolescents with torsion signs complained of pains in the lower back which increased after a physical load. When diagnosing torsion, children were advised to consult the family doctor to have their backbone examined.

Table 4. Backbone form for boys and girls.

Backbone form		Sex		Total
		Boys	Girls	
Straight	N	638	695	1333
	%	78.9	78.5	78.7
Torsion	N	171	190	361
	%	21.1	21.5	21.3
Total	N	809	885	1694

The Pearson's chi-square test shows that the difference of the distribution of the bacbone form between boys and girls is not statistically confident ($\chi^2 = 0.03$; p=0.87).

Asymmetry of leg length.
In normal posture the both leg length is equal. Asymmetrical leg length promotes the formation of the backbone torsion. The difference of the leg length between the right and the left leg from 0 till ±0.5 cm was considered to be the measurement error, but the difference higher than ±0.5 cm was considered to be asymmetry.

In the group of 7-year-old boys, only one boy had the left leg by 0.8 cm longer than the right one. The highest occurrence of this asymmetry sign was seen in 10-year-old boys. The leg length asymmetry was retained at all age groups, most often the longer was the left leg.

The girls at 7 and 8 years had, in fact, both legs of equal length. From 16 years the adolescent girls' legs show signs of asymmetry and it increases: more often the longer is the left leg with the difference from 1 to 1.5 cm, in single cases – even 2.5 cm.

Characteristics of posture parameters at the sagittal plane.
Position of the head.
In the normal posture at the sagittal plane the head is straight. In the case of posture disorder, the head is declined forward from the vertical axis. Simultaneously the cervical lordosis and kyphosis as compensation of the upper part of the thorax develop. The position of the head for boys and girls is shown in Table 5

Table 5. Position of the head in boys and girls.

Position of the head		**Sex**		**Total**
		Boys	**Girls**	
Straight	N	284	359	643
	%	44.9	50.6	47.9
Bent forward	N	348	351	699
	%	55.1	49.4	52.1
Total	N	631	710	1342

The Pearson's chi-square test shows that the difference in the distribution of the position of the head between boys and girls is statistically confident (chi-square = 4.242; $p = 0.039$).

Backbone curvatures.

According to the depth of lordosis and the position of the pelvic girdle one can identify several pathological posture types.

Kyphotic-lordotic posture. This type of posture is seen with a deepened cervical and lumbar lordosis, compensated by enlarged thoracic kyphosis, the head forward, the pelvis is rotating forward.

Military posture. It is characteristic of decreased cervical lordosis, deepened lumbar lordosis and the pelvis is rotating forward.

Flat back – the head bent forward, thoracic kyphosis moderately enlarged, lumbar lordosis levelled, the pelvis is rotating backwards.

Round back (stooping posture; the back leaning backwards) is characteristic of rapidly-growing children ("lanky teenager's posture"). The head bent forward, cervical lordosis enlarged, thoracic kyphosis well-seen, lordosis is forming at the lower thoracic part and upper lumbar part.

7-year-old boys were seen to have the medium value of the cervical lordosis 4.53±1.5 cm but in 18-year-old adolescents it was on average 5.9±1.3 cm deep. In boys from 7 to 18 mean value of the cervical lordosis is gradually increasing by 1.4 cm. The normal depth of the cervical lordosis was seen in 523 children. Straightened lordosis (from 0.5 to 3.0 cm) was seen in 88 children, deepened lordosis (from 4.0 to 10.0 cm) was seen in 1085 children. 7.0 cm deep lordosis was seen in 68 children, 7.5 cm – in 30 children, 8.0 cm in 26 children. The mean value of the cervical lordosis in girls at the age of 7 years is 4.4±1.1 cm, but at the age of 19 years – 5.6±1.1 cm. The mean value of the cervical depth of the girls is increasing from 17 years. From 7 to 19 years the depth of the cervical lordosis increases on average by 1.2 cm.

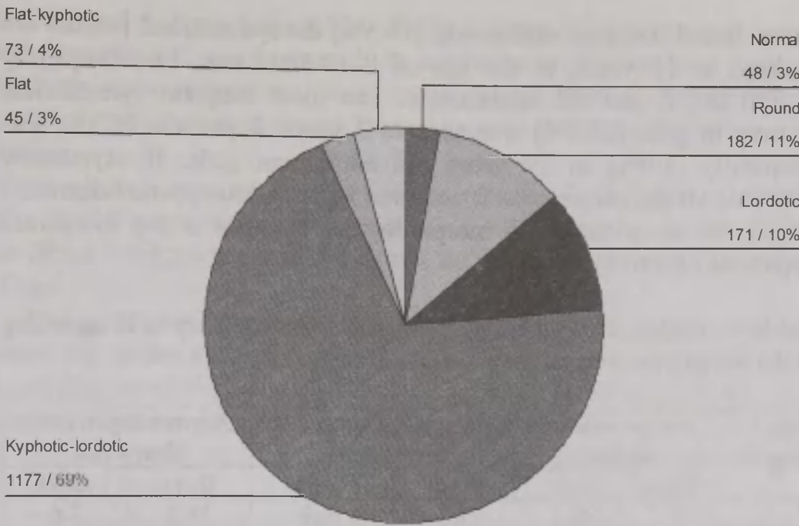

Figure 6. Posture types in schoolchidren in absolute and relative numbers.

In boys the cervical lordosis is deeper. The mean value of lumbar lordosis in 7-year-old boys is 5.3±1.3 cm, at 18 years – 5.8±1.3 cm; the increase by 0.4 cm.

The mean value of the depth of the lumbar lordosis in girls at 7 years is 5.4±1.2 cm, at 18 years 5.9±1.5 cm; the increase is by 0.5 cm. Analyzing the depth of the lumbar lordosis in children individually, one could see that the normal lordosis (the depth from 3 to 4 cm) was seen in 261 children. Straightened lordosis (the depth from 2 to 3 cm) was in 23 children, but deepened lordosis (from 4.0 to 10.5 cm) was seen in 1412 children. Children under study were most commonly seen to have kyphotic-lordotic posture, as well as the round back "a lanky teenager's posture", less often the flat back and flat lordotic back (Figure 6).

With the children growing, the rate of kyphotic-lordotic postures is increasing.

Incidence of asymmetry of the posture parameters.

In schoolchildren (both boys and girls) the asymmetry of single posture parameters and its incidence at a certain age group were measured. The difference between the right and the left body side parameters up to 1 cm was not considered to be an asymmetry. Analyzing the asymmetry rate for girls and boys in certain age groups, it was found that most commonly (19.5%) the symmetrical posture are in boys at 11 years, at the age of 8–17.5% cases, less frequently (2.9%) in 18-year-old adolescents. The most frequent symmetrical posture in girls (20.5%) was seen at 7 years, 9 years – 20.3%, less frequently (3.9%) in 19 years old adolescent girls. If asymmetry concerns all the parameters, it points to more serious posture disorders which are associated with morphological changes in the locomotor apparatus (Table 6).

Table 6. Incidence of schoolchildren's posture asymmetry in % according to the posture parameters included in the study.

Age (years)	Symmetrical posture		Asymmetry from 1 to 4 parameters		Asymmetry in more than 4 par.	
	Boys	Girls	Boys	Girls	Boys	Girls
7	9.7	20.5	71.1	76.9	19.2	2.6
8	17.5	18.5	73.6	66.7	8.9	17.8
9	16.7	20.3	63.7	72.6	19.6	7.1
10	12.5	15.4	73.9	70.6	13.6	14.0
11	19.5	11.1	65.9	76.6	14.6	12.3
12	8.9	12.7	85.6	73.2	5.5	14.1
13	15.9	5.5	65.3	79.3	18.8	15.2
14	4.4	6.7	69.1	76.0	26.5	17.3
15	7.3	5.8	69.1	70.9	23.6	23.3
16	5.8	4.2	52.0	62.6	42.2	33.2
17	3.4	5.8	65.7	73.8	30.9	20.4
18	2.9	5.4	72.8	65.2	24.3	29.4
19	–	3.9	77.0	55.9	23.0	40.2

The changes of Riga schoolchildren's morphological status in the 20th century.

The studies of several authors of the end of the 20th century point to the weakening of the body's biological ties between the growth and development (maturation) process, the interruption of the acceleration process, some negative tendencies (for example, the decrease of the correlation between the sexual maturation processes and the defining measurements of the body), the gracilization of the body and the decrease of muscular strength. The results of the studies carried out by many Latvian doctors and anthropologists within the 20th century on the mean value increase of the body mass in girls between the ages of 8 to 18 years show similar data, e.g., G. Fedders (1930–1933) – 32,6 kg, R. Millers (1962) – 32.4 kg, I. Duļevska (1996–1997) –

32.2 kg and S. Umbraško (1998–2003) – mean value increase of the body mass is 31.5 kg. As a result, in our study we observed the sign of the body mass retardation. Girls are taller and slender, paying more attention to their weight dynamics and keep to the requirements of the fashion.

