Papers on Anthropology

XIX

PAPERS ON ANTHROPOLOGY
XIX

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CENTRE FOR PHYSICAL ANTHROPOLOGY

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PREFACE

With the current collection we commemorate with deep sadness a long-time member of our International Editorial Board, Professor Gintautas Jurgis Česnys (23 April 1940 – 28 September 2009).

One of the papers by Estonian authors deserving attention is the continuation of the analysis of the 70 years of activities of the Anthropology Section founded by Juhan Aul on 19 April 1939. We have also finished collection of data for new norms of Estonian school students' (aged 7–18 years) height, weight and body mass index. In this collection the data of 10 years ago are compared with the current data.

We thank all the authors for their interesting articles on diverse topics and look forward to continuing cooperation with them in the future.

Helje Kaarma

Prof. Helje Kaarma

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In memoriam

Professor Dr. Gintautas Jurgis Česnys, 23 April 1940 – 28 September 2009

This spring Professor Dr. Gintautas Jurgis Česnys would have celebrated his 70th birthday. Alas, the event happened to be "In Memoriam"... The community of anthropologists, archaeologists and medical professionals has lost this bright and prominent personality, whom several generations will call the Teacher. His heart, already weak, refused to carry on.

Professor Česnys was born into a family of High School (Gymnasium) teachers. His entire professional life was closely connected with the Faculty of Medicine of Vilnius University: since graduation, he worked in the Department of Anatomy, Histology and Anthropology as an assistant (1963–1974), as an associate professor (1974–1988) and from 1988 until his death as a professor. In 1988–2000, he was the Head of the Department and from 1989 to 1999 the Dean of the Faculty of Medicine. He occupied numerous significant positions that were related to policies reforming academic life and the health care system in Lithuania: the expert member of the Lithuanian Academy of Sciences, member of the Lithuanian Scientific Council (1991), the National Health Council (1998), the Vilnius City Council (2000) and the Lithuanian Committee of Bioethics (since 1997). The scope of the Professor's interests was very wide – science, art, literature, history, the individual and society, nation and state.

Gintautas Jurgis Česnys was one of the creators of modern anthropology in Lithuania. His early research focused on physical and psychomotor development of infants. He was the first who performed longitudinal investigation on infants, which formed the basis of his first dissertation, defended in 1970.

Later on, he started fundamental investigations of ancient populations of Lithuania and the Eastern Baltic area. It was his initiative and efforts to collect all the skeletal materials from archaeological excavations and deposit them in our department; a collection that now contains over 15,000 skeletons – a basis for his own studies and for the studies of numerous other researchers. His works on craniology, palaeodemography, palaeosomatology and population history relate to a time period covering 7,000 years, from Mesolithic until Early Modern times. The data were collected in various centres in Russia, in Minsk, Riga, Tallinn, Warsaw, Krakow, Poznan, Lodz, etc. The major part of these studies was summarized in his second thesis "Anthropology of ancient inhabitants of Lithuania", defended in 1986.

His original findings and ideas, summarised in eight books, two monographs and a hundred and twenty-nine papers, had a significant impact on science, and are frequently quoted.

As a scholar, he managed to overcome the obstacles caused by the Iron Curtain, and established countless professional and personal contacts with the researchers in the West, becoming a valued partner in academic networks. These contacts very much paved the way for his students to become members of the international scientific community.

Having been a charismatic, very open and modest personality, Gintautas Česnys was always surrounded by large circles of students and followers, for whom he served as a mentor and whom he inspired in their studies, research and work not only in anthropology but also in human anatomy, medical terminology, history of medicine and bibliographic research, among others. G. Česnys left a vast scientific bibliography, also numerous papers popularising anthropology, even some phonography, but most importantly – he established biological anthropology as an essential scientific discipline at the intersection of biology, medicine and the humanities. We do regret that only an outline and sketches of his last work – the history of anthropology in Lithuania – remained in computer files.

G. Česnys during his second thesis defence, Institute of Anthropology, Moscow University, 1986.

With student researchers a during visit in Riga, the Museum of History of Medicine, 1981.

G. Česnys – a soloist with his beloved folklore ensemble, c.1990.

Lithuanian delegates at the Tartu anthropological conference, 1985.

G. Česnys with "his" skull collection, 2009.

G. Česnys at the conference "Archaeology of terror", Tallinn, 2005.

Serving as the Dean, he also made the facilities of the medical faculty the site of cultural events. Being himself more than just an amateur baritone singer, he infused the spirit of the humanities into the academic atmosphere of the Faculty of Medicine and into the entire university.

Gintautas Česnys' scientific skills, as well as his passion for arts and humanities, finally – his engagement as a citizen were fully unveiled in his particular interest – in the commemoration of his father, whom he lost just a few moths after birth. His father Antanas Česnys, a gymnasium inspector, fell a victim of the very first wave (July 1940) of stalinist oppressions. Already being a professor, G. Česnys rediscovered and reconstructed his father's life and fate from extensive archival research. This study ("I am proud of my Father") G. Česnys considered to be his third dissertation.

Professor Gintautas Česnys always felt a great sympathy for Tartu University and for Estonia. He was among regular and active participants of anthropological conferences, which were taking place during the last decades. He considered a great honor for him to have an invitation to participate in the search, exhumation and indentification of the remains of Konstantin Päts, the late president of the Republic of Estonia, in 1990. For this work, he was awarded with “Terra Marianna” cross of the Estonian Republic in 2005.

Being fond of our Professor, we are facing a duty to preserve at least a part of his spirit.

Rimantas Jankauskas

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SEVENTY YEARS OF THE ANTHROPOLOGY SECTION OF THE ESTONIAN NATURALISTS' SOCIETY (PART II)

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Part I of the current article, published in the previous issue of *Papers on Anthropology*, gave a short characterization of the Estonian Naturalists' Society and viewed the emergence of its specialized subsidiary units. It described in greater detail, the foundation of the Anthropology Section in 1939 and the preceding period, 1853–1939, in the Society, assessed from the viewpoint of anthropology. Thereafter, the most essential facts were presented as excerpts from the annual reports of the Anthropology Section until the year 1994 (incl.).

After the demise of Prof. J. Aul at the end of August of that year, the Section was headed by Dr. L. Heapost who did it until April 2004 [11].

The second part of the article deals with the activities of the Anthropology Section during this period, presenting excerpts from the Section's annual reports.

In 1995 two research paper presentation meetings were held where eight papers were presented

11 October: Meeting to celebrate Prof. J. Aul's 98th birth anniversary: J. Kärner, *Memories about cooperation with Prof J Aul*; H. Kaarma, *An overview of the activities of the Centre for Physical Anthropology at the University of Tartu 1994–1995*; G. Veldre, *On body types of 8–9-year-old children of the town of Tartu*; K. Kalling, *The 13th-century inhabitant of Tartu from the anthropological aspect*.

18 December: J. Raud, *Influence of mother's height, weight and weight gain during pregnancy on the weight and status of the newborn*; J. Peterson, *Relations of women's body build to various medical and social problems* (based on literature); V. Loolaid, *On a health protection endowment project on analysis of secondary school girls' body build*

and nutrition; L. Heapost, *An overview of the work of the anthropology section of the 8th FU Congress in August 1995*.

28 February, K. E. von Baer's birth anniversary: J. Peterson, *K. E. von Baer's anthropological works*.

27 April, at the general meeting of Estonian Naturalists' Society: M. Viikmaa, *On population genetic heterogeneity of Estonians*.

From 29 May to 2 June the 7th Tartu International Anthropological Congress was arranged in Tartu and Kääriku.

Collection of articles *Papers on Anthropology VI* was published in print [1].

On 16 October 1996 the Anthropology Section held a research paper presentation meeting dedicated to J. Aul's 99th birth anniversary. Presentations were made by J. Raud, *The anthropological factor among other risk factors in obstetrics*; E. Maiste, *On possibilities of classification of 15-year-old girls' body measurements*; M. Thetloff, *New growth curves of Estonian schoolchildren*; L. Heapost and G. Veldre, *Impressions from the conference in Brussels*.

Preparations were made for the 8th Tartu International Anthropological Congress.

Collection of data for Estonian schoolchildren's (aged 7–18 years) growth curves was completed. The data were entered into the Estonian Anthropometric Register and were also given to the Ministry of Social Affairs for being used at schools.

Participation in international events:

1. L. Heapost and G. Veldre made a presentation at the 10th Congress of the European Anthropological Association in Brussels from 18–22 August.
2. H. Kaarma and J. Peterson made a presentation at the 30th Congress of the Nordic Federation of Societies of Obstetrics and Gynecology in Stockholm.
3. H. Kaarma, M. Thetloff and G. Veldre made a presentation at the 6th Congress of Lithuanian Morphologists in Kaunas [2].

In 1997 the Section held two research paper presentation meetings where two papers were presented:

29 October: H. Kaarma and G. Veldre, *On teaching research methods of anthropology in Estonia* (was transmitted on television).

12 November: J. Peterson, *Problems of health, body build, temperament and nutrition of female students of different ages.*

The 8th Tartu International Anthropological Conference was prepared and held.

Conference abstracts, *Papers on Anthropology VII* and a revised edition of Juhan Aul's bibliography were published in print.

National refresher courses for district and family physicians were arranged:

1) 8–12 April, *Analysis of medical and anthropological data on the computer.* Supervisors H. Kaarma and L. Saluste.
2) 9–13 September, *Present-day views on nutrition.* Supervisors H. Kaarma and L. Saluste. Lectures were delivered by T. Vihalemm, H. Kaarma, V. Loolaid, S. Teesalu, L. Kiisk, G. Timberg, M. Rokk and V. Salupere.

Participation in international events:

1. J. Peterson participated in a world conference on nutrition in Montreal and made the presentation *Young women's body build model for studies of nutrition.*
2. G. Veldre made a presentation at the world conference of auxology in Philadelphia, *Methodology of determining fractioned body volume of children aged 8–9 years.*
3. L. Heapost participated in the symposium *The Future of the Past in East Europe: New Visions of the Peoples & Societies that Formed the Present* in Lódź with the presentation *Genetic heterogeneity of Fenno-Ugrians (on the basis of Estonian modern and archaeological material)* [3].

In 1998 the Section held one research paper presentation meeting:

15 October: Meeting to celebrate Prof. J. Aul's 101st birth anniversary:

17 December: Annual report meeting where members of the Anthropology Section (15 participants) reported on their research activities. H. Kaarma presented an overview of the work of the Centre for Physical Anthropology at the University of Tartu

On 23 April the national anthropological conference *Body Build and Health* was held.

Yearbook of the Estonian Anthropometric Register 1998 and methodological instructions *Body Build Structure of Women, Pregnant Women and Newborns* were published in print.

Two refresher courses for family physicians were arranged:

1) *Analysis of medical and anthropological data on the computer*, 8 participants.
2) *The nutritional factor in health promotion and medicine*, 18 participants.

Participation in international events:

1. H. Kaarma, L. Heapost, J. Peterson and M. Thetloff particpated in and made a presentation at the 11th Congress of the European Anthropological Association in Jena from 30 August to 3 September.
2. L. Heapost participated in the 2nd congress of Fenno-Ugric history.
3. G. Veldre made a presentation at an anthropological congress in Williamsburg, USA [4].

In 1999 the Section held one research paper presentation meeting:

15 October: Meeting to celebrate Prof. J. Aul's 102nd birth anniversary with four presentations.

19 December: Annual report meeting where the research work of the members of the Anthropology Section was analysed.

On 21 April, in cooperation with the Centre for Physical Anthropology at the University of Tartu, the national anthropological conference *60 Years of the Anthropology Section of the Estonian Naturalists Society* was organized.

Yearbook of the Estonian Anthropometric Register 1999 and *Papers on Anthropology VIII* were published in print.

Two refresher courses for family physicians were arranged:

1) *Analysis of medical and anthropological data on the computer*, 7 participants.
2) *The nutritional factor in health promotion and medicine*, 18 participants.