Comparing our results with other scientists' findings on Riga schoolchildren physical development in the 20th century, in our study we found a bigger growth of the total body height from 8 to 17 years of age.

The maximum growth rate in boys 60 years ago was from 14 to 15 years, but in the study of 1998–2003 – from 12 to 13 years of age. According to G. Fedders' (1930–1933) and R. Millere's (1962) studies, the maximum growth rate has been observed from 12 to 13 years of age, but in the study in1998–2003 – a year earlier, i.e. from 11 to 12 years of age.

The acceleration of growth in girls in the city of Riga in the study of I. Duļevska from 1996–1997 was observed from 11 to 12 years of age when the increase of the body height a year was 7.82 cm. L. Aberberga-Augškalne in the study from 1978–1987 defines the maximum growth rate at 12.2 years of age, when the body grows by 8.2 cm a year. G. Fedders (1930–1933) found out that the average height among 17-year-old adolescents is similar to 18-year-old adolescents' height and it is 170.0 cm. R. Millere's (1962) study shows that it is 174.6 cm at 17 years, but at 18 years – 175.4 cm. In the studies of 1998–2003 the average height of 17 years old adolescents was 180.4 cm. The average height for girls at 18 years was 160.3 cm according to G. Fedders (1930–1933), according to R. Millere (1962) – 162.6 cm, but in the study of 1998–2003 the mean value of the height was equal – 167.6 cm in 17 and 18-year-old adolescent girls.

One cannot make general conclusions as to the acceleration process on the Latvian schoolchildren`s population because the selection of 1998–2003 was made up from Latvian and other ethnic group representatives. The selection of G. Fedders' (1930–1933), R. Millere's (1962) studies was made only of the children of Latvian nationality.

The study of 1998–2003 shows that the absolute and relative growth rate of the body height in boys is uneven, with a more intensive growth rate from 8 to 9 years, from 10 to 11 years, from 12 to 13 years and from 14 to 15 years, while the growth rate of the body height of girls is much more even and bigger from 7 to 12 years, in comparison to the boys of the same age. After 12 years of age, the growth rate of the height in girls decreases. The mean value of the girls' height at 8, 10, 11 and 12 years is higher than that of boys of the corresponding age. In the current study, for the first time in Latvia, we have made comprehensive measurements of the backbone in ontogenesis according to sex.

The children under survey in 1998–2003 showed the continuation of the growth to 17 years of age. The longitudinal parameters acquired in the study show the differences in sex – the maximum yearly increase in the height for girls is seen from 11 to 12 years of age, but for boys – from 12 to 13 years of age.

The body posture is one of the indices which is depicting the child's functional status of the physical development, i.e., the ability to hold the body in the vertical static posture, as well as move and to perform professional movements. In the literature no analogous data were found, therefore there were no data for the comparison. In the current work we determined the frequency of asymmetry and its level for children of various ages and sex. In Latvia such comprehensive studies have not been made yet on schoolchildren's posture parameter asymmetry, its level and incidence. The posture parameters are defined by doctors empirically.

More marked all parameter asymmetry both for boys and girls was found in all the age groups, more often in teenagers from 13 to 16 years, adolescent girls and girls from 12 to 19 years. Primary school children showed more symmetrical posture in comparison to more senior children, or 1–4 posture parameter asymmetry; asymmetry in all parameters was seen rarely. In the case the asymmetry is in all posture parameters, it gives evidence to serious posture disorders, which are related to morphological changes in the locomotor apparatus. At the age of 17 years every third adolescent boy and every fifth adolescent girls (at the age of 19 every second, third adolescent girl) had a marked posture parameter asymmetry in all the measurements. According to A. Potapčuks (2001) in St. Petersburg, four from every five girls were seen to have posture disorders.

The major studies of schoolchildren's physical development, which also dealt with posture and foot status, were carried out in the 1960s of the 20th century under the guidance of professor A. Biezinš. In these studies, normal posture was seen in 50–64% children, unstable posture – 16–30% schoolchildren, posture disorders in 9–26% and scoliotic posture in 0.6–2% schoolchildren. In boys the posture was found to be worse than in girls.

In the studies of 1998–2003, more often kyphotic-lordotic posture, less flat foot both in boys and girls at all age groups were found. Boys had more often a round posture, while girls – more a kyphotic posture with a deepened lumbar lordosis. The children getting older, the number of those with kyphotic-lordotic posture increases – from 67.7% at the age of 7 years to 84% at the age of 18 years. Normal, kyphotic, flat and military type posture change as well. The number of children and adolescents who are diagnosed kyphotic-lordotic posture is increasing. It makes us think that it is due to long-term sitting at inappropriate for age desks or chairs at school or at the computer at home, as well as, insufficient movement activities (71% children).

Physical development and body posture are the indicators of the health of the growing body, which depicts also the functional status and maturation of the body. In comparison to the 1960s of the, the rate of children with a kind of posture disorders which are diagnosed in senior schoolchildren, has rapidly increased. Every sixth child suffers from some kind of a chronic problem, more than half of the children suffer from insufficient physical activities. 14% of Riga schoolchildren are officially included in a computer-addicted risk group. 60% of the surveyed children have started to walk very early, they have had too heavy schoolbags, or they have carried the satchel wrongly, they have to sit for long time at the unappropriate desks for their height, or have had unwholesome food (lack of protein), as well as, have been influenced by other harmful factors, which, as a result, have caused impairments in the period of their biological maturation. For more than ten years, in elementary and secondary schools the subject teaching method has been applied where children learn in a classroom of a definite subject profile. In this classroom lessons are delivered to children from the fifth to the twelfth class. Labelling of school furniture is not paid attention enough. Scoolchildren are sitting for several hours a day in chairs unappropriate for their height.

The same situation is in the computer classes where children work at the same computer desks, being either 11 years old or 19 years old. At schools the staff of a doctor has been liquidated (except at some schools where there is a swimming-pool). Doctors could check the hygienic conditions at school, to take preventive measures. The changing socioeconomic conditions, the environmental pollution, the decline of birth-rate, the increase of diseases and the lack of preventive measures call for the necessity for teachers, parents and doctors to cooperate in order to motivate children to have a healthy lifestyle and to have a healthy generation. The results of the study have proved that at the end of the 20th century, the schoolchildren's growth and development (maturation), have not been harmonious, the biological ties between the human's growth and development process has become weakened. Professor A. Biezinš in 1933 said the following on the posture and feet defects: "It is true that no one can die of this trouble, but can become disabled, and it makes life hard to us all!"

CONCLUSIONS

1. In the study of 1998–2003 we observed the longitudinal parameter growth in the height among children and adolescents up to 17 years of age. In boys the acceleration of the growth is seen from 12 to 17 years, in girls – from 11 to 12 years. In this study the height in boys in the population is on average 180.4 cm, in girls 167.6 cm.
2. The mean value of the girls' height at 8, 10, 11 and 12 years of age is higher than in boys at the definite age. From 12 years the mean value of the height of boys at all age groups exceeds the mean value of the height in girls.
3. Analyzing the mean value of the asymmetry at the respective ages of boys and girls, it was seen that most of the asymmetrical parameters are in boys at 16 years of age, but in girls at 19 years of age. At 17, each third boy and each fifth girl (at 19 – each second girl) are seen to have posture parameter asymmetry in all measurements, which exceeds the difference between the right and the left body side by more than 2 cm. Such asymmetries give the evidence of serious posture disorders which are connected with morphological changes in the locomotor apparatus.
4. About 70% of the surveyed children are seen to have kyphotic-lordotic postures, equally often in boys and girls. Kyphotic postures are more common in boys, lordotic – more in girls. Flat postures, military type postures and normal postures are seen more rarely.

REFERENCES

1. Aberberga-Augškalne L. (2001) Longitudināls pētījums par sirdsdarbības ritma un asinsspiediena izmaiņām 7–16 gadu vecumā. LMA ZR: Ķirurģija, internā medicīna, medicīnas bāzes zinātnes, stomatoloģija, farmācija, Rīga, 2001, 152– 156.
2. Bieziņš A., Liepiņa H.(1996) Stājas defekti un mugurkaula izliekumi. Metodiska vēstule, Rīga, 1966, 1–27.
3. Duļevska I.(2003) Rīgas skolas vecuma latviešu meiteņu fiziskās attīstības izvērtējums gadsimta pārmaiņu procesos. Promocijas darbs, Rīga, 2002, 196.
4. Fedders G. Rīgas latviešu pamatskolas garums un svars. IM mācību līdzekļu nodaļa, Rīga, 1936, 45.
5. Millere R.(1963) Rīgas pilsētas skolēnu fiziskās attīstības standarti. Metodiski norādījumi, Rīga, 1963, 31.
6. Prīmanis J.(1937) Ievads antropoloģijas metodikā (somatoskopija, somatometrija). Valters un Rapa, Rīga, 1937.
7. Martin S., Saller K.(1957) Lehrbuch der Anthropologie I. Stuttgart; Fischer Verlag, 1957, 661.
8. Вайнруб Е. М., Волощук А. С.(1988) Гигиена обучения и воспитания детей с нарушениями осанки и болъных сколиозом. Здоровъе 1988, Киев, 1–45.
9. Макарова Г. А. (2003) Спортивная медицина. 2003, 108–130.
10. Тегако Л. И., Марфина О. В. (2003) Практическая антропология. Ростов на Дону, Феникс, 2003, 60–82.

Papers on Anthropology XV, 2006, pp. 294–301

INSIGHTS ON BEHAVIOURAL AND EDUCATIONAL PRESSURES ON LATERALITY DEVELOPMENT IN CHILDREN

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ABSTRACT

The finding of a great number of handprints in a Sulawesi cave (Indonesia) during a speleological expedition stimulated the present study. Rock art representations are in fact a functional indicator of the genesis of laterality, as some cultural constraints could merge from the context. What is lacking is a present day set of data on cultural pressures that influence laterality and that are useful for comparisons. The purpose of this observational study was to collect data on laterality in children aged 5–11 years of age. A sample of 669 primary school children, 383 males and 286 females, was divided into 3 age groups: 5–7; 7–9 and 9–11. To all of them the Spennemann's Test (1985), which requires subjects to draw the profile of a human face on a A4 paper, was administered and the hand used to sketch the drawing was recorded. Data were analysed according to the hand used to sketch the profile, the orientation of the drawn face (right or left) and the area of residence of the children (urban or rural).

In the whole sample, 6.2% of the rural children sketched the face with the left hand, compared to 20.1% of the urban children (χ^2=12.8, d.f.=4, p<.001). 55.9% of these subjects oriented the face to the left side (χ^2=9.3; d.f.=1, p<.01). Left-handed children (LH) did not show a preference in the orientation of the drawings; while right-handed children (RH) preferred the left side of the paper.

The higher incidence of LH found in urban vs rural schools suggests that there are still prejudices against LH in the rural social environment. A different tendency in the direction of the profile was ascertained. RH drew the profile towards the left side of the paper, while LH showed no preference in orientation. It appears that LH are lesser prone to represent situations in a culturally conventional manner.

Key words: Laterality, lateralization, social pressure, handedness.

INTRODUCTION

Anatomical and functional brain asymmetries are found in a number of animal species. They are not homologues and have different adaptive aims: a progressive evolution of brain asymmetry apparently does not exist. Studies on laterality have been performed with different aims: for example, the association handedness/health indicates that non-right-handedness is associated with a number of health disorders such as high blood pressure and epilepsy [2]. Other studies were carried out to verify (and possibly ban) social stigma and repression of left-handedness, or to associate human traits with laterality. For example, a link between schizotypal personality, ambidextrality and weak cerebral dominance is hypothesized, while the association extends to modalities other than hand preference [23].

The most commonly accepted theory of handedness is the brain hemisphere division of labour (with objections), and many scolars directed their efforts to the roots of brain lateralization, which is commonly believed to be very old, as its origins are unknown. Ethologists direct their efforts to manual tool-use of great apes (for a recent example, see [24]). Dart [6], Holloway [11], and others [22], found asymmetries in the Australopithecines suggesting lateralization in them. Toth [25], working on a Kobi Fora artefact, highlighted the presence of preferential dexterity as far back as 1.9–1.4 million years ago. For ancient men, data from handprints of the European Superior Palaeolithic age (35.000–9000 b.C.) suggested to Groenen [9] that about 80% of the Gravettian population (26.000–20.000 B.C.) was right-handed. More recent data on some hand laterality indexes from Clacton-on-Sea (±20.000 B.C.) indicates that man manipulated with the right hand [16]. All Ancient Egyptian representations permit us to infer the right hand dominance of Ancient Egyptians [17], and the analysis of the military paraphernalia of Ancient Greece strongly suggests a right hand preference in ancient Greeks [21]. Regarding another laterality indicator (drawing orientation), a left side predominance was found in children asked to draw a human profile [31,32]. Further studies on Norwegian, American and Egyptian scholars [14], among the Japanese [15], the Israelis [1] and the Navajo Indians (Ballinger, quoted by 27), showed the same results. This is in contrast with recent data from Saharan prehistory sites [19]. Chateau [4,5] demonstrated that in rural subjects or in uncultured people a right orientation is more frequent and that this is not connected to lateralization.

Hudson [12] noted that, even if the foundations of graphic organization are surely of neuromotor origin, social pressures reinforce or contrast them. Comparison among different Saharan sites, permitted to Le Quellec [20] to affirm that strong social pressures produce a rock art that is for most part "codified", since artists are driven by strong collective motivations. Recently, Grassivaro Gallo et al. [8], found that a left hand polarization peak exists in those situations linking the following aspects: to be male, adult and an individual who is possibly uninfluenced by environmental pressures. This profile could well fit the "painter" of the past.

The finding of a great number of handprints in an Indonesian cave [29], going with iconic and ideoplastic drawings, stimulated the present investigation. Until now, hand preference in relation to drawings has been studied (with different aims and from different perspectives) [18,13,3] and more deeply, by Spennemann [28]. The latter found that social pressures have a great impact on lateralization development. The aim of the present study was to collect, for Italian children, raw data, useful for comparisons, on indicators of social pressures connected to the environment affecting laterality and lateralization.

MATERIALS AND METHODS

669 primary school children (383 males and 286 females aged 5–11 years) were asked to sketch a human profile on a piece of A4 paper without time limitations and without looking around, according to the Spennemann Test [28]. They had to give their sex, date of birth, the name of the school and the grade attained. The operator annotated the hand used to draw the profile. All the children's parents gave their informed consent.

The following criteria were used to analyse the drawings: sex (SEX), orientation of the drawing (ORI), urban or rural background (BAK), position of the drawing on the paper (POS), and the hand used to perform (LAT). Subjects were analysed on the whole and then subdivided into three age groups: 5/7, 7/9 and 9/11, according to the criteria of sex and the place of origin. Cross tabulations and χ^2 were used for statistical analysis.

RESULTS

Out of the whole sample, 9.3% of the subjects (males: 9.4%, females: 9.3%) used the left hand to perform the test. These percentages slightly differ from the percentage of 7.9% found in schoolboys [10]. Grassivaro Gallo and Bettini [7] found in more aged Italian students (7.3%, and respectively 8% in males and 6% in females), while Viviani [30] found in Italian sportsmen a percentage of 9.27%, vs a 5.35% in sportswomen. Relevant LAT differences emerged for BAK: in the urban background 20.1% of LH were found, vs. 6.2% of those from rural backgrounds (in the sample 77% of the subjects were of rural origin).

Significant differences were found for ORI (55.9% of the subjects oriented the face towards the left). Table 1 and 2 compare our data with reference percentages found in relevant literature.

Table 1. Percentages of the left orientation of drawings seen in different population samples

Samples	Author	Left orientation
Italians boys	Present study	55.4%
Italian girls	Present study	56.7%
German boys (urban)	Spennemann, 1985	88.1%
German boys (rural)	Spennemann, 1985	67.7%
German girls (urban)	Spennemann, 1985	85.6%
German girls (rural)	Spennemann, 1985	65.6%
Boys and adults	Zazzo, 1950	78–84%
Navajo Indians	Ballinger, 1975	73%
Norvegian boys	Jensen, 1952	91%
American boys	Jensen, 1952	60%
Egyptian boys	Jensen, 1952	60%
Israelian boys	Abraham, 1973	95%
French adults	Hudson, 1952	67–88%
South African boys	Hudson, 1952	41%

Table 2. Orientation of the drawn face according to laterality

	RH with right ORI		**RH with left ORI**		**LH with right ORI**		**LH with left ORI**	
	N	%	N	%	N	%	N	%
Males	156	58.3	191	55.8	21	65.6	15	30
Females	109	41.1	151	44.2	11	34.4	15	30
Total	256	43.7	342	56.3	32		30	
Chi square= 9.8, d.f.=1; p<.001					N.S.			