Participation in international events:

1. On 2 February J. Kasmel made a presentation at the conference dedicated to the 125th birth anniversary of Prof. A. Starkov at Latvian Medical Academy in Riga, *On the role of Privatdozents*

J. S. Weinberg and A. E. Landau in teaching anthropology at the University of Yuryev (Tartu) in the early 20th century.

2. On 9 April J. Kasmel made a presentation at the conference dedicated to the 100th birth anniversary of Prof. V. Derums at Latvian Medical Academy, *On the student years of the Latvian anatomist and anthropologist Prof J. Primanis in Yuryev (Tartu) from 1911–1913.*
3. On 20 April, at the conference of the Department of Biomedical and Biosocial Anthropology of St. Petersburg Medical Academy, J. Kasmel presented a short overview about teaching anthropology at the University of Yuryev (Tartu) in the first quarter of the 20th century.
4. On 9 June presentations were made at the 3rd conference of Russian ethnographers and anthropologists dedicated to the 275th anniversary of the Russian Academy of Sciences: J. Kasmel, *An overview of Prof. A. F. Brandt's activities in Tartu from 1922–1932*; L. Heapost, *An overview of Estonians' genetic divergence*; G. Veldre, *An overview of Estonian children's somatotypes.*
5. On 1 July L. Heapost made a presentation at the symposium *Roots of the peoples and languages of North-Eurasia III* at Loona in Saaremaa, *On the anthropology and genetics of Estonians.*
6. On 29 August G. Veldre made a presentation at the 4th Czech Anthropological Congress, *On age-related changes in Estonian schoolchildren.*
7. On 16 October J. Kasmel made a presentation in the section of history of medicine at the 19th Baltic conference of history of science in Kaunas, *On anthropology at the University of Yuryev (Tartu) in the first decade of the 20th century* [5].

In 2000 the Section held one research paper presentation meeting:

19 October: Meeting to celebrate Prof. J. Aul's 103rd birth anniversary with five presentations.

20 December: Annual report meeting where the research work of the members of the Anthropology Section was analysed.

On 28 April, in cooperation with the Centre for Physical Anthropology at the University of Tartu, a national anthropological conference was organized.

Yearbook of the Estonian Anthropometric Register 2000 and *Papers on Anthropology IX* were published in print.

Participation in international events:

1. In May J. Kasmel and K. Kalling made presentations at Latvian national conference of anthropology.
2. In July G. Veldre made a presentation at JUAES international Conference in Beijing, China, *On body fat content of pubertal girls and boys*.
3. In August L. Heapost made a presentation at the 9th Congress of Finno-Ugrists in Tartu, *Baltic Finns and Indo-Europeans. An anthropological aspect*. H. Kaarma participated in the Russian conference of biomedical anthropology in Belgorod.
4. In September R. Stamm made a presentation at the 12th Congress of the European Anthropological Association in Cambridge, *On the possibilities of using anthropometric data in medicine, health promotion and sports* [6].

In 2001 the Section held one research paper presentation meeting:

18 October: Meeting to celebrate Prof. J. Aul's 104th birth anniversary with six presentations.

19 December: Annual report meeting where the research work of the members of the Anthropology Section was analysed.

On 19 April, in cooperation with the Centre for Physical Anthropology at the University of Tartu, a national anthropological conference with six presentations was organized.

Yearbook of the Estonian Anthropometric Register 2001 and *Papers on Anthropology X* were published in print.

Participation in international events:

1. J. Kasmel and L. Heapost presented abstracts for the 4th conference of Russian ethnographers and anthropologists in Nalchik in September.
2. G. Veldre and L. Saluste participated in the Belarusian anthropological conference in September and made presentations there [7].

In 2002 the Anthropology Section held one research paper presentation meeting:

17 October: Meeting to celebrate Prof. J. Aul's 105th birth anniversary with six presentations.

20 December: Annual report meeting where the research work of the members of the Anthropology Section was analysed.

On 18 April, in cooperation with the Centre for Physical Anthropology at the University of Tartu, a national anthropological conference with five presentations was organized.

Yearbook of the Estonian Anthropometric Register 2002 and *Papers on Anthropology XI* were published in print.

Participation in international events:

1. L. Heapost participated in the 4th international congress of integrative anthropology in St. Petersburg.
2. G. Veldre made a presentation at the 13th Congress of the European Anthropological Association in Zagreb [8].

In 2003 the Section held one research paper presentation meeting:

23 October: Meeting to celebrate Prof. J. Aul's 106th birth anniversary with five presentations:

18 December: Annual report meeting where the research work of the members of the Anthropology Section and Gudrun Veldre's doctoral dissertation were analysed.

Papers on Anthropology XII was published in print.

Participation in international events:

1. J. Kasmel and L. Heapost presented abstracts for the Russian anthropology and ethnology conference which was held in Omsk in June.
2. H. Kaarma, M. Lintsi and M. Lember made a presentation at the international Baltic conference of family physicians.
3. H. Kaarma, M. Lintsi and J. Kasmel made a presentation at Prof. V. Backman Memorial Conference in Riga [9].

To the meeting of the Anthropology Section on 21 April 2004, Dr. L. Heapost, who had been head of the Section for nearly ten years, had submitted an application for resignation from the duties of the head of the Anthropology Section of the Estonian Naturalists' Society. After the approval of her application the new head was elected. Prof. H. Kaarma proposed that G. Veldre, who had been secretary of the Section from 1996, should be elected as new head of the Anthropology Section. No other candidates were nominated. By open ballot G. Veldre was unanimously elected as head of the Anthropology Section. The meeting was attended by six members of the Section [10].

An overview of events at the Anthropology Section under her supervision until 2009 and a summary of the most essential activities of the 70-year-old Section will be published in next issue of *Papers on Anthropology*.

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SKELETAL STRESS-MARKERS IN THE EARLY MODERN TOWN OF PÄRNU, ESTONIA

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ABSTRACT

Human skeletal remains from St. John Cemetery of the Early Modern Times town of Pärnu (16^{th}–18^{th} century) were studied. The stress-markers on the bones and the teeth indicating the consequences of disruptive events on the individual and populations level were analysed. Skeletal biologists have developed numerous skeletal indicators and demographic measures that can be used to assess the response to stress in prehistoric human groups. In the current study an attempt was made to evaluate the physiological stress level of inhabitants of the Early Modern Times Estonian town. The general stress-markers like sexual dimorphism in the adult stature; the growth curves of children; *cribra orbitalia*; linear enamel hypoplasia; specific diseases, infections and traumas on skeletons were studied.

***Key words:** stressmarker, Military community, urban, rural*

INTRODUCTION

To evaluate the lifestyle of the past people, not only their income and wealth but also their health is a very important indicator of the quality of life [56]. Physiological disruptions from impoverished environmental circumstances – “stress” – is central in the study of health and well-being in earlier human societies [33]. Although archaeological human samples are commonly biased samples of the original living population and inferences based on such samples have the potential to be misleading, the skeletal measures are, in many cases, the only way to analyse the health and well-being of historical populations. Generally, the indicators of stress are the growth disruption, diseases and death itself is also a consequence of stress [19]. Usually the osteologist, odontologist or bioarchaeologist can note on bones and teeth many indicators of physiological stress: changes in the size and shape of bones and teeth, changes in the microstructure of bones and teeth, the chemical composition of bones and teeth, growth interruptions/retardations, specific pathologies, traumas and so on. There are numerous skeletal indicators and demographic measures that can be used to measure the response to stress.

Most of these stress-markers are "non-specific" which means that one cannot indicate the exact reason and aetiology of these lesions. Usually such non-specific stress-markers (certain changes in the skeleton) indicate that the individual suffered from an infection, parasites, the deficiency of minerals or vitamins and/or general undernutrition. The causes of undernutrition the false diet or infectious diseases are usually connected with the environment where individuals come from. The consequences of stress experienced by individuals depend on a number of factors such as genetic susceptibility, age, sex, and resiliency [21].

The aim of this paper is to describe the indicators of stress response on the Pärnu military skeletal population and to make some conclusions concerning the lifestyle, health and nutritional conditions of these individuals.

MATERIAL AND METHODS

Material

The Cemetery of Pärnu Jaani Church was established at the turn of the $16^{th}/17^{th}$ century. At first the cemetery was used by the local Lutheran community. From 1617 it became a burial place for the officers of the Pärnu garrison and their family members. It is known from history that the military men of Pärnu garrison were not only Estonians, but also Swedes, Russians and Finns who were in service. The cemetery was overhanded to the Russian garrison in 1714, in 1750 the cemetery was abandoned. There were fixed 257 burials from the cemetery (archaeologist Villu Kadakas, AGU-EMS), 117 skeletons, including some separated long bones, were deposited in the Pärnu Museum. The skeletal material was analysed osteologically in the framework of a bigger project the aim of which was to study the anthropology of the inhabitants of the Hansacatic Town Pärnu [9]. The current study mainly concentrates on physiological stress-markers on bones and teeth of Pärnu St. John's Church Cemetery skeletons, which are probably the remains of the Pärnu military community of the 16^{th}–18^{th} centuries. Individuals of Pärnu Cemetery had round-headed skulls, the high braincase and a high and wide facial part of cranium. This craniological type is not widely spread in Western Estonia. Skeletons belong to the northern gracile odontological type, which is also not widely spread in Western Estonia [8, 9]. Probably most of these individuals who were buried into cemetery were not of local origin and had come to the garrison from different parts of Europe.

Methods

For ageing and sexing skeletons different widely known techniques were used [1, 13, 14, 15, 39, 40, 51, 59, 61, 63]. To describe the skeletal manifestations of physiological stress, the following stress-markers were analysed: **The adult stature**. The measurements of long bones (*humerus, ulna, radius, femur and tibia*) of both body sides were taken according to Martin & Saller (1957). The stature of adults was reconstructed according to Trotter & Gleser (1952). **Growth curves of children.** The diaphyses of all the available long limb bones of both body sides were measured and the stature of children was reconstructed according to Telkkä et al (1962).

Cribra orbitalia. Spongy lesions in the orbital roofs were registered for all the observed individuals who had at least one intact eye orbit. The presence of osseous lesions was studied macroscopically [47] and the frequency of affected individuals was calculated separately in children and in individuals over 15 years of age. ***Linear enamel hypoplasia*** was registered macroscopically on all the permanent teeth. Included were the individuals from the age of 7 years. Only those individuals who had at least one upper central incisors and one lower canine (which are most hypoplastic teeth) were included. The severity of hypoplasia was recorded according to Brothwell 1972. **Specific metabolic and infectious diseases** which leave skeletal "signatures" on the bone in progressed stages (for example, syphilis, tuberculosis, rickets, scurvy and, etc.) were also registered according to the descriptions presented in literature [10, 42, 49]. **Traumas** – fractures, injuries and deformations of bones were also registered. The statistical package SPSS was used for data processing. Statistically significant differences between groups were found using the t-test.

RESULTS

The age and the sex structure of the Pärnu skeletal population. The number of male skeletons is 44 and the number of female skeletons is 36, masculinisation index 1.22 indicates slight predominance of male graves in the excavated part of cemetery. The result is not surprising as the cemetery was mainly in military use. In Latvian 13^{th}–18^{th} century urban skeletal samples the masculinisation indices vary between 1.27–3.2 [65], in the Tallinn 16–17^{th} century churchyard the masculinisation index was 1,08 [6]. Proportions of subadults and adults are 28.3% and 71.7% respectively in Pärnu St John's skeletal population (Fig. 1). In Estonian rural and urban populations the proportion of subadults is commonly higher, in the Makita village cemetery 60.8% [22], in Tartu in the 13^{th}–14^{th} century St John's Church 55.2% [28], in the Tääksi 14^{th}–18^{th} village cemetery 57.6% [3], in Tallinn the 16^{th}–7^{th} century churchyard 27.7% [6], in Siksälä the 11^{th}–15^{th} century village cemetery 49.2% [23]. The number of infants is not representative in the Pärnu St John's Church skeletal sample, it should have been higher than 2.3%. The age structure of the skeletal sample of the 16^{th}–17^{th} century churchyard in Tallinn (Suur-Kloostri Str 14) was also biased; the proportion of infant burials was 5.5% from the total number of burials. Children of 10–15 years of age constitute 33.3% of the total number of buried subadults, it may refer to the nursing home or school closely related to the church [6]. The absence of infant skeletons in the Pärnu material is possibly due to the frequent burials in the cemetery, the peculiarity of the excavated area (only a part of the cemetery was excavated) or to the excavation techniques. The number of buried females in the age group 20–24 years is also noteworthy, some authors have argued that the elevated number of female deaths in this age group can be caused by childbirth [64].

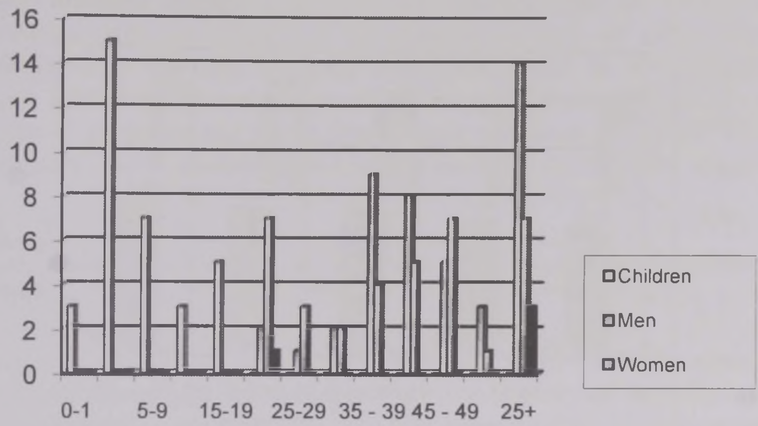

Fig. 1. Number of individuals in certain age and sex groups.

The adult stature and sexual dimorphism is presented in Figure 2. The stature of the Pärnu garrison males and females is comparatively small, but at the same time sexual dimorphism in the stature is well expressed [7, 9]. The same concerns the later skeletal sample of the town of Viljandi [27]. It seems that in later populations the living conditions were better [7, 9].

Growth curves of children. The reconstructed stature of the Pärnu garrison children and the comparative data are presented in Figure 3. Lithuanian children – a summarized sample [26] and the urban one [52] indicate a higher stature in most age groups in comparison with Estonian children [7]. Exceptional are the children of the Pärnu garrison growing nearly in the same rate or even slightly faster after 3 years of age. The children of suburban Tallinn are the shortest ones until the age of 11–12 years when they nearly catch up the body height of Lithuanian populations. Unfortunately the osteological data for Pärnu and Tääksi children are few to make a conclusion about the stature and growth rate after 9 years of life.

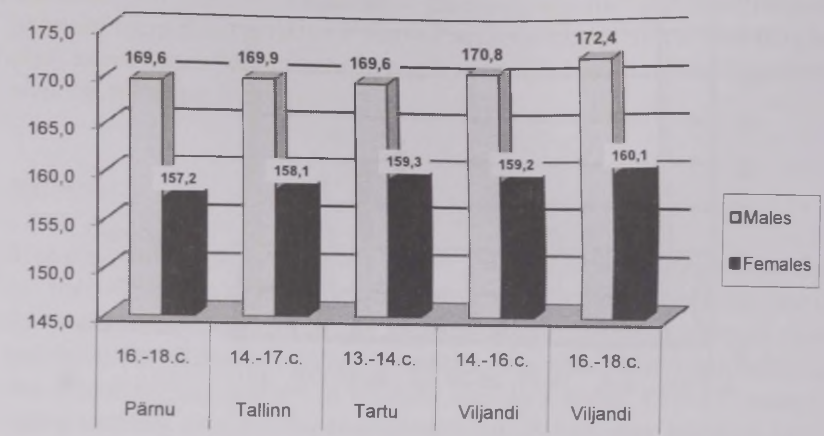

Fig. 2. The stature and sexual dimorphism in Estonian urban skeletal samples.

Fig. 3. The body height of children of the Pärnu garrison community and comparative data: (St Barbara, Tääksi – Allmäe 1997, 1998; Lithuanian summarized – Jankauskas 1992; Pärnu – Allmäe & Limbo 2008; Alytus – Sereikiene & Jankauskas 2004).

Cribra orbitalia occurred in 50% of children and in 15.5% of individuals over 15 years and up. Severe degrees of cribra were registered only for two children. For comparison: in the 14th–18th century Tääksi village cemetery *cribra orbitalia* occurredon 44.1% of children's' skeletons and on 23.1% of adult skeletons [4], in the 12th–14th century Danish sample the respective numbers are 50% and 10–20% [11].

Linear enamel hypoplasia, which shows childhood metabolic stress episodes, occurred in 42 individuals of 47 (89.4%). This is similar to the rural populations of Medieval and Early Modern Europe where the occurrence of LEH is around 80% [35, 43, 44]. The strength and duration of stress episodes is bigger when the severity of stresslines on the teeth enamel is stronger [24, 44]. The mean severity of defects was 1.19 for the Pärnu populations. In Danish and Lithuanian Late Medieval/Early Modern samples severity was higher, reaching up to 1.87 in the Vilnius suburb [44]. Strong defects of LEH were very seldom seen in the Pärnu sample; only two individuals had LEH degree 2 and most severe defects (degree 3) were not observed. All the observed children were affected and the mean severity of defects for children was 1.5.

In the Pada group LEH formed more frequently at the age of 2–3 years and 4.5–4.5 years (Fig. 4).

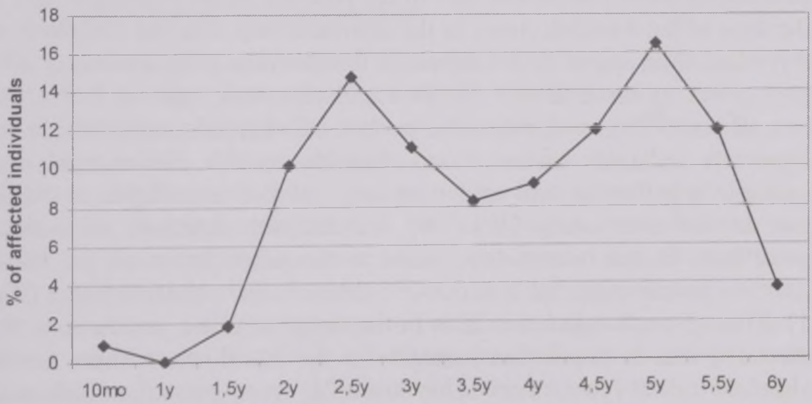

Fig. 4. LEH affected individuals in certain age groups.

Earlier studies in the Pärnu group have shown that LEH occurred slightly more often in women, the severity of LEH did not differ between men and women. The only difference between men and women was the age of the formation of defects [9, 36].

Specific diseases and infections. Clear skeletal signatures of far developed bone tuberculosis were registered on the skeleton of 12-year-old children. Skeletal changes typical of syphilis were registered on the male skeleton, died at the age 50 years or up.

Traumas. Traumatic lesions of facial and cranial part of the skull were observed on six individuals. Two females and one male had healed fractures of nasal bones. One male had a healed fracture of the left side of mandible. A 15-year-old boy had a healed fracture of the cranial vault, two adult males had healed fractures of ribs and one had it on the innominate bone.

DISCUSSION

Overall morbidity and mortality, access to resources and social care

From historical data it is known that the living conditions of ordinary soldiers in the Livonian garrisons were quite bad [32], the analyses of the Pärnu garrison skeletal sample do not indicate poor living conditions in comparison with other Estonian skeletal samples [9]. Historical documents show that almost half of the soldiers in the Pärnu garrison at the time of the Swedish Army in the Garrison were married and many of them had their wives and children in the garrison [32]. The army also kept count of the soldier's children and also took care of them. The overall morbidity and mortality pattern of skeletal population is an important indicator of stress and depends on the environment. For example war, famine and epidemics may cause a remarkable mortality rate in the community [20]. The age and sex structure of skeletal population is not remarkably biased in the adult group of the Pärnu garrison community, but it is out of balance in the subadult group (Fig. 1). Masculinisation index 1.22 is in the range of urban populations, the mortality rate in population increases in the late thirties. There are no signs of catastrophic events (for example, mass-graves), which may refer to the military activity, epidemics or famine. Unfortunately the demographic data of the Pärnu skeletal sample are few to estimate the stress on the population level and to make important conclusions of mortality and living conditions. The signs of violence on skeletons were few and are plausibly the results of domestic violence or accidents. Only six individuals have had traumas in the facial and the cranial part of the skull; no fractures of long limb bones were registered, two individuals had healed fractures of ribs and still another had a healed fracture of the innominate bone [9]. Thus, it was mainly the garrison cemetery, most likely the deceased buried here died of natural causes, not because of the war, famine or epidemics. Some of the stress-markers can show the actual cause of stress. For example, a number of infectious diseases leave skeletal "signatures" on the bone in progressed stages. Tuberculosis, syphilis and leprosy cause skeletal changes that are specific to the pathogen [12, 37, 49]. All these are population density-dependent diseases and the incidences of these diseases are higher in urban societies. The evidence of syphilis in Estonian past populations is, for example, recorded in the Kaberla village cemetery of the 13^{th} –17^{th} century. [29]. Two skeletons were found with the signs of specific diseases in the Pärnu skeletal sample: one case of bone tuberculosis and one case of syphilis [9]. In both cases the diseases were in the progressed stages, these members of the community needed special care and medical treatment – consequently, the community had enough recourses to take care of these members society.

Non-specific stressmarkers – the indicators of nutrition, social status and overall living conditions

The adult stature and sexual dimorphism. The attainable stature of each individual is determined genetically, but in the course of growth and development the individual adjusts biologically to environmental conditions [55]. Cross-sectional systematic differences in the height between different income groups have been established, without exception, everywhere and for all the time-periods [31]. We must bear in mind that the Pärnu garrison community had a varied origin [8, 9], military men and their families came from Sweden, Russia, Finland, etc., thus their adult body height was attained somewhere else – not in the environment the town of Pärnu, thus the stature and sexual dimorphism in the stature (SD) is more an indicator of their social status and the environment of their childhood and is not reflecting their environment of their adulthood – the town of Pärnu. The formation of sexual dimorphism (SD) in the population is slow process; SD does not derive directly from social and environmental conditions influencing the populations at the moment [50]. The average stature of the Pärnu 16th–18th century inhabitants is relatively small in comparison with other contemporaneous towns in Estonia, Tallinn and Viljandi (Fig. 2), the genetic reasons are most likely.

The average male stature in the Pärnu garrison community is comparable to the males in the 13th–14th century Tartu. The females of the Pärnu garrison community were also the shortest ones in comparison with Tartu and Viljandi females; it is noteworthy is that at the same time the average female stature was highest in the the Tartu 13th–14th century community in comparison with Viljandi and Pärnu. Women are taller, relative to men, in the societies where women contribute more to food production – their access to food is better and their nutritional status is better in these societies [25]. On the other hand, it is commonly known that men are more sensitive to the nutritional stress [18, 57]. Sexual dimorphism in the stature is well expressed in the Pärnu community in comparison with other urban populations of Estonia. SD in the body height refers to the living conditions of the community, especially indicating the access to resources and nutrition in childhood, both are linked to the individuals' status in society. Estonian urban and rural populations of the 13th–18th centuries are different from the Scandinavian ones, where the stature is higher and SD more expressed in urban populations, in Estonia the rural populations indicate a higher stature and a better expressed SD in the stature – consequently the living conditions and the access to resources were better in the 13th–18th century rural areas than in towns [5]. SD in body size and its variation between populations is not a solved problem; the causes are not clear despite the years of research. From ecology it is known that the growth and development of organisms is influenced by several factors, but the most important one is the limiting one. Regardless of most factors, being favorable, the only limiting one becomes dominating. It is a complicated task to suppose which one was economic, environmental or genetic that caused the hampering in growth in ancient as well historical populations [7]. Well expressed sexual dimorphism in the stature in the Pärnu garrison community is probably a good indicator of their social status, the military men and their wives grew up in good conditions, where access to resources, especially to food, and parental care in childhood were good.

Growth curves of children. When SD in the adult stature enables us to assume their overall social status and the quality of living conditions in their childhood, then the skeletons of children and infants of the Pärnu garrison cemetery are even more valuable for this kind of assumptions. These children were probably born and lived in the community and are reflecting the environment more directly. The children of Pärnu garrison of the 16th–18th century were of higher stature than the children in the Tallinn 14th–18th century suburban population and in the Tääksi 14th–18th century village cemetery (Fig. 3). The growth curve of Pärnu children is a good indicator of their relatively better living conditions. Higher social status, linked to income and education, is highly correlated with the taller physical stature [55]. The growth process can be influenced by economic stress; the growth velocity may diminish for certain periods of childhood or adolescence [16]. The children in the earlier town (Tallinn suburban 14th–17th cc) were shortest, the children in the contemporary rural area (Tääksi village of 14th–18th cc) were slightly taller, and the children of Pärnu from the 16th–18th century garrison (the latest community) were the tallest ones. The access to food and parental care were better in the military community. The differences in the growth rate between urban and rural children and between early and late populations were found.