The majority of the subjects preferred to draw on the upper left-hand side (36.8%) of the paper or in the centre of the sheet of the drawing paper (31.2%).

265 RH out of 607 (43.7%) oriented the drawing to the right-hand side vs. 342 that did the contrary (p<.01); while LH showed no differences, (they oriented the face towards the right and the left side respectively in 46.9% and 53.1% of the cases), significant differences emerged between LH and RH, who oriented the drawing either to the right (p<.0001) or to the left side (p<.0001).

Significant differences were found in the three age groups for: ORI (p<.01), BAK (p<.000), POS (p<.001) and LAT (p<.001). No sex differences emerged. In the first age group only 3 children out of 66 of rural origin (4.5%) vs. 18 out of 43 of urban origin (41.9%) resulted as being LH.

DISCUSSION AND CONCLUSIONS

Laterality and lateralization develop during ontogenesis and the latter is not an exclusive/global phenomenon, but it is functional and relative: on the basis of the task to be performed, the main segment avails itself of the succubus segment as well. Then, even if at 5–6 years of age lateralization is quite clear, it evolves up to around 13 years old, in connection with social pressures [28]. Our sample did not reveal the considerable differences found by the latter author for BAK. This could be due to the low average age of our children and to the fact that even at higher ages (10–15 years old) lefthandedness percentages between both sexes of Italian students (urban: 9.6%, rural: 6.8%) are lower than those found in Germany [8]. However, no differences emerged between the rural Italian and German age-class sub-samples. It is possible that both north and south European children face analogous social pressures. For ORI e LAT, the low age of the children could explain the differences that emerged as compared to the known data. Due to the low age of children, we checked the hand used to write (and we called it LAT). We did not use validated questionnaires to ascertain hand laterality, as in a previous session answers to administered questionnaires were not trustworthy. Therefore the performing hand is not a clear and good indicator of right/left/handedness as, because writing when moving one's hand away from its side of the body can cause smudging (if the outward side of the hand is allowed to drag across the writing), it is considered easier to write the Latin alphabet with the right hand than with the left. In other cultures using right to left alphabets (Arabic and Hebrew), it is generally considered easier to write with the left hand. Even if the left orientation in ORI predominates, its percentages are lower than those known in boys and adults; this could be due to two concomitant effects: the young age and the rural origin. It must be mentioned that it has been known since the beginning of the last century that: "the right hand naturally draws from right to left" [26:335] and that it is well known by painters that the movement of a painting is effortlessly seen if it proceeds towards the right, as a painting is "read" from left to right. It can be the hypothesises that very young and rural children are not accustomed like the urban children to "reading" paintings and they are, therefore, less prone to cultural constrictions.

From the data it appears that social pressures act mainly on LAT and ORI: this is in agreement with recent acquisitions [23]: even if the foundations of graphic organization are under neuro-motor control, its organization could be reinforced or opposed by scholarization or informal pressures due to the dominant cultural background.

REFERENCES

1. Abraham A. (1973) Le profil dans le test de Machover. Revue de neuropsychiatrie infantile 21(6),361–363.
2. Bryden P. J., Bruyn, J., Fletcher P (2005) Handedness and health: an examination of the association between different handedness classifications and health disorders. Laterality 10,429–440.
3. Brown E. V. (1990) Developmental characteristics of figure drawings made by boys and girls aged five through eleven. Perceptual and Motor Skills 70,279–288.
4. Chateau J. (1965) Attitudes intellectuelles et spatiales dans le dessin. Monographies françaises de psychologie CNRS. 182.

5. Chateau J. (1966) Influence sur les attitudes intellectuelles des facteurs culturels, caractériel et scolaire. Enfance 4–5,1–23.
6. Dart R. (1949) The predatory implemental technique of Australopithecus. American Journal of Physical Anthropology 7,1–38.
7. Grassivaro Gallo P., Bettini D. (1987) Contributo allo studio del mancinismo: fattori ambientali nella dominanza laterale della scrittura. Antropologia Contemporanea 10(1–2),67–76.
8. Grassivaro Gallo P., Angioletti E., Viviani F (2000) On the origins of human laterality: environmental and hereditary variables in a sample of children. Perceptual and Motor Skills, 90, 944–946.
9. Groenen M. (1990) Quelques problèmes à propos des mains négatives dans les grottes paléolithiques. Approche épistémologique. Annales d'Histoire de l'art et de l'Archéologie. 12,7–29.
10. Guaraldi G. P., Ruggerini C., Bolzani R. (1980) Preferenza laterale in età scolare: rilievi epidemiologici e analisi di fattori congeniti e acquisiti. Neuropsichiatria infantile 176,179–197.
11. Holloway R. L. (1983) Cerebral brain endocast pattern of Australopithecus afarensis hominid. Nature 303,420–422.
12. Hudson W. (1952) Pictorial Perception and Educational Adaptation in Africa. Psychologia Africana 9,226–239.
13. Gottfried A. W., Bathrust K. (1983) Hand preference across time is related to intelligence in young girls, not boys. Science 221,1074–1076.
14. Jensen B. (1952a) Left-right orientation in profile drawing. American Journal of Psychology 601,84–88.
15. Jensen B. (1952b) Reading habits and left-right orientation in profile drawings by Japanese children. American Journal of Psychology 2,306–307.
16. Kelley L. H. (1977) The Function of Palaeolithic Flint Tools. Scientific American 237(6),108–119.
17. Kenesi C. (1997) Rive droite, rive gauche. Main droite, main gauche. Essay sur la latéralisation dans l'Egypte ancienne. Manovre XI(2),7–17.
18. Kilshaw W. D., Annett M. (1983) Right and left-hand skill I: Effects of age, sex, and hand preference showing superior skill in lefthanders. British Journal of Psychology 74,253–258.
19. Le Quellec J. L. (1994) Art rupestre saharien et aires culturelles. Sahara 6,120–124.
20. Le Quellec J. L. (1996) L'art «classique» de la civilisation du Messak (Fezzân, Libye). Studia Africana 7, 8–42.
21. Levame J. H. (1997) Lateralisation et art militaire. Manovre XI (2),19–22.

22. Levy J., Nagylaky T. (1972) A model for the genetics of handedness. Genetics 72,117–128.
23. Nicholls M. E. R., Orr C. A., Linell A. K. (2005) Magical ideation and its relation to lateral preference. Laterality: Asymmetries of Body, Brain, and Cognition 10(6),503–515.
24. O'malley R., McGrew W. (2006) Hand preferences in captive orangutangs (Pongo pygmaeus) Primates, in publication (http://lib.bioinfo.pl/pmid,16604276).
25. Toth N. (1985) Archaeological evidence for preferential right handedness in the lower and middle Pleistocene, and its possible implications. Journal of Human Evolution 14,607–614.
26. Salmon P. (1904) Influence du sexe sur le dessin. Bulletin et Mémoires de la Société d'Anthropologie de Paris 3,332–337.
27. Simounet P. (1975) La droite et la gauche dans le dessin de l'enfant et de l'adulte. Enfance 60,47–69.
28. Spennemann D. R. (1985) Regional trends in handedness as a result of environmental and educational pressures. The evidence of drawn faces. Anthropologie 23(2),167–168.
29. Viviani F. (1992) La grotta di Sumpangbita: aspetti antropologici. In: De Vivo A., Campion N., Menin A., and Viviani F. Vecchie storie indonesiane. Speleologia 27, 32–41.
30. Viviani F. (1986) Il mancinismo e le attività fisico-motorie. In: Viviani F. (ed.) Appunti di antropometria applicata allo sport. Padua, Cortina, 61–85.
31. Zazzo R. (1950) Le geste graphique et la structuration de l'espace. Enfance 4,17–33.
32. Zesbaugh H. (1934) Children's drawings of the human figure. Chicago, University of Chicago Press.

Papers on Anthropology XV, 2006, pp. 302–309

SOME ASPECTS OF THE BODY IMAGE AND SELF-PERCEPTION IN ADOLESCENTS

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ABSTRACT

To gain insights into adolescents' body image and self-perception, a questionnaire was administered to 248 high school students (83 males and 165 females). It included: the Body Parts Satisfaction Scale (BPSS; Berscheid et al., 1973) and a test on the body image (FRS; Stunkart et al., 1983). Subjects were then measured and their Body Mass Index (BMI) was calculated. Students were subdivided into three age classes: 14/15, 16/17 and 18/20 years old.