Cribra orbitalia. Pitting and porosity in orbital roofs is usually linked to chronic acquired anemia, which has resulted in the hyperplasia of the hematopoietic bone marrow in order to increase erythrocytes production [30, 54, 62]. The prevalence of this condition may be a result of chronic diarrhea; low nutritional value food intake (lack of foods of animal origin); or intestinal parasites; or combinations of these [37, 49, 62].

In the studied Estonian skeletal sample of the 14th–18th century. Tääksi village the occurrence of *cribra orbitalia* was almost similar to the Pärnu 16th–18th century urban sample. In the skeletal sample of the Pada stronghold of the 12th–13th century. *cribra orbitalia* was less frequent. Similar or even higher frequencies of *cribra orbitalia* like in the Pärnu and the Tääksi group are registered in other contemporary European skeletal samples (Fig. 5). Only Lithuanian populations of the

Early Modern times (Alytus, Kaimas) show lower frequencies of *cribra orbitalia* similar to the Estonian Iron Age/Early Medieval population of Pada. It seems that the occurrence of *cribra orbitalia* is higher in urban populations – this is understandable as the main cause of cribra orbitalia – acquired anaemia, is mainly caused by infections which are population density-dependent.

The aetiology of porotic lesions on orbital roofs may evolve via several mechanisms: parasite-induced blood loss and diarrhoea (both iron and magnesium malabsorption) or anaemia as a hepcidin-mediated body adaptive response to infection [17]. Probably the investigated Pärnu population was exposed to frequent infections, including parasitic ones, which led to the development of porotic bone lesions. The fish parasites (for example, *Diphyllobotrium latum*) cannot be excluded in the case of the Pärnu community because these people had access to fresh water fish. Anaemic conditions which cause *cribra orbitalia* are more related to infections and pathogenic stress than to diet [17], the same probably concerns the Pärnu garrison community.

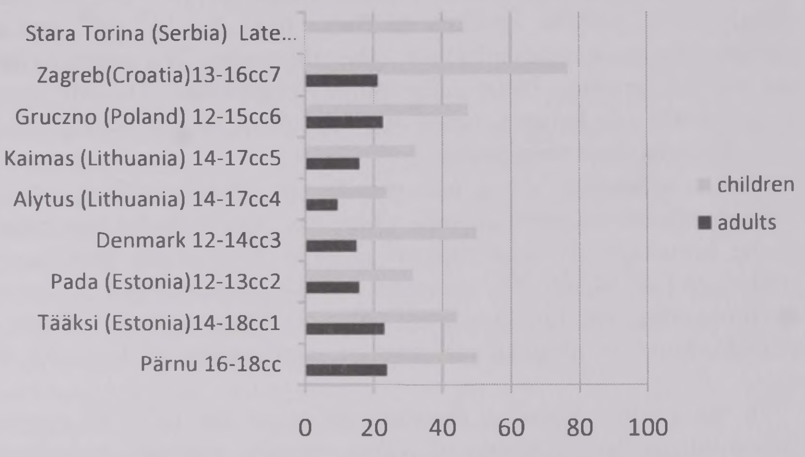

Fig. 5. Occurrences of *Cribra orbitalia* in different European skeletal samples.

1 – Allmäe 1999, 2 – Limbo 2006, 3 – Bennike 1985, 4 – Jankauskas 1995, 5 – Jankauskas 1995, 6 – Piontek & Kozlowski 2002, 7 – Novak et al. 2009, 8 – Djuric et al. 2008

Linear enamel hypoplasia. Dental enamel defects on the external surface of the tooth crown, which form during childhood if enamel formation is disturbed [46]; are very common in archaeological populations. Mainly such disturbances resulting from systemic metabolic stresses caused by malnutrition or infection diseases during tooth formation [20]. Duration of physiological stress is related to the severity of the email defect. A wider furrow on the tooth crown means longer durations of growth disruptions [24]. The Pärnu inhabitants of Early Modern times had furrow-like defects very often, but these defects were not severe; the same concerns the samples of Early Medieval Estonia. The occurrence of LEH is higher – rising up to 100% – in many skeletal series in the beginning of Modern Times in Europe [43, 44]. The occurrence of LEH is higher in later urban and aristocracy samples, in rural samples LEH seems to occur less frequently (Rukliai, Lithuania; Jõuga and Pada, Estonia; Tirup, Denmark) (Fig. 6).

The soldiers of Napoleon in Vilnius (1812) who were probably most fitted individuals, selected for the army, had a lower occurrence of hypoplasia (78.5%) and the mean severity of defects 1.72 [45]. It seems that the Pärnu inhabitants spent their childhood in better environments than the average of Early Modern urban populations. Their childhood stress level is comparable to the contemporary rural populations and to the soldiers of the Napoleon army.

Whilst the chronological development of hypoplasia is well understood, the developmental age at which the hypoplastic lesions evolved is possible to determine [10, 24]. There were two peak ages of LEH formation in the Pärnu group: at the age of 2–3 years and 4.5–5.5 years (Fig. 4). Similar two peak ages of LEH formation are also observed in other skeletal populations [35, 48]. The first peak age is usually associated with the stressful effects of weaning caused by transition from a diet comprised largely of immunologically protective mother's milk to a diet of gruel made from iron-poor grains that led to malnutrition, infection, and dehydration due to diarrhea. The second peak age of LEH formation may be due to nutritional and infectious aetiology [48]. It is probable that the children of the Pärnu community were weaned at the age of 2–3 years, this is similar to the Pada population the of 12^{th}–13^{th} century Estonia [35], but the second peak age is about a year later for the Pada sample.

The occurrence of LEH for males and females was similar; the severity of LEH was low for both. However, there were clear differences between men and women in the age of the formation of LEH defects. Both groups had two peak ages of LEH formation, women at the age of 2–2.5 years and of 5–5.5 years; men at the age of 2.5–3 years and 4.5–5 years. This may be due to the varied origin of men and women of the community (different environment and childhood stress levels) or because the boys and girls in the Pärnu community were treated differently. The first assumption is more plausible, thus the Military Garrison of Pärnu used the cemetery and the military men and their family members were of varied origin [8, 9, 32].

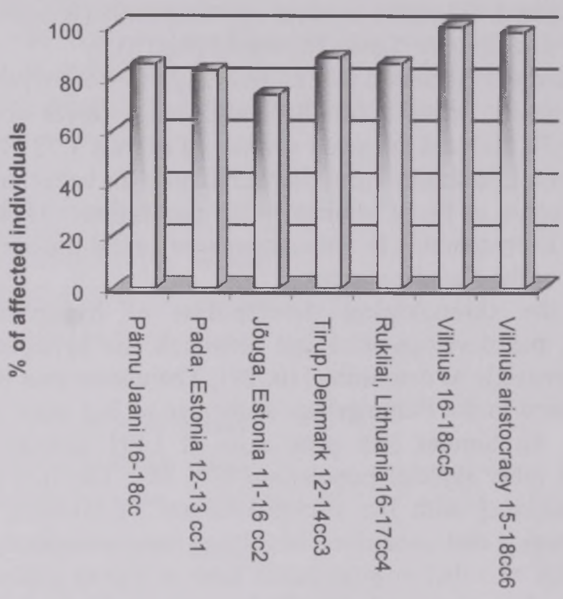

Fig. 6. LEH affected individuals in different populations.

1 – Limbo 2009 2, 3 – Limbo 2006; 4 – Palubekaitė & Jankauskas 2001, 5.6 – Palubekaitė et al. 2002.

SUMMARY

Anthropological analyses of the Early Modern skeletal sample from the cemetery of the Pärnu Jaani Church provide exceptionally valuable information on the standard of life of the inhabitants of this mainly military town. Though the frequencies of non-specific stress-markers (LEH, *cribra orbitalia*) are high in the Pärnu 16^{th}–18^{th} century garrison skeletal sample, the severity of these markers is not remarkable. The occurrence of stress markers on the skeletons of children and adults do not demonstrate remarkable differences in comparison with other contemporary populations in Northern and Central Europe. Two cases of specific diseases were found – syphilis and tuberculosis. In both cases the diseases were in the progressed stages, these members of the community needed special care and medical treatment – consequently the community had enough recourses to take care of these members of society. The members of the Pärnu garrison community have lived in relatively good conditions; well expressed sexual dimorphism in the body height of adults, a relatively tall stature of children and only few cases of severe nonspecific stress-markers (*LEH, Cribra orbitalia*) are all the indicators of quite a good quality of life and higher than the average social status. The community had probably good access to resources, medical treatment and parental care were available for children, old or ill people were also taken care of.

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CHANGES OF BODY PROPORTIONS IN THE GROWTH PROCESS OF RIGA SCHOOL AGE BOYS

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ABSTRACT

By body proportions we understand the dimensions of the head and the neck, as well as those of the torso and the extremities expressed in the percentage of the total body length. The human body proportions are determined by the skeletal dimensions which are the variables. There are also differences in the growth rate of separate body parts.

The determination of body proportions has an important practical meaning in the assessment of one's physical development because only a proportional body succumbs to the chief biomechanical law – consumes the least of energy and is an ideal of health and beauty. The second practical meaning could be the manufacture – clothes, furniture, etc. Proportions play an important role in the spheres of art and sport. The aim of the study is to state the constitutional type of Riga boys in the definitive age. The anthropometric measurements acquired in 2005–2007 from Riga school and pre-school boys were taken for the basis of the current study. 1,359 boys, included in the study, were divided into 12 age groups. Anthropologic measurements were carried out according to the methodical recommendations of R. Martin, K. Saller and J. Primanis. During the study several anthropometric parameters were analyzed – sizes of the head, the arm, the leg and the torso, as well as the shoulder and the pelvis width and their indices. For the parameters of the boys' body proportions were used the percentage of the value of separate body parts in relation to their definitive value. It shows the different growth rates of these body parts. Adding to this method, proportions of separate body parts against the body height were used.

Since the body proportions of boys in different age groups are changeable, and according to the mean statistic parameters, the boys included in the study have different constitutional parameters, they do not correspond to a definite type. However, some main characteristics, which are typical for boys in all age groups are observed. Riga boys are characterized by methodological relatively shorter legs, a short and narrow torso and narrow shoulders. The last two signs are typical of the dolychomorphous type, though it differs from it by shorter legs. Considering the results of measurements and by analyzing the data, we can conclude that: for boys the growth process proceeds harmoniously (balanced) and proportionally; the decisive factor in the body length variations is the length of legs; at the age of 17–18 years the boys' constitutional type corresponds to that of dolichomorphous, except for the length of legs which are shorter and corresponds more to the mesomorphous type.

Key words: *anthropology, boys, body proportions, head perimeter, dolychomorphous type*

INTRODUCTION

By body proportions we understand the dimensions of the head and the neck, as well as parameters of the torso and the extremities expressed in the percentage of the total body height. The human body proportions are determined by the skeletal dimensions which are the variables. There are also differences in the growth rate of separate body parts [1, 2].

In order to determine the body constitution or structure type, a relative parameter or the index method was used for the comparison.

The proportions of interrelated body parts change in the growth process. The human body proportions are determined by the skeletal dimensions which are the variables. The growth rate of separate body parts is different. The newborn's body proportions are characterized by a comparatively big head, short neck, long torso and short, especially low extremities. The proportions of body parts gradually change. After the baby's birth the fastest growth is seen in the torso and extremities – the torso length – three times, arm length – four times, but the leg length – five times. Thus, the fastest growth is seen in the extremities (Fig. 1).

In children of eleven and twelve years the relationship of legs and arms gets similar to that of a grown-up person's proportions. The arm length in relation to the legs gets shorter, the head keeps pace in growth. Till puberty children have short legs and a comparatively long torso.

In puberty the girls are seen to have a fast growth of the pelvis size, but in boys – the shoulder width, which depicts the sex dimorphism of the growth period [4].

Body proportions are important both in medicine as an indicator of a human physical development (health), and in national economy (clothes, furniture, etc.), and in the social sphere (sport, art, etc.).

We distinguish three types of body proportions:

1. The dolichomorphous type, characterized by long legs (55% of body height), a short and narrow torso type (29.5%) and narrow shoulders (21.5%);
2. The brachimorphous, characterized by relatively short legs (51%), a longer torso (33.5%) and wide shoulders (24.5%);
3. The mesomorphous type, which is between both before-mentioned types (length of legs – 53.%), torso length – 31.0%, shoulder width – 23.5%).