For BPSS significant sex differences emerged: height, weight, complexion, buttocks, hips, legs, ankles, general physical appearance and muscular tone. On average, the girls' tendency towards dissatisfaction regarding their own body was quite high, opposite results were found in males. As far as FRS is concerned, ANOVA 2(sex) x 3(ages) applied on the differences between the BMI values and the FRS scores, did not reveal significant differences, showing a substantial homogeneity for sex and age between the "actual" and the "perceived" body. Good correlation was found between the perceived body image and the ideal ($r=.42$, $p<.001$).

On average, girls revealed to be more prone to the socially-induced desire for slenderness, as their degree of dissatisfaction with their own body was higher than that of their counterpart; in addition, their perception of the "ideal female body" resulted as being relatively distorted, as it was thinner than that desired by boys.

Key words: body image, self-perception, adolescents.

INTRODUCTION

The body image is a complex and multidimensional construct in which several components interact: cognitive, affective, evaluative, tactile-kinestesic, social [9]. Its development and strengthening is an endless process influenced by direct or indirect feed-backs with other humans and is strongly connected to life events and various social pressures. The individual's body representation and that belonging to the other bodies allow the individual to analyse his/her body image, the characteristics of which are both objective (anthropometric) and subjective, that is merely cognitive – the body as it is known – and affective – the body as it is experienced – [26]. A comparison between an individual's own body and the bodies of the others is constantly carried out by any person and, due to the dynamics of the changes of the referring models, its representational congruence/incongruence changes during time as well [21]. Some periods of life, such as adolescence, are more prone to rapid modifications. Growth, in fact, requires continuous adaptations to the dramatic changes that the individual is facing, most of them connected to height and weight. If an individual cannot interfere with stature, he/she thinks to be able to control the body masses, and sometimes some disastrous sequels regarding dietary control, often belong to dietary carelessness outcomes. Relevant literature offers data on the body image in adolescents and young adults: it is known that adolescents tend to overestimate their body dimensions [28,29] and that differences exist between genders: women of all ages report greater dissatisfaction with their body than men [12]. High levels of body image dissatisfaction have been demonstrated in children as young as nine years old [25] and the desire to weigh less is more common in women than in males [20]. This trend has been recently found in China as well [19]. Young girls show a general tendency towards the ectomorphic structure and are not satisfied with their weight [10,31]. In general, their dissatisfaction regards specific regions and the relationships among them [24]. Males are more concerned about muscular masses [13] and strongly desire a mesomorphic structure [27]. The perception of preadolescent males may be affected by action figures, in order to idealize a body type focused on a lean, and muscular physique [4]. It is claimed that adolescents are preoccupied, like adults, with the body weight and physical appearance [7], in this they do not differ from adults. However, the body image does not appear to be connected to biological maturity and intelligence [32]. Investigations on the cognitive-behavioural account of the body image disturbances show that a distorted or negative self-schemata contributes to a distorted body image and affects the body-connected aspects regarding attention, perception and the recall of information from the body itself [16]. From prospective studies there is strong evidence that the body image dissatisfaction is a causal risk factor for the onset of eating disturbances [33,1,22,19]. It must be remembered that anorexia nervosa is associated with the highest mortality rate of any psychiatric disorder [3]. Male adolescents who practice trained sporting activities evaluate their body wider than controls in team sporting activities like soccer [29]. No differences, however, were found in tennis players and swimmers [30]. Nevertheless, the nature of the relationship between body satisfaction and the degree of exercise is not easily understood, both for the inconsistencies found in literature and the incongruence of data. Therefore, in this field of study, observational data are strongly recommended, for their clinical and epidemiological implications [7].

The aim of the present paper was to collect raw data on the adolescents' attitudes towards B.I., together with some habits connected to their quality of life.

MATERIAL AND METHODS

The subjects participating in this study were 248 adolescents (83 males and 165 females), aged on average 16.9± years. The data were collected in an art high school, with previous informed consent of both children and parents. They were requested to answer questions on age, school achievement, the use of tobacco and alcohol and nutritional habits. Later on, the Body Parts Satisfaction Scale (BPSS) [6] and the modified Body Image Test (FRS) [23] were administered. Care was taken to administer the figurine test, according to Greenleaf et al., [14] and Holder and Keates [15] suggestions. Subjects were anthropometrically measured for height, weight, and triceps skinfold later on. From these measures, the Body Mass Index (BMI) was calculated.

The sample was subdivided into three age classes: 14/15, 16/17 and 18/20 years old. Statistical analysis included both the parametric and the non-parametric test (ANOVA and Kruskal-Wallis).

RESULTS

The main anthropometric results are shown in Table 1, while the results of the FRS test are depicted in Table 2.

Table 1. Main anthropometric results

	Males (n=81)		Females (n=158)	
PARAMETERS	X	SD	X	SD
Height (cm)	173.2	6.0	160.4	5.8
Weight (Kg)	69.2	12.9	56.8	9.3
Triceps (mm)	9.7	5.5	13.1	4.7
BMI	23.0	3.9	22.0	3.4

Table 2. Average values for FRS according to sex

	Males *(n=81)*		Females *(n=158)*	
	X	SD	X	SD
FRS1	36.4	9.8	35.8	9.3
FRS2	36.6	4.9	30.2	7.0
FRS3	36.0	5.3	30.8	5.4
FRS4	33.4	6.3	35.1	5.0

Legend:
FRS1= The subject was asked: "How do you see yourself"
FRS2="What kind would you like to be ?"
FRS3= "Which figurine is preferred by the other sex ?"
FRS4= "Which figurine of the opposite sex do you like?"

In the whole sample, FRS1 resulted to be correlated to weight (r=.65, p<.001), triceps skinfold (r=.57, p<.001), BMI (r=.80, p<.001), FRS2 (or the ideal body image, r=.42, p<001) and FRS4 (the figurine preferred of the opposite sex, r=.20, p<.001).

FRS2 was correlated to weight (r=.46, p<.001), height (r=.37, p<.001), BMI (r=.33, p<.001) and FRS3 (or the image preferred by the other sex, r=.64, p<.001) and FRS4 (r=.21, p<.001).

FRS3 gave the following correlations: weight (r=.20, p<.001), height (r=.30, p<.001), FRS4 (r=.25, p<.001).

Between FRS1 and BMI an ANOVA 2(sex) x 3(age) on the summation notation of differences was carried out. No differences emerged, only interactions age/sex (F=4.4, p.05).

The BPSS test revealed differences between sexes, as the boys' general tendency was towards a higher satisfaction with their own bodies, while girls tended towards dissatisfaction. Significant differences ($p<.05$) emerged for the following body parts: stature, weight, legs, ankles, hips, buttocks, general muscular tone and physical appearance.

Epidemiological data, related to weight, confirm the girls' dissatisfaction, as 53% of the boys consider themselves ponderally right, vs 43% of the girls ($\chi2=11.8$, $p<.05$). To the question asking if the subjects had the sensation to be ponderally right, males answered affirmatively in 42.2% of the cases, while females in 35.2% of the cases ($\chi2= 13.3$, $p<.01$). Girls would like to lose weight in 58.2% of cases, vs 27.7% of boys ($\chi2=34.3$, $p<.001$).

39.8% of boys vs 22.4% of girls practiced regularly trained physical activity ($\chi2=23.4$, $p<.001$), only 4.8% of the boys and 6.7% of the girls declared not to practice any kind of physical exercise. On the whole, the other collected epidemiological data are congruent with those known for Italian adolescents.

DISCUSSION AND CONCLUSIONS

The results collected up to now show that both boys and girls do not diverge from the known anthropometric data of the Italian population. A substantial adhesion of our sample to epidemiological reports found in relevant literature for aged and adult subjects was found [2]. They are up to the standard with respect to other Italian adolescents [11].

Girls' general tendency towards a dissatisfaction with their own body is confirmed both by the figurine and the BPSS test. They make the same mistake of adult women [8], as they believed that the woman shape preferred by the other sex was thinner than the real. Boys show a more realistic vision of their own body, as they do not diverge, on average, from actual and imagined data. Both sexes, however, showed to adhere to reality, as a substantial homogeneity for sex and age was found between BMI values and FRS1. Results are congruent with recent findings [15].