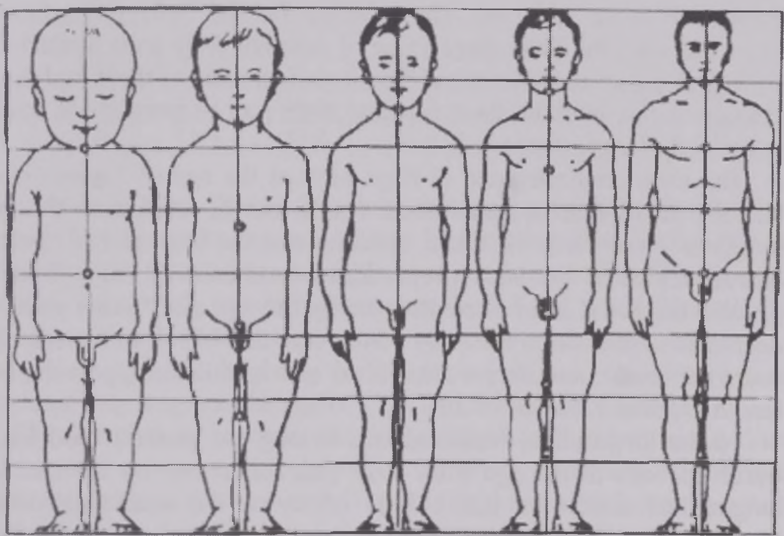

Fig. 1. Change of human body proportions from birth till adulthood (Stac)

AIM OF STUDY

To state the constitutional type of boys in the definitive age.

MATERIAL AND METHODS

In the study the anthropometric measurements carried out from 2005–2007 of Riga school and pre-school boys were used. **1,359** children included in the study were divided into 12 age groups. Anthropologic measurements were done according to the methodological recommendations of R. Martin, K. Saller and J. Primanis [6].

RESULTS AND DISCUSSION

In the study anthropometric parameters – the head sizes, arms, legs and the torso length, as well as shoulder and pelvis width and their parameters were analysed. The criterion for the body proportions in boys was used the percentage value of separate body parts against their definitive value. It shows the different growth rates of these body parts. Adding to this method, there separate body part proportions in relation to the body length were used.

The head circumference of Riga boys at the age of 7 years makes 92.13% of 18-year old adolescent's size, but in relation to the body height at 7 years it is 42.1%. It indicates that the boys of this age have characteristics of the body proportions of children this age. With the growth, the boys' head circumference by the age of 17 years gradually decreases in relation to the body (from 42.1 to 31.7%). In the age of 17 years the head circumference stabilizes and its relationship to the body length is about 32% (see: Table 1).

To the longitudinal measurements belong the greatest head length, which in boys in the age from 7–18 years increases by 1.3 cm. This longitudinal dimension has a little effect on the total body length. Morphological face length from 7–18 years of age increases by 1.8 cm. The growth of both of these dimensions is seen evenly in all the age groups.

The torso length in the study of 2005–2007 of 7–18 –year-old boys increases by 16.6 cm. Its absolutely greatest growth rate – 3.0 cm – is at the age of 14–15 years, which reaches its maximum at the age of 18 years, its mean value is 54.0 cm. In Estonian boys the torso length reaches its maximum at the age of 17–18 years, its mean value is 53.3 cm[8].

Table 1. Changes of body proportions in relation with age (% of body height)

Age group (years)	N	Head perimeter	Trunk length	Lower extremity length	Upper extremity length	Shoulder width	Ship width
7	73	42.1	29.9	49.0	43.6	21.8	15.9
8	105	40.5	29.6	49.5	43.3	21.3	15.9
9	112	39.2	29.2	50.7	44.0	21.5	15.9
10	79	38.2	29.0	51.3	44.3	21.3	16.0
11	108	36.9	29.1	51.5	44.4	21.3	15.8
12	113	35.9	29.0	51.9	44.7	21.1	15.9
13	106	34.9	28.9	52.0	44.6	21.0	15.9
14	137	33.3	28.9	52.5	44.9	21.2	15.6
15	131	32.4	29.5	52.1	45.0	21.1	15.7
16	154	32.1	29.4	52.2	44.8	21.4	15.8
17	103	31.7	30.0	51.2	44.8	21.5	15.9
18	136	31.7	29.8	51.2	44.8	21.8	15.9

The mean value of the leg length in the study of 2005–2007 in boys from 7–18 years increases by 31.5 cm. The greatest absolute leg growth rate in boys is seen at the age of 13–14 years, i.e., 96.5 cm. The greatest absolute leg growth rate in boys is seen from 8–14 years, it is prior to puberty and at its initial stage, which coincides with the mean value of the growth rate of the body length. The Estonian boys reach their maximum leg length at the age of 17 years and it is 94.44 cm [8].

The correlation between the body length and other longitudinal parameters show certain dynamics. Growth dynamics of separate parameters shows that the torso length against the body length increases gradually in the initial stage of puberty, but especially it increases in the mid-stage of puberty and in its final stage. At the age of 18 years the boys' relative torso length against the relative body length is 29.8%.

Several authors mention that by the start of puberty children have relatively short legs and a greater torso length, after 10–11 years of age, the legs become longer in relation to the body length, at the age of 15–

16 years one can see the definitive relationship of these parameters. It is mentioned that in teenagers, in comparison to younger children, legs are longer but the torso – shorter [7, 10, 12].

According to the study data of 2005–2007, the first changes in the body longitudinal parameter dynamics are observed in 8–9 old children when the body length per year is 6.3 cm and 4.8 cm. In this age the annual increase in the leg length is one of the highest – i.e. 3.8 cm and 3.6 cm. In further years up to 17–18 years of age these parameters grow evenly. After that the increase of the body length and leg length is comparatively slight. In the study it was found that other longitudinal parameters also start to increase at the same age, i.e. 8–9 years of age. For instance, the arm length per year increases respectively by 2,4 cm and 3,0 cm, shoulder width – by 1.3 cm, the torso length – by 1.5 cm.

At the initial stage of puberty, at the age of 10–11 years, one can observe the even increase of longitudinal body parameters. In the mid-stage of puberty (13–14 years of age) one can see an exponential growth rate with a gradual decrease of these parameters at the final stage of puberty (at the age of 16–17 years). At the age of 17–18 years the relative torso length against the relative body length is 29.8%.

The relative mean leg length at its maximum evenly increases at the age from 7–16 years, but their accelerated growth rate is seen at the age 8–9 years and 13–14 years. For 17–18 year old adolescents the relative mean leg length makes 51.2% of the relative mean body length. In Estonian boys the relative mean leg length makes 52.66% of the relative mean body length parameters.

The relative mean arm length increases evenly till 15 years of age, then the growth rate stops and reaches 44.8% of the relative mean body height. In Estonian boys it is 43.97%.

The parameters of the torso length affect the children's body length from 14–15 years of age. In the age of 17–18 years the variety of the body length is determined by the leg length. Considering the results of the measurements and analyzing the acquired data, we can conclude that the determining factor in the body length variations is the leg length.

The leg length and the torso length affect the body length differently. The body length in separate age groups increases relatively – it is more dependant on the leg length rather than on the torso length parameters.

The indices which point to the relationship to the body length make sufficiently precisely characterize the relative growth specificities of the body length. V. Nikityuk points to the changes in the proportions of longitudinal body parameters [9, 10].

The correlation of the body length and other longitudinal parameters is depicted by the regression coefficient. Varieties of the body length depend on the leg length at various age groups of boys. In Riga boys the leg length maximum growth rate is reached alongside with the development of secondary sex signs, but also the torso length in the age of 13–14 years, i.e., in the mid-stage of puberty. In total, the varieties of the body length depend more on the leg length rather than on the torso length.

Analyzing the acquired study data of longitudinal parameter growth rate dynamics, we can conclude that in boys the growth process proceeds harmoniously (balanced) and proportionally, except for the puberty, when one can observe the accelerated growth of these parameters.

By 15 years of age, when you can already assess the body's constitutional type, using the values of this index, body proportions can balance the body mass and the chest circumference growth tendencies and mutual dynamics in relation to the body length.

Determining the changes of Riga boys' constitutional type, one can see that the body mass increase in boys is observed in the age of 8 years, reaching its maximum in the age of 15 years, when the body mass, comparing to the age of 14 years has increased by 8.6 kg.

In the age of 15–16 years, the mean value of the body mass starts to stabilize. In this age one can observe the stabilization of the parameters of the greatest part of the body width. The tendency for the chest to increase is more pronounced at the age of 7–8 years (by 3.3 cm), 10–11 years – by 3.7 cm, but the greatest growth increase – 14–15 years of age (by 5.4 cm). Riga boys by the age of 15 years are characterized by a wide body constitution which could be explained by a faster increase of the body mass and the chest circumference in relation to the body length. After 15 years of age the body length and the body mass keep growing, while body width parameters have already been stabilized. In the age of 17–18 years the boys' constitutional type corresponds more to the dolychomorphous type, except for the leg length which is more typical of the brachimorphous type (see Fig. 2).

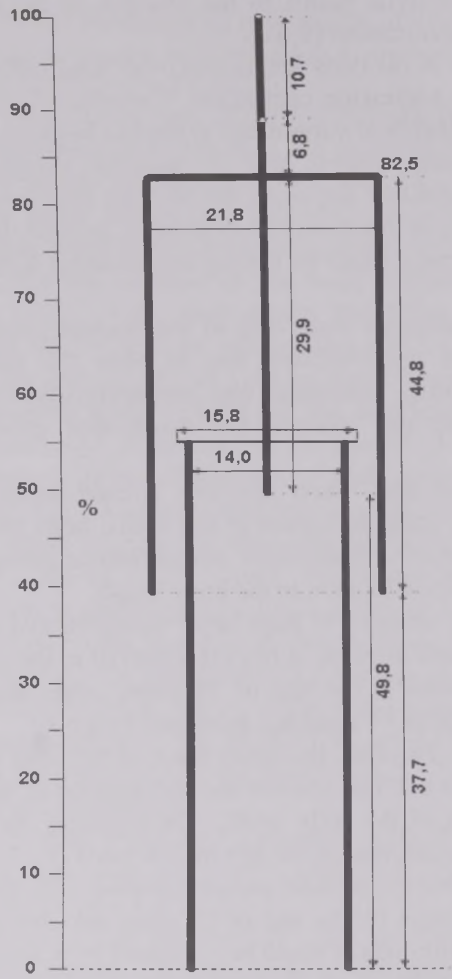

Fig. 2. Scheme of 18-year-old boy's body proportions

Since the body proportions in boys of various age groups are changeable, and according to the mean statistic parameters of boys included in the study there are different constitutional parameters, they do not correspond to a certain type. However, one can see some main signs which are characteristic of boys in all the age groups. Riga boys are characterized by relatively shorter legs, a short and narrow torso and narrow shoulders. The last two signs are typical of the dolychomorphous type, but differ from it by shorter legs.

The percentage value of the head circumference is determined in relation to the body length, which shows that from 7 to 14 years of age the children's characteristic proportions show a relatively big head circumference in relation to the body length. In the age of 14 years the relationship of the head circumference and the body length are the same as for adults.

In the study made by I. Kokare, J. Vētra and Dž. Krūmiņa on the body form proportions in Latvian soldiers of the century changes (1939–1996) one can find changes in the scheme of body proportions [5]. In the study we see that Latvian soldiers' increase in the body length by 86.3% is related to the lengthening of the body's lower segment, but 13.71% – to the lengthening of the upper segment. A relative shoulder width increase can be seen, simultaneously reducing the hip relative width and the body mass. The authors are of the opinion that the male body in 1996 has become more masculine [5].

In the study of Riga girls one can observe the same tendency: the shoulder width increases but the hip's relative width decreases. It means that these signs are not related to a certain gender, but regardless of it points to the century changes [4].

Also, in other authors' publications one can find the data on the changes in the male body proportions. For instance, a relative increase of the shoulder width and the decrease of relative width of *distantia cristarum* has been found in Russian workers [9, 11].

CONCLUSIONS

Considering the results of measurements and by analyzing the data, we can conclude that:

1. for boys the growth process proceeds harmoniously (balanced) and proportionally;
2. the decisive factor in the body length variations is the length of legs;
3. in the age of 17–18 years the boys' constitutional type corresponds to that of dolichomorphous, except for the length of legs which are shorter and corresponds more to the mesomorphous type.

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THE ANTHROPOMETRIC AND FITNESS CHARACTERISTICS OF THE FOOTBALL PLAYERS COMPETING IN THE ROMANIAN JUNIORS CHAMPIONSHIP

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ABSTRACT

Within this study we determine the anthropometric profile of junior football players competing in the Romanian Championship for two age categories by comparison to sedentary groups. We also analyze the correlation of the fitness characteristics to anthropometric ones for junior football players. There are two groups of junior football players, the group A of 26 footballers of age the 18–19 years and the group B of 20 footballers of the age 16–17 years, and two control groups: 28 boys of 16–17 years old and 24 boys of 18–19 years old. The football players show a normal content of body fat, a good aerobic capacity and also a good capacity to recovery after physical effort. There are significant differences ($p<0.05$) between football players and sedentary boys concerning the percentage of body fat and the deficit of active body mass. The sedentary boys present increased values (more than double of the normal ones) for the percentage of body fat and a high deficit of the active body mass. For the football players, there is a significant effect ($p<0.05$) of age and playing level on the muscular power of legs, speed, agility and maximal aerobic capacity, these fitness characteristics increase with increasing age and playing level. We also notice a good correlation between the muscular fitness characteristics and the anthropometric ones. These kinds of fitness capacity tests may be used as a predictive tool for football player selection, respectively for the rationalization and standardization of the training techniques.

Key words: *Romanian footballers, anthropometric characteristics, fitness capacities*

INTRODUCTION

Football is a sport game played at the junior and senior level by amateur, semiprofessional and professional competitors. The play is physically demanding requiring players to participate in bouts of intense activity separated by short bouts of low intense activity. Because of this reason, the football players must draw upon some fitness components such as: muscular power, speed, agility and aerobic power [1, 15]. In specific literature there are some studies concerning the fitness characteristics of junior [2, 6, 7, 4, 11–13] and senior [9, 14, 17] football players correlated to the requirements for training and match-playing.

Football players spend a substantial time trying to improve their fitness capacities, including speed, power and agility [1, 7, 15]. For young football players, the parameters, associated with physical maturity and chronological age, are important to determine their success as a football player. Usually, the selected players are taller, powerful and faster [6, 13]. For adolescent soccer players (13–16 years), their skills differ in age, experience, body size, speed and power and aerobic endurance, the aerobic resistance being a significant predictor of soccer skills [4, 6].

It is well known that the anthropometric characteristics are epigenetically influenced by environmental factors, such as habitat (urban vs. rural), socioeconomic status, lifestyle and nutrition [3]. Also, the body composition and fitness performance can be maintained or/and improved by training techniques and even during the competitive seasons by specific practices and conditioning programs [6, 14]. Different fitness characteristics have been noticed for players belonging to teams of different ranking [6, 10] and also for players having different positional roles [13].

Taking into account these considerations, within this study we determine the anthropometric profile and the fitness characteristics of junior football players competing in the Romanian Juniors Championship for tow age categories: 18–19 years (the group A) and

16–17 years (the group B) respectively. We compare their anthropometric characteristics with those corresponding to the control groups, 24 boys in the age of 16–17 years and 24 boys in the age of 18–19 years, and we analyze the possible correlation between the muscular fitness and anthropometric characteristics for the junior football players.

SUBJECTS AND METHOD

A total of 46 footballers participated in this study divided in two groups: the group A consists of 26 footballers of the age 18–19 years and the group B consists of 20 footballers of the age 16–17 years. All the footballers are registered players from the same football club, *Politenhica 1921 Stiinta Timisoara*, and were competing in the Romanian Juniors Championship. The group A ranged is the first position and the group B ranged in the second position in the 2008–2009 championship. We have also considered two control groups (sedentary boys), one group consisting of 16 boys of 18–19 years old and another group consisting of 14 boys of 16–17 years old.

All the footballers and sedentary boys received a clear explanation of this study including the risks and benefits and their consent (respective the parental consent for minors) was obtained. All the footballers have performed 6 training sessions a week and one match-play. Two of the match training sessions were oriented to develop their physical skills, such as: one training session was dedicated to the exercises concerning the development of the muscular power and endurance and the other training session was dedicated to the exercises concerning the development of speed and agility. The other four training sessions were concentrated on the technique exercises.

For all the subjects the selected anthropometric field tests for this study are: the body mass, the body height, skinfold total thickness, the percentage of body fat, the active body mass. In addition, for footballers we have also considered the haunch perimeter. For junior football players we have measured the following fitness parameters: the muscular power of the legs (MPL) expressed by the length of 5 repetitive horizontal jumps, the sprint for 50 m, the muscular power of the arms (MPA, expressed by the number of repetitive floatation), agility (expressed by commute, 5 times of 10 meters) and the maximum aerobic capacity (VO_{2max}) using the cycling test.

The field tests have been done two times for both groups: the first test (T1) was done on 27 August 2008 and it was repeated on 11 October 2009 (T2). For the first test (T1) the environmental temperature was 27°C in a sunny afternoon and for the second test (T2) the temperature was 19°C in raining conditions. It is important to mention that the first test has been done after 4 weeks of rest because of the summer holidays. The control groups were tested on 12 December 2009.

RESULTS

For the junior footballers the anthropometric and fitness characteristics considered in this study (average values) are presented in Tables 1 and 2 respectively. The anthropometric characteristics for the control groups are presented in Table 3.

The results obtained here are comparable with other published data in the specific literature [8, 9, 15]. For example, for 20 m sprint, 21 elite soccer players from the team *Chievo Verona* (mean age 17.6 ± 0.4) have registered 3.05 ± 0.02 s before 8 weeks of training and 2.97 ± 0.02 s after it [18].

Both the independent Student and one way-ANOVA statistic tests, implemented under ORIGIN 7.0 package, show that at 0.05 level the differences between the parameters revealing anthropometric characteristics such as the percent of body fat and the deficit of active body mass between the junior footballers and sedentary boys are statistically significant for every age category. Also, the same statistical tests indicate that the differences in the anthropometric characteristics such as body mass, height and haunch perimeter are significantly different between the two age categories both for junior footballers and sedentary boys and that there are significant differences of these characteristics from one test to another for every group of footballers. This result is expected as both the footballers and sedentary boys still grow up at this age. There are also significant differences between some fitness capacities between the two groups of footballers and also between the values corresponding to the two tests for every group: the maximal aerobic capacity, the muscular power of legs and agility. These results underline the fact that age and participation history as a football player are important factors for developing optimal fitness

Table 1. The average values of the anthropometric parameters for the two groups of junior football players.

Group	Test	Body mass (kg)	Height (cm)	Haungh perimeter (cm)	Skinfold (mm)	Body fat (%)	Excess of body fat (%)	Active body mass (kg)	Deficit of active body mass (kg)
Group A (18–19 years)	T1	67.91±0.23	174.96±0.32	54.04±0.78	25.48±0.13	11.58±0.35	0.43±0.04	58.13±0.68	–3.76±0.21
	T2	71.15±0.37	176.78±0.71	56.28±0.78	25.00±0.36	11.34±0.23	0.45±0.03	60.08±0.76	–3.82±0.22
Group B (16–17 years)	T2	58.08±0.98	172.02±0.68	54.91±0.78	24.30±0.23	11.98±0.26	0.47±0.07	56.88±0.59	–3.88±0.41
	T4	67.77±0.37	177.28±0.16	56.10±0.94	25.85±0.43	11.89±0.45	0.49±0.04	63.08±0.47	–3.92±0.33

Table 2. The average values of the investigated fitness parameters for the two groups of junior football players.

Group	Test	Sprint (s)	Agility (s)	MPL (m)	MPA	VO_{2max} (ml/kgcorp)
Group A (18–19 years)	T1	6.48±0.11	11.98±0.10	12.16±0.36	24±1	63.62±0.28
	T2	6.49±0.04	11.74±0.12	12.45±0.67	38±1	65.40±0.26
Group B (16–17 years)	T1	6.97±0.07	12.29±0.24	10.84±0.52	24±1	60.68±0.32
	T2	6.70±0.02	12.01±0.15	11.80±0.06	28±1	63.32±0.30

Table 3. The average values of the anthropometric parameters for the control groups.

Group	Body mass (kg)	Height (cm)	Skinfold (mm)	Body fat (%)	Excess of body fat (%)	Active body mass (kg)	Deficit of active body mass (kg)
Sedentary boys (18–19 years)	74.20±0.47	181.18±0.17	132.5±7.51	27.39±1.12	15.39±1.26	53.51±0.95	–11.61±1.10
Sedentary boys (16–17 years)	66.75±0.98	171.57±0.96	111.5±5.16	24.19±0.77	14.81±1.21	50.59±0.89	–8.15±0.54

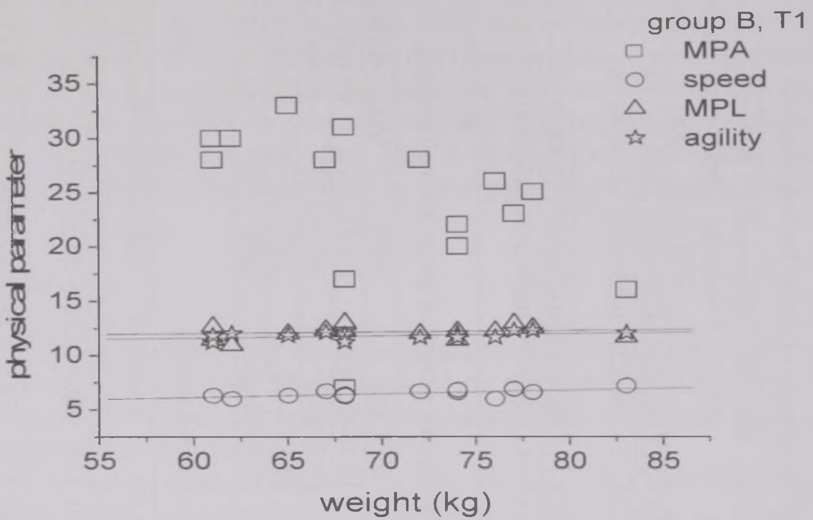

Fig. 1. Correlation between the measured physical parameters and the body mass for the group B at the test T1

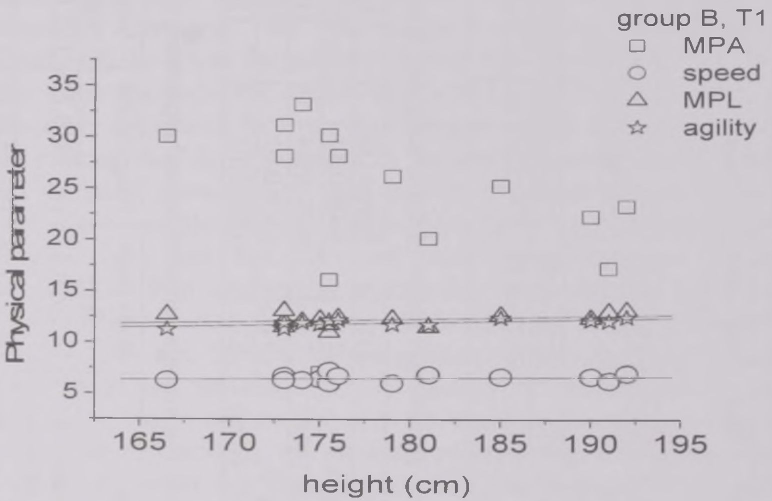

Fig. 2. Correlation between the measured physical parameters and the height for the group B at the test T1

characteristics and they also reflect the efficiency of training methods oriented to improve these characteristics. Our data are in good agreement with other published data revealing the importance of age, experience, specific practices and conditioning for the success of football players [4, 10–13].

In order to check if there are positive correlations between the fitness and anthropometric characteristics, we plot the fitness parameters versus anthropologic ones. In Figures 1 and 2 we present for the group A at the test T1 the plots of the fitness parameters versus the body mass and versus the body height, respectively.

We notice a positive correlation for the speed (correlation coefficient R=0.74), MPL (R=0.82) and agility (R=0.78) and no correlation for MPA (R=0.26). The same results are obtained for the group B at the tests T2 and for the group A at both T1 and T2 tests (data not shown because the pictures are almost similar). These results are in good agreement with published data concerning correlation between some fitness and anthropometric characteristics of soccer players [7, 10]. A strong correlation between physical and anthropometric characteristics has also been noticed for other sports, such as volleyball [8], rock climbing [16] and rugby [5].