Apparently girls were more prone to the current western meso-ectomorphic body ideal, and the tendency towards a dissatisfaction with their own body permits to infer that the social *diktats* for slenderness work effectively, at least in most of the adolescent and post-adolescent examined girls. A conclusion that might proceed from such a statement is the following: apart from the need of a good physical appearance requested to cope with social and health requirements (a successful outcome hoped for everybody), the finding that social pressures work efficiently in adolescents girls and not only in adult women, must be taken into consideration. The insistence on the bodily appearance and the societal pressure to conform to an "ideal" body shape, might become a subtle modality to "socially control" women. Not only, but it could lead to eating disorders during adolescence and, perhaps, in the whole life. As the sample was composed of students belonging to the working class, the next step will be to compare them with a sample of higher class students.

REFERENCES

1. Agras W. S. (2001) The consequences and costs of the eating disorders. Psychiatric Clinics of North America 24, 371–379.
2. Altabe M., Thompson J. K. (1992) Size Estimation Versus Figural Ratings of Body Image Disturbance: Relation to Body Dissatisfaction and Eating Dysfunction. International Journal of Eating Disorders, 11(4), 397–402.
3. American Psychiatric Association APA (2000) Diagnostic and Statistic Manual of Mental Disorders (4th ed.-text revision). Washington: APA.
4. Baghurst T., Hollander D. B., Nardella B., Haff G. G. (2006) Change in sociocultural ideal male physique: An examination of past and present action figures. Body Image 3(1), 87–91.
5. Ben-Tovim D. I., Walker M. K., Murray H., Chin G. (1990) Body Size Estimates: Body Image or Body Attitude Measures? International Journal of Eating Disorders, 9(1), 57–67.
6. Berscheid E., Walster E, Bohrnstedt G (1973) The Happy American Boy: a Survey Report. Psychology Today, 7, 199–131.
7. Byrne N. M., Hills, A. P. (1995) Assessment of Eating Practices in Adolescence. Proceedings of Nutrition Society of Australia, 19, 104.
8. Casagrande G., Viviani F., Grassivaro Gallo P. (1997) A methodological approach to the assessment of the "ideal body figure" in fat, obese and non-obese women. Proceedings of the XIX ICPFAR Congress, Itala, South Africa.
9. Cash T., Pruzinski T. (1990) Body Images: Development, Deviance and Change. New York, Guilford Press.
10. Cash T., Winstead B, Janda L. (1986) The great American shape-up. Psychology Today, 30, 37.

11. ESPAD Report (2004) ESPAD Results 2004. Pisa, CNR of Pisa ed.
12. Fox K. R. (1997) The Physical Self. Champaign, Human Kinetics.
13. Franzoi S., Shields S. (1984) The Body Esteem Scale: multidimensional structure and sex differences in a college population. Journal of Personality Assessment, 48, 173–178.
14. Greenleaf C., Starks M., Gomez L., Chambliss H., Martin S. (2004) Weight-related words associated with figure silhouettes. Body Image 1, 373–384.
15. Holder M. D., Keates J. (2006) Size of drawing influences body size estimates by women with and without eating disorders. Body Image 3(1), 77–86.
16. Hong C., Todd J. (2004) Are cognitive biases associated with body image concerns similar between cultures? Body Image. 2(2), 177–186.
17. Hundleby J. D., Bourguin N. C. (1993) Generality in the Errors of Estimation of Body Image. International Journal of Eating Disorders 13(1), 85–92.
18. Levine M., Smolak L. (2006) Prevention of eating problems and eating disorders. Theory, research, and practice. New York, Lawrence Erlbaum.
19. Luo Y., Parish W. L., Laumann E. O. (2005) A population-based study of body image concerns among urban Chinese adults. Body Image 2(4), 333–345.
20. Pliner P., Chaiken S., Flett G. L. (1990) Gender differences in concern with body weight and physical appearance over the life span. Personality and Social Psychology Bulletin, 16, 263–273.
21. Robazza C., Bortoli L., Viviani F., Vàlkovà H. (1995) Bodily Self-Perception Differences by Study Course and Gender. Physical Activity for Life: East, West, South and North. Svoboda B. & Rychtecky A. (eds.) Meyer & Meyer Verlag, 255–259.
22. Shroff H., Thompson J. K. (2006) The tripartite influence model of body image and eating disturbance: A replication with adolescent girls. Body Image 3, 17–23.
23. Stunkart A., Sørensen and Schlusinger (1983) Use of the Danish Adoption Register for the Study of Obesity and Thinnes. In: Kety, Rowland, Sidman and Matthysse (eds), The genetics of Neurological and Psychiatric Disorders. New York: Raven Press, 83–101.
24. Thompson J. K., Psaltis K. (1988) Multiple Aspects and Correlates of Body Figure Ratings: A Replication and Extension of Fallon and Rozin's (1985) International Journal of Eating Disorders, 7(6), 813–817.
25. Thelan M., Powell A., Lawrence C., Kuhnert M. (1992) Eating and body image concerns among children. Journal of Clinical Child Psychology, 21, 41–46.

26. Torras De Beà E. (1987) Body Schema and Identity. International Journal of Psycho-Analysis, 68, 175–184.
27. Tucker L. A. (1984) Physical attractiveness, somatotype and the male personality: a dynamic interactional perspective. Journal of Clinical Psychology, 40, 1226–1234.
28. Viviani F., Bortoli L., Robazza C. (1995) Cognitive and Emotional Bodily Self-Perception in Youngsters. Proceedings of the 9th European Congress on Sport Psychology. R. Vanfranchem-Raway & Y. Vanden Auweele (eds.) Brussels, July4/9th, 1285–1290.
29. Viviani F. (1996) Body Image of Italian Junior Male Soccer Players. African Journal for Physical, Health Education, Recreation and Dance, 2(2), 143–148.
30. Viviani F., Bortoli L., Robazza C. (1997) The physique of circumpubertal medium-class swimmers and tennis players. African Journal for Physical, Health Education, Recreation and Dance, 3(2), 211–217.
31. Viviani F. (2001) Body image and its relationship with body composition in adolescents. In: Body composition and adolescence. A. Hills & T. Jürimäe (eds). Basel, Karger Press, 101–114.
32. Viviani F., Lavazza A., Grassivaro Gallo P. (2004) Body image and growth aspects in male adolescents basketball players. Papers on Anthropology XIII, 294–298.
33. Williamson D. A., Perrin L., Blouin D. C., Barbin J. M. (2000) Cognitive bias in eating disorders: Interpretation of ambiguous body-related information. Eating and Weight Disorders, 5, 143–151.

Papers on Anthropology XV, 2006, pp. 310–320

COUNTS OF PERMANENT TEETH IN 5- TO 15-YEAR-OLDS IN TALLINN, ESTONIA

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ABSTRACT

The aim of this cross-sectional study was to describe the average picture of dental development of 5- to 15-year-old children living in Tallinn (Estonia) by means of tooth counts. We used two distinct methods: direct oral examination and inspection of dental forms of school dentists by permission of dentists. The sample for the study consisted of 617 children (308 boys and 309 girls), representing 3 % of 5–15-year-olds of Tallinn. The children were randomly selected from different secondary schools, kindergartens and a primary school of Tallinn. In 5–9-year-olds body height was also recorded. The average numbers of erupted permanent teeth, excluding third molars, were given by all age groups in both genders.

The results showed that in Estonian children the process of eruption of permanent teeth began at the age of five and was terminated by the age of fifteen, except eruption of maxillary secondary molars. The first erupted permanent teeth were first molars (M1) and medial incisors (I1).

The results of this study showed that the entire tooth eruption process of the second dentition occurred in females earlier than in males. With the exception of mandibular secondary molars the average age at eruption of permanent teeth in girls was lower than in boys.

Body height and number of erupted permanent teeth were correlated positively and significantly in children aged 7 and 9, but not in 5-year-olds. The Pearson correlation coefficients between body height and permanent tooth counts increased along with age.

Our investigation revealed a difference in the counts of permanent teeth in comparison with previous Estonian tooth studies.

Future longitudinal studies in different regions of Estonia are needed for construction of reference curves of tooth emergence for Estonians.

Key words: tooth eruption, permanent teeth counts

INTRODUCTION

Human beings have two sets of natural teeth – the deciduous and the permanent dentition. The permanent dentition comprises of 32 teeth, which erupt approximately at the age of five or six years [7, 10, 14, 19, 20, 27]. The eruption of permanent teeth (except the third molars) typically ends around the age of thirteen [7, 10, 19, 20, 27], by some data at the age of fourteen-fifteen years [1, 14]. Variability in the eruption of third molars is great, usually the third molars emerge at about 17–21 years of age [7, 16, 27].