DISCUSSION

In our knowledge, it is the first study to analyze the anthropometric profile of Romanian junior football players. It reveals that Romanian junior football players do not differ from the sedentary boys in body mass and height, but they have higher active body mass and a normal content of body fat. In every age group for the sedentary boys 60% of them are living in Timisoara and 40% of them are living in Brasov, the two Romanian towns being 600 km from each other, Brasov, being a mountain town, and Timisoara, being on a plane. There are not significant differences between the body composition of the sedentary boys living in the two towns. Anyway, the percentage of body mass for sedentary boys is too big, the obtained values being even more than twice as normal ones, the percentage of body fat and implicitly the deficit of active body mass being higher for the control group of 18–19 years. It reflects that young people in Romania usually have a sedentary live style which favours the anabolic processes of metabolism increasing the lipids deposition.

The significant differences in some cardiovascular and muscular fitness capacities as maximal aerobic capacity, legs' muscular power and sprint between the two groups of football players is not a surprising result as they differ in age and playing skills: the group A is in the last year of competition at the junior level and the group B still has 3 years of competitions at this level. Also, the group A has been formed in the competitive year 2007–2008 by selecting the best junior football players but they had no continuity regarding the team and coaches. The group B had 3 years of continuity in the same team and coaches, they always ranged in the firsts positions in the championship and their results obtained at the physical tests are considered as very good ones.

The comparison between the fitness capacities of the footballers from the same group at the two tests shows significantly different average values for the aerobic capacity, MPL and sprint in a positive sense. The average values of agility and MPA do not differ significantly and it shows that footballers maintained these fitness capacities. These results underline the efficiency of training methods that allowed the improvement of some fitness characteristics and the preservation of the others. These results also reflect the importance of training techniques that have been used during the training sessions and assure the support to obtain good results in the future competitions if the team and coaches are maintained.

For the footballers, the muscular fitness characteristics such as speed, agility and the muscular power of the legs are strongly correlated to the anthropometric ones (body mass and height) and they increase with increasing age and playing experience. We do not notice any correlation between the muscular power of the arms and the anthropometric characteristic, but the training sessions do not specifically contain exercises dedicated to develop this fitness capacity for the junior football players.

In every group there are a few football players who considerably improved their fitness characteristics from one test to the other. It assures the possibility to discover a few exceptional football players in the future in these two groups.

The average values that we have obtained within this study for the investigated parameters reflecting the fitness performance of the junior football players have a few practical implications, such as:

- they are the results obtained by concrete used training techniques and reflect that these techniques are adequate;
- they may be useful for selecting junior football players;

- they could be used to rationalize or to establish some standard levels for training techniques.

They also reflect that the continuity in training techniques, team composition and even playing positions are premises of obtaining good results in the National Junior Championship and any other high level competition.

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AN ASSESSMENT OF MORPHOMETRIC ANALYSIS IN LIVER BIOPSY SPECIMENS OF PATIENTS WITH CHRONIC HEPATITIS C

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ABSTRACT

The quantitative stereological morphometric analysis of liver biopsy was used for the more correct evaluation of the dynamic of liver damages in patients with chronic viral hepatitis C. The analysis allows us to estimate the area (%) of non-parenchymal elements, such as portal tracts, bridging and piecemeal necroses, intralobular focal infiltrates. Thit is important for the estimation of the efficiency of antiviral therapy. The investigation showed that the portion of the area of non-parenchymal elements of different patients strongly varied; the interrelations between some morphological parameters and the level of serum alanine aminotransferarase were established. This study demonstrates that the ratio of the area of non-parenchymal elements to that of the entire tissue specimen in the initial biopsy might be a predictive factor for prognosis.

Key words: *chronic hepatitis C virus infections, liver biopsy. Stereometric morphometry, Knodell, Ishak, METAVIR scoring systems*

INTRODUCTION

Information on the stage of fibrosis in chronic hepatitis C (HCV) is essential to make prognosis and decide antiviral treatment [9]. Liver biopsy is the gold standard for fibrosis staging in chronic hepatitis. However, recent studies have reported that the estimation of fibrosis by the semi-quantitative scoring system is not always accurate and the high rate of inter- and intraobserver discrepancies takes place [14].

We used the quantitative stereological analysis of liver biopsy for the more correct estimation of the stage of fibrosis in patients with chronic hepatitis C. We also performed the comparative analysis of the development of fibrosis and the level of serum alanine aminotransferase (ALT).

MATERIAL AND METHODS

Patients

18 HCV patients with weak, moderate and expressed degree of fibrosis according to the classification by Ishak [6] and METAVIR [18] participated in the study .

The diagnosis of chronic HCV was established after the careful examination of patients: the anamneses of diseases and life, laboratory analyses, virological and morphological studies. HCV infection was defined as positive HCV-RNA by polymerase chain reaction. The serum level of ALT was expressed. The upper limit of normal (ULN) of ALT was 41 U/L for men and 31 U/L for women. During the formulation of the diagnosis, the classification of chronic liver diseases, accepted by the International Congress of Gastroenterology (Los Angeles, 1994), was used.

To refine the diagnosis as well as for the detection of pathologic processes activity in the liver, aspiration biopsy according to G. Menghini was taken from all the patients [10,11].

Morphology

All the liver biopsies were performed according to the routine medical follow up program, using the standard Menghini procedure. Samples were formalin-fixed and paraffin-embedded and 5 mcm thick sections examined. Hematoxylin-eosin stain was used.

Each biopsy for necroinflammatory activity and fibrosis was assessed by two hepatologists. The Knodell Histology Activity Index (HAI) was used to grade histopathological lesions [8]. Biopsies were assigned into one of four grades of necroinflammatory severity: minimal (scores 1 – 3), mild (4 – 8), moderate (9–12), or severe hepatitis (13 – 18).

The METAVIR group scoring system was used for detecting the stage of fibrosis [18]. Fibrosis was staged on a scale from F0 to F4, as follows: F0 = no fibrosis, F1 = portal fibrosis without septa, F2 = few septa, F3 = numerous septa without cirrhosis, and F4 = cirrhosis.

Fibrosis was also stage by the Ishak scoring system [6]. In the Ishak system, interface hepatitis (piecemeal necrosis), focal necrosis in the lobule, and portal inflammation are each scored from 0 to 4, incomplete cirrhosis (bridging necrosis with occasional nodules) and cirrhosis are scored from 5 to 6. None of the included patients showed any signs of cirrhosis.

Stereometric analysis

The stereometric analysis is based on the determination methods of the specific volumes of different structures [3]. The calculation was carried out using the standart graticule (400 square). Morphometry was applicated on counting the points or intersections at the standard unit as the field of microscope at the magnification of x 400. The field of vision of a microscope at the magnification of x400 as a standard unit (SU) of accounting was accepted. In each field of sight a quantity of non-parenchymal liver structures – portal tracts, with nearby piecemeal and bridging necroses (Fig. 1, Fig. 2), vessels, intralobular (Fig. 3) necrosis (infiltrations) – were calculated (Fig. 3). Other liver structures were studied together with parenchyma (hepatic cords and sinusoids) (Fig. 4).

The total area of the section was the sum of the area of all microscopic fields including parenchyma and non-parenchymal elements. Fibrosis in the space of Disse was not evaluated. The fibrosis ratio was the total area of non-parenchymal elements divided by the total area of sections.

All the liver sections were considered adequate and based on the specimen size (about 10 mm) and the number of portal tracts (no less than 5).

Statistical analysis

Variables, differing significantly according to the quantity of non-parencymal elements in the estimation group were identified by the univariate analysis. Therefore, all the variates were included in a multivariate forward stepwise regression analysis to determine the morphometric data. The Spearman correlation coefficients were used to evaluate whether changes in the morphometric data were correlated with

ALT. The statistical analysis was performed by the tabulated processor MS Excel, package STATISTICA.

RESULTS

The biopsies showed pathological findings that ranged from nearly normal to severe chronic hepatitis (Tables 1 and 2). The degree of hepatocellular injury and inflammation was quite variable (Fig. 1–4), but many cases were moderate and heavy.

The results of morphometric investigation are summarized in Table 1. Additionally we have calculated the area of bridging and piecemeal necrosis. The presence or absence of chains of lymphocytes is also marked.

For the morphometric analysis the field of vision of a microscope at the magnification of x400 as a standard unit (SU) of accounting was accepted. The number of investigated SU changed from 58 to 290 and on average was 173.3 ± 16.8. Accordingly, the total volume of morphometry (the number of points or intersections) varied from 17,980 to 89,900, the average value $53{,}339.7 \pm 5{,}211.6$. The amount of investigated material was sufficient and statistically significant.

The analysis showed that the portion of the area of the non-parenchymal elements of different patients strongly varied from 2.16% to 11.93%. Comparative estimations of morphological pictures, semi-quantitative evaluation of HAI and staging of fibrosis, quantitative stereological morphometric analysis of non-parenchymal parameters showed specific interaction. So, if the portion (%) of non-parenchymal elements varied from 2.26% to 4.30%, fibrosis was absent (F0). The portion of non-parenchymal elements from 4.63% to 6.64% corresponded to weak fibrosis (F1). The portion of non-parenchymal elements from 8.67% to 11.93% was typical of the patients with the picture of moderate and heavy fibrosis (F2, F3) (Table 2).

Table 1. Quantitative characteristic of liver biopsies of the patients with chronic hepatitis C by the stereological morphometric analysis

№	ALT (U/L)	Total area of morphometry (points or intersections)	Total number of microscopic fields (SU) (× 400)	Parenchymal elements (%)	Non-parenchymal elements (%)	Ratio of non-parenchymal elements	Portal tracts (%)	Focal intralobular infiltrates (%)	Hepatic veins (%)	Bridging necrosis (number of intersections at 50 SU)	Piecemeal necrosis (number of intersections at 50 SU)	Chains of lymphocytes (absent/present)
1	15	29450	95	97.84	2.16	0.022	1.79	0.05	0.32	0	0	-
2	20	18910	61	97.54	2.46	0.025	2.00	0.25	0.21	0	0	-
3	57	37690	126	96.49	3.51	0.036	2.30	0.46	0.75	0	0	-
4	14	17980	58	96.40	3.60	0.037	3.18	0.01	0.42	0	0	-
5	26	46190	149	95.70	4.30	0.044	3.15	0.12	1.02	0	0	-
6	104	70060	226	95.37	4.63	0.048	3.25	0.3	1.09	0	19	-
7	15	86800	280	95.30	4.70	0.049	2.91	0.02	1.77	31	18	-
8	42	37820	122	94.94	5.06	0.053	3.81	0.26	1.00	72	0	-
9	35	80290	259	94.82	5.18	0.054	3.93	0.84	0.41	143	57	+
10	441	89900	290	93.36	6.64	0.071	3.29	2.02	1.32	6	108	+
11	214	54560	176	91.33	8.67	0.094	7.24	0.89	0.55	0	0	-
12	187	70680	228	90.54	9.46	0.104	7.57	1.76	0.13	86	148	+
13	333	47720	152	90.32	9.68	0.107	7.51	1.17	1.00	5	126	-
14	107	32860	106	90.29	9.71	0.107	8.32	1.02	0.37	0	0	-
15	38	53514	193	89.44	10.56	0.118	6.23	2.61	1.71	21	194	+
16	122	49600	160	89.11	10.89	0.122	9.07	1.27	0.54	178	115	+
17	596	75330	243	88.24	11.76	0.133	9.26	1.56	0.94	20	198	+
18	162	60760	196	88.07	1193	0.135	11.49	0.44	0.00	27	68	+

Table 2. Comparative characteristic of the non-parenchymal area, grading of histopathological lesions (HAI) and the stage of fibrosis (morphometric and semiquantitative estimation) in the liver of patients with HCV

№	Stereological morphometry: non-parenchymal elements (%)	HAI by Knodell (1981)	Stage of fibrosis (METAVIR, 1994)	Stage of fibrosis (Ishak, 1995)
1	2.16	1	F_0	F_0
2	2.46	2	F_0	F_0
3	3.51	2	F_0	F_0
4	3.60	2	F_0	F_0
5	4.30	2	F_0	F_0
6	4.63	3	F_1	F_1
7	4.70	3	F_1	F_1
8	5.06	4	F_1	F_1
9	5.18	14	F_2	F_3
10	6.64	10	F_1	F_2
11	8.67	13	F_2	F_3
12	9.46	14	F_2	F_3
13	9.68	10	F_2	F_3
14	9.71	10	F_2	F_3
15	10.56	16	F_3	F_4
16	10.89	16	F_2	F_3
17	11.76	13	F_3	F_4
18	11.93	12	F_2	F_3

It is also essential that, as a rule, the patients with a high ratio of non-parenchymal elements (Table 1) were discovered with bridging and piecemeal necrosis and the chains of lymphocytes in sinusoids. Correlations between focal intralobular infiltrates and the presence of the chains of lymphocytes inside sinusoids was discovered (r= 0,7104). That is important for the estimation of the severity of necroinflammatory activity with HCV.