In general, there are numerous factors which influence the development and eruption of permanent teeth, such as genetic background, hormonal and geographical factors, ethnic origin, gender as well as economic and social status, nutrition, growth parameters, oral hygiene, and also premature loss of primary antecedents [3, 4, 7, 9, 13, 24, 25]. Since the end of the nineteenth century a trend for earlier eruption of permanent teeth has been reported in industrialized countries. This is thought to be primarily caused by earlier puberty that is the result of better nutrition and healthcare for children [8]. Correlation has also been found between the time of eruption, and the weight and height of children – children who are below average weight and height for a specific age show a later eruption time than those children, who are within the standard range [13, 18]. The entire tooth eruption process for the second dentition occurs earlier in females [7, 17, 25, 26, 27]. The only exception is wisdom teeth that typically emerge at an earlier age in boys than in girls [7, 27].

Assessment of dental development by means of tooth counts is a convenient and simple method, although it can be applied only at the ages when emergence can be expected. Knowledge of the timing of emergence of permanent teeth is an important maturity indicator that allows us to say whether the emergence of teeth is within normal limits or not. Knowledge about the timing of emergence of permanent teeth is also necessary for construction of population standards of teeth emergence. These standards of populations are needed for diagnosis of growth disturbances, for dental treatment planning or for forensic dentistry to estimate the chronological age of children or for comparison with paleodontological data. Unfortunately, there is little [17, 21] information about the time and sequence of the eruption of permanent teeth and no information about the range of natural variability of permanent teeth eruption in Estonians. The aim of the present study was to find the average picture of dental development of 5- to 15-year-old children living in Tallinn (Estonia) by means of tooth counts.

MATERIAL AND METHODS

The cross-sectional study comprised data of dental development of 617 children (308 boys and 309 girls) from different educational institutions in Tallinn (children of secondary schools, kindergartens and a primary school). All the children were within the age range of 5 to 15 years. The sample represented 3% of Tallinn children of the respective age groups. The parents or guardians of children gave their written permission for the voluntary examination of their children.

Distribution of the randomly selected subjects according to their age and gender is presented in Table 1.

Table 1. Distribution of study subjects according to age and gender.

Age	Boys	Girls	Total
5-year-old	51	54	105
7-year-old	53	50	103
9-year-old	49	52	101
11-year-old	50	51	101
13-year-old	50	51	101
15-year-old	55	51	106
Total	308	309	617

The subjects were examined during a direct dental check-up or by permission of school dentists by inspection of dental records of school dentists. The records showed the status of primary teeth and also the status of eruption of each permanent tooth. A tooth was considered emerged if any part of it, however small, had pierced the gum. The average number of permanent teeth of boys and girls was given in age groups for both sexes. Third molars were excluded from the evaluation due to the large variability of their eruption time.

In 5- to 9-year-olds also body height as an important variable was measured according to the method of R. Martin using a Martin metal anthropometer [12].

SPSS for Windows was used for statistical analysis. Significance was set at $p \leq 0.05$.

RESULTS

The average characteristics of erupted permanent teeth of 5- to 15-year-old children of Tallinn by age groups are given in Table 2.

Our results indicated that the process of eruption of permanent teeth began at the age of five and in most of children (in 92.7% boys and in 92.2% girls) ceased by the age of fifteen. The first permanent teeth to erupt were first molars (M1) in both genders and medial incisors in some (at least 5.6%) girls. At the age of five there were two boys (3.9%) and nine girls (16.7%) who had at least one erupted permanent tooth.

At the age of seven the average number of erupted teeth was 7 (7.0 for boys and 7.5 for girls ($p=0.88$)) (Table 2). In both genders there were some children who did not have any erupted permanent teeth by this age (4% of girls and 5.7% of boys). At the same time, the maximum of teeth that had had erupted by age 7 was twelve (first molars, medial and lateral incisors). The maximal 12 teeth were erupted in 7.5% boys ($n=4$) and 14% ($n=7$) girls. Exceptionally, in one 7-year-old boy the lower canine was also erupted.

At the age of nine the average number of permanent teeth erupted was 15.2 teeth in boys and 15.6 teeth in girls (Table 2). By the age of nine, in girls the eruption of first molars, medial incisors and mandibular lateral incisors was completed. At the same age, the eruption of canines (C), first premolars (PM1) and secondary premolars (PM2) took place.

At age 11, in addition to first molars and medial incisors, the development of lateral incisors was finished. The eruption of secondary molars (M2) started at this age. 11-year-old boys had an average of 20.8 permanent teeth; the same number for girls was 23.

The average number of permanent teeth for 13-year-old boys was 27 and for girls 27.7 ($p=0.46$).

Table 2. The average number of permanent teeth in 7–15-year-old children of Tallinn

Age (years)	BOYS						GIRLS					
	n	Mean	SD	Median	Min	Max	n	Mean	SD	Median	Min	Max
5	51	0.10	0.57	0	0	4	54	0.47	1.21	0	0	5
7	53	7.02	3.28	8.00	0	12	50	7.49	3.04	7.94	0	12
9	49	15.16	4.30	13.00	9	24	52	15.57	4.10	14.00	10	24
11	50	20.78	4.38	22.00	12	28	51	23.02*	3.81	24.00	12	28
13	50	27.04	1.52	28.00	22	28	51	27.67*	0.77	28.00	24	28
15	55	27.91	0.35	28.00	26	28	51	27.76	0.89	28.00	24	28

* Difference between means of boys and girls is statistically significant ($p \leq 0.01$).

Table 3. The mean body height of 5–9-year-old children.

Age (years)	BOYS						GIRLS						
	n	Mean	Med	Min	Max	SD	n	Mean	Med	Min	Max	SD	$p<0,05$
5	51	111.17	110.60	98.3	121.1	5.02	54	111.09	112.05	102.3	121.4	4.72	NS
7	53	125.24	124.50	115.7	135.4	5.23	50	124.78	125.00	106.5	139.9	6.04	NS
9	35	133.97	134.70	122.0	143.7	5.21	17	135.41	134.70	127.2	147.1	5.57	NS

At the age of 15 the process of eruption of permanent teeth was in its final stages, with the exception of the maxillary secondary molar. In 7.8% of girls the maxillary secondary molar had not erupted even at that age. At the age of fifteen the average number of permanent teeth was 27.9 for boys and 27.8 for girls.

The results of the study pointed out that the entire tooth eruption process of the second dentition tended to be earlier in females than in males. The only exception was maxillary secondary molars, which erupted earlier in boys. At the age of 11 there were statistically significant gender differences in the time of eruption of canines and secondary molars. At ages 13 and 15 there were significant differences between genders in the time of eruption of secondary molars. Statistically significant difference also occurred at the age of five for M1 eruption.

Table 3 shows the mean (± SD), median, minimum and maximum values of body height in 5- to 9-year-old children. Gender differences in body height of 5- to 9- years-olds were statistically insignificant.

In 5-year-old children body height and the number of erupted permanent teeth were not related. In 7- and 9-year-olds the Pearson correlation coefficients between body height and the number of erupted permanent teeth were moderate ($r=0.46$ at age 7 and $r=0.54$ at age 9) and significant. As a total for children aged 5 to 9 ($n=260$), the correlation coefficients between body height and erupted permanent teeth were high and significant ($r=0.86$) ($p<0.001$).

DISCUSSION

This cross-sectional study presented the average numbers of erupted permanent teeth in 5- to 15-year-old boys and girls living in Tallinn, Estonia, in six age groups.

The results of the present study showed, consistently with previous studies [2, 20], that the eruption of permanent teeth began at the age of five, but only in a few children. So, the average age of six years reported for the eruption of the first permanent teeth in most studies [7, 9, 10, 16, 19, 25, 27] is not in contradiction with our results. Rajić et al. [14] and Varul [21] have also reported considerably earlier beginning of teeth eruption.

Our data showed that in Estonian children the first two permanent teeth to erupt were first molars (M1) and, in some girls, medial incisors (I1) also. This confirms the results of some previous studies

[9, 16], although these studies did not indicate any gender differences in the eruption of central incisors. The tooth eruption process of Tallinn children was different from tooth development of Zagreb children [14], as in Zagreb the first lower molar and the lower central incisor began to emerge earlier in boys than in girls.

At the age of fifteen in most of Estonian children the eruption of permanent teeth was terminated, except for the maxillary secondary molars.

Comparing the teeth of upper and the lower jaw, there is a tendency for earlier eruption of lower jaw teeth in both genders. The same has been reported by other authors [11, 14].

Except for the maxillary second molars, the average age of eruption of permanent teeth was earlier in girls than in boys. Significantly earlier emergence ages in girls are in agreement with other studies on the emergence of permanent teeth [11, 26]. The reasons for the differences in tooth eruption in males and females are still poorly understood. It has been assumed that the earlier onset of permanent dentition is part of the differences in sexual maturity of both sexes at a given age [15]. Earlier eruption is generally taken as a sign of earlier maturation in the female, and it is possible that the later onset of puberty in the male is associated with catch-up development by the age of eruption of second molars.

The time of eruption of permanent teeth in the children studied was earlier in comparison with previous Estonian data [17], except for 7-year-olds and 15-year-old girls (Figure 1). Differences between previous and recent data in 15-year-old girls may be related to the fact that in this study the third molars were excluded. Compared to previous data collected in 1971 by N. Vihm, A. Kõdar and S. Russak [17], there was trend to later start of eruption of permanent teeth. This is also in concordance with studies Grünberg [5], and Veldre [23] indicating that puberty of Estonian children started relatively late.

In comparison with a previous Tartu study [21], Tallinn children had later emergence of permanent teeth – in Tallinn there were considerably fewer children with at least one erupted tooth at the age of five.

Our results indicated that body height had not significantly changed in 5- to 9-year-old children in comparison with studies carried out in 1971, in 1984–1985 [17] or in 1996–1997 [6] (Figure 2). In comparison with previous studies, steady mean body height has also been reported in Tartu children [22, 23].

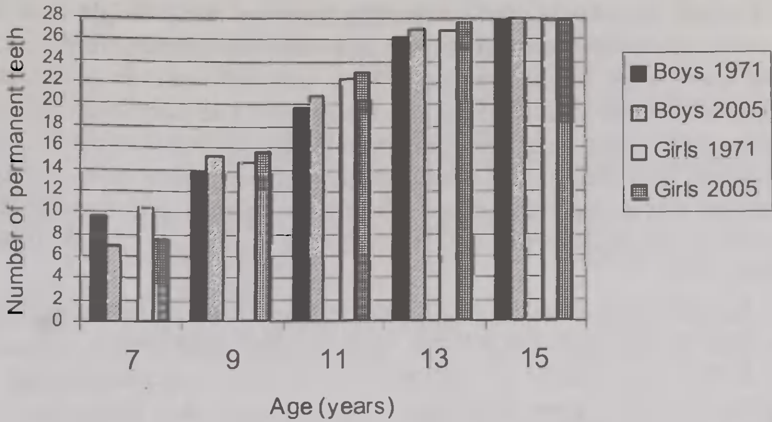

Figure 1. The number of erupted permanent teeth in Tallinn in 1971 [17] and in 2005.

Figure 2. Mean body height of children of Tallinn in 2005 in comparison with previous studies in 1971, 1984–1985 [17] and in 1996–1997 [6].

We could not detect any correlation between body height and the number of erupted permanent teeth in 5-year-old children. In 7- and 9-year-olds body height was correlated with the number of erupted permanent teeth significantly and positively. The correlation coefficient grew along with age. The overall high correlation coefficients between body height and mean number of permanent teeth showed that the permanent tooth count could be a useful maturity indicator. Tooth count could also be an indicator of variability of the studied population.

In conclusion, we can say that the eruption time of permanent teeth in Tallinn followed the patterns seen in other populations, although profound examination of sequence of permanent teeth eruption is required in the future. Our study also indicated that there could be significant regional differences in counts of permanent teeth of Estonian children.

REFERENCES

1. Demirjan A. (1998) Dental development. – In: The Cambridge Encyclopedia of Human Growth and Development. Eds.: S. J. Ulijaszek, F. E. Johnston and M. A. Preece. Cambridge University Press, 70–71.
2. Ekstrand K. R., Christiansen J., Christiansen M. E. C. (2003) Time and duration of eruption of first and second permanent molars: a longitudinal investigation. *Community Dentistry and Oral Epidemiology,* 31, 344–350.
3. Eveleth P. B., Tanner J. M. (1990) Dental development. In: Worldwide Variation in Human Growth. Cambridge, Cambridge University Press, 157–161.
4. Goodman A. H. (1998) Variation in time of tooth formation and eruption. In: The Cambridge Encyclopedia of Human Growth and Development. Cambridge, Cambridge University Press, 209–211.
5. Grünberg H., Thetloff M. (1997) Pubertal stages of Estonian children. *Papers on Anthropology* VIII. Tartu, University of Tartu, 84–89.
6. Grünberg H, Adojaan B., Thetloff M. (1998) Growth and growth disorders. Methodical instructions for evaluating children's physical development. Tartu, OÜ Tartumaa Trükikoda. (In Estonian, with summary in English.). 31 pp. and appendices.
7. Harris E. (1998) Dental maturation. In: The Cambridge Encyclopedia of human Growth and Develpoment. Cambridge, Cambridge University Press, 45–48.

8. Koch G., Poulsen S. (2001) Pediatric Dentistry – A Clinical Approach. Copenhagen, Munkgaard.
9. Kochhar R., Richardson A. (1998) The chronology and sequence of eruption of human permanent teeth in Northern Ireland. *International Journal of Paediatric Dentistry*, 8, 243–252.
10. Labotkina R., Kõdar A. (1992) Hammaste-lõualuude süsteemi areng ja kasv. Tartu, Tartu Ülikool. 28 lk.
11. Lerov R., Bogaerts K., Lesaffre E., Declerck D. (2003) The emergence of permanent teeth in Flemish children. Community Dent Oral Epidemiol, 31(1), 30–39.
12. Martin R. (1928) Lehrbuch der Anthropologie. Zweite, vermehrte auflage. Ester Band: Somatologie. Jena, Verlag von Gustav Fischer, 26–38, 117–204.
13. Pahkala R., Pahkala A., Laine T. (1991) Eruption pattern of permanent teeth m a rural community in North Eastern Finland. *Acta Odontologica Scandinavica*, 49, 341–349.
14. Rajić Z., Rajić-Meštrovic, Verzak Ž. (2000) Chronology, Dynamics and Period of Permanent Tooth Eruption in Zagreb Children (Part II). *Coll. Anthropol.*,24, 137–143.
15. Ritz-Timme S., Cattaneo C., Collins M. J. Waite E. R., Schütz H. W., Kaatsch H. J., et al. (2000) Age estimation: the state of the art in relation to the specific demands of forensic practise. *Int. J. Legal. Med.*, 113, 129–136.
16. Russak S., Nõmmela R., Saag M., Olak J. (2001) Suuõõne haigused ja nende ennetamine. http://www.ut.ee/tervis/hambad/index.htm
17. Silla R., Teoste M. (1989) The health of the Estonian youth Tallinn, Valgus. 288 p. (In Estonian, with summary in English, Russian and German).
18. Stewart R., Thomas K., Troutman Kenneth C., Stephen H. W. (1982) Pediatric Dentistry, Scientific Foundations and Clinical Practice. St. Louis, MO, CV Mosby.
19. Tehver J., Hussar Ü. (1979) Suuõõne ja hammaste histoloogia. Tartu, Tartu Riiklik Ülikool, 65.
20. Tälli H., Paves A., Nigesen U., Orgulas K. (1989) Abitabelid pediaatritele. Tartu, Tartu Riiklik Ülikool, 128.
21. Varul R. (2000) Jäävhammaste lõikumise järjekorra võimalik seos hambumus-anomaaliatega. *Hammas* 4.
http://www.hambatehnik.ee/ hammas/index.php?id=72
(http://www.eays.ee/konverents/2000/22.htm)
22. Veldre G. (1999) Differences that could be observed in 8–9-year-old Tartu children. Eesti antropomeetriaregistri aastaraamat 1999, Tartu, 210–219. /In Estonin with summary in English./

23. Veldre G. (2003) Somatic status of 12–15-year-old Tartu schoolchildren. Dissertationes Biologicae Universitatis Tartuensis 85, Tartu University Press.
24. Virtanen J., Bloigu R. S., Larmas M. A. (1994) Timing of eruption of permanent teeth: standard Finnish patient documents. *Community Dentistry and Oral Epidemiology*, 22, 286–288.
25. Wedl J. S., Schoder V., Blake F. A. S., Schmelzle R., Friedrich R. E. (2004) Eruption times of permanent teeth in teenage boys and girls in Izmir (Turkey). *Journal of Clinical Forensic Medicine*, 11, 299–302.
26. Wedl J. S., Schmeizle R., Friedrich R. E. (2005) The eruption times of permanent teeth in boys and girls in the Storman District, Schleswig-Holstein (Germany). *Anthropol. Anz.*, 63 (2), 189–197.
27. Зубов А. А. (1990) Зубы. В книг. Никитюк Б. А, Чтецов В. П (ред.): Морфология человека. Изд. Московского университета, 177–192.

ISSN 1406–0140