We supposed that the evaluation of index of non-parenchymal elements had important predicting value. As a rule, the increasing of the index higher than 6% was connected with the activation of necroinflammatory lesions.

With the help of the correlation and the regression analysis the interrelations between the level of serum ALT and morphological parameters of non-parenchymal elements were established (coefficient of correlation r_{xy} = 0.74124499, p = 0.0025; coefficient of determination R^2 = 0.54944413, *F*-statistic *F* = 14.63376674 at the level p = 0.0025). Interrelation appeared more strongly at the light increase of the level ALT.

Statistically significant correlation and regression dependences of the specific area focal intralobular necrosis and the level of ALT were also considered (coefficient of correlation r_{xy} = 0.7807727, p = 0.00025; coefficient of determination R^2 = 0.609613146, *F*-statistic *F* = 23.42342499 at the level p = 0.0003). These findings support the clinical usefulness of monitoring of ALT levels in assessing the disease progression.

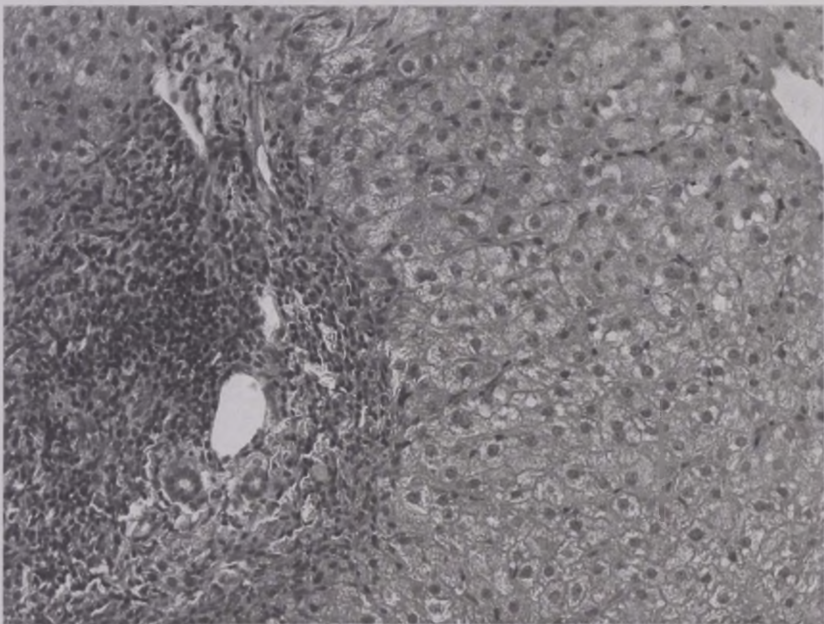

Fig. 1. Portal lymphoid aggregate adjacent to an injured bile ducts, typical of chronic hepatitis C. Obj. 20x.

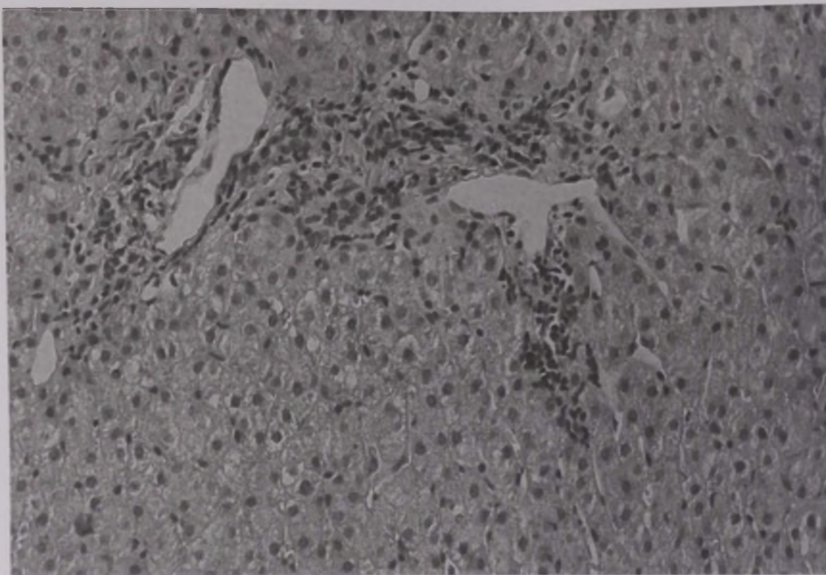

Fig. 2. Region of portal tract with piecemeal necrosis (interface hepatitis). Obj. 20x.

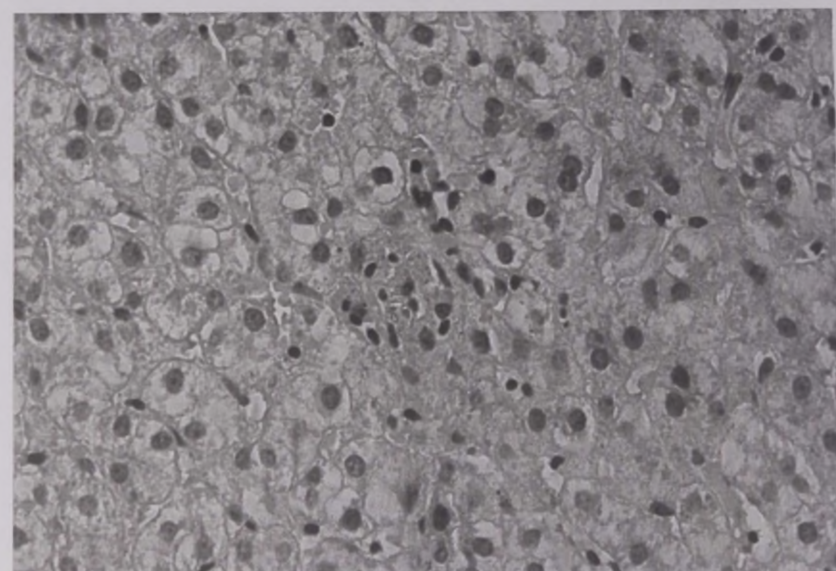

Fig. 3. Intralobular necrosis in the middle part of the liver lobule. Obj.40x.

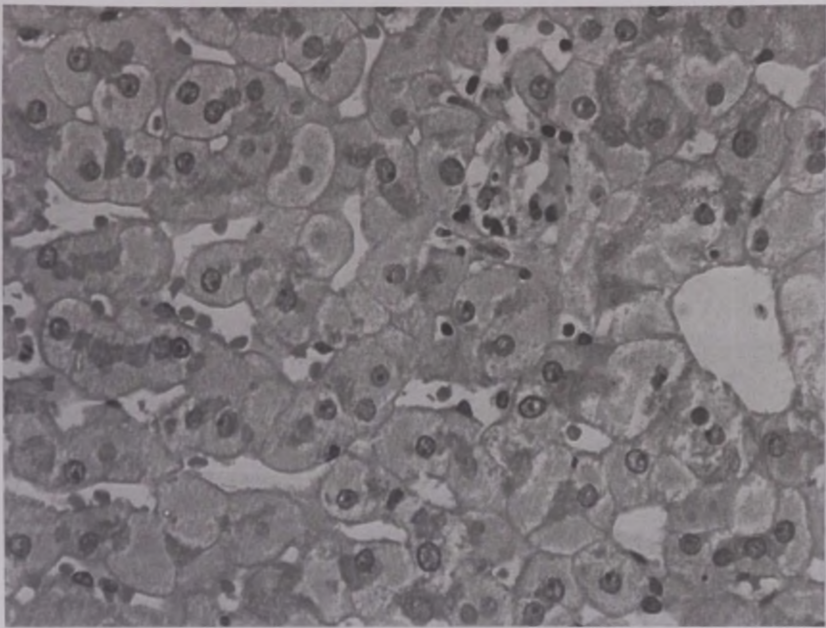

Fig. 4. Hepatic cords and sinusoids in liver biopsy. Note extended bile canaliculi. Obj. 40x/

DISCUSSION

Chronic viral hepatitis is a significant problem worldwide. Presently available therapies lead to the sustained resolution of inflammation only in the minority of treated patients, and newer therapies are constantly being introduced. Such therapies need to be evaluated particularly to determine whether they halt inflammation and result in the regression of fibrosis.

Histological scoring systems, evaluating inflammation and fibrosis, offer objective measures of improvement in either or these parameters [6, 18, 8, 16, 4, 1, 15]. Ziol et al. [19] compared paired liver biopsy specimens from the patients with hepatitis C to evaluate changes in multiple histological parameters, including fibrosis, 18 months after the initiation of 6 or 12 months of treatment with interferon. They used the METAVIR classification system (0–4). For the 6 months treatment group, the values for worse, no change, and better were 11%, 62% and 27% accordingly.

Several investigators have proposed the use of digital quantification as an alternative to the subjective scoring of fibrosis in liver biopsy specimens of the patients with chronic hepatitis C [2, 7, 13, 5]. All the studies reported a statistically significant correlation between the fibrosis assessed by the image analysis and the respective fibrosis classification used.

Other investigators [12] found that the fibrosis ratio of liver biopsy specimens, calculated by digital image analysis, was not always reflecting the fibrosis in chronic hepatitis as indicated by the subjective scoring classification. They supposed that the computed fibrosis ratio might be more accurately reflecting true differences in the stage of disease among livers with more advanced fibrosis (stage 3–6).

In our study quantitative stereological morphometric analysis of liver biopsy was used for the more correct evaluation of the dynamic of liver damages in the patients with chronic viral hepatitis C. The analysis allows us to estimate the area (%) of non-parenchymal elements such as portal tracts, bridging and piecemeal necroses, intralobular focal infiltrates. The quantitative analysis of the severity of hepatic fibrosis is very important for the prognosis of the disease progression, as well as antiviral treatment decisions [17]. The investigation showed that the portion of the area of non-parenchymal elements of different patients strongly varied; the interrelations between some morphological parameters and the level of serum alanine aminotransferarase were established. This study demonstrates that the ratio of the area of non-parenchymal elements to that of the entire tissue specimen in the initial biopsy might be a predictive factor for prognosis.

CONCLUSION

Stereological quantitative morphometry allows us to get a more correct evaluation of some morphological parameters of pathologically changed liver in the patients with chronic viral hepatitis. It is very important for the establishment of either positive or negative dynamic changes in liver, especially during the estimation of the efficiency of antiviral treatment. We supposed that the stereological morphometry is a suitable tool for the quantitative evaluation of liver biopsies in therapeutic trials.

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SEASONAL VARIATION IN SYMPATHOVAGAL BALANCE CONSIDERING SPORT-SPECIFIC EFFECTIVENESS IN BASKETBALL

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ABSTRACT

The purpose of this study was to examine qualitative changes in sympathovagal balance and to assess relationships between indicators of sport-specific effectiveness and post-exercise heart rate recovery in high-level basketball players for the whole season. Measures of heart rate were determined for eight male high-level basketball players (age 23.0±3.12 years, body mass 97.3±11.33 kg, height 202.0±6.7 cm) from the same team during practices executed in September, November, January and April. Sympathovagal balance was assessed after a basketball-specific exercise, on the basis of heart rate recovery, as the difference between heart rate at the peak of the sport-specific exercise, and 60 s after the end of the exercise ($HRR = HR_{peakE} - HR_{post60s}$). Individual longitudinal graphs of heart rate recovery were constructed after which players were divided into groups according to the ascending or descending trend of recovery. Also the athletes were ranked according to playing time and the coefficient of effectiveness in played matches. The most effective athletes showed descending trend of recovery while the players ranked lowest showed an ascending trend of recovery in all cases of ranking. Playing time and the coefficient of sport-specific effectiveness for individual players were compared considering the trend of recovery. Significant differences were found in sport-specific effectiveness between the group of athletes with the descending and the group with ascending trend of HRR ($t=3.925$, $p=0.008$).

The results of the current study showed that the most effective and most involved players can undergo non-beneficial changes of sympathovagal balance during the season. Our findings could be considered when planning post-season activities for individual players.

Key words: *heart rate recovery, basketball, monitoring, sympathovagal balance*

INTRODUCTION

The timing and magnitude of seasonal variations in physical fitness depend on physical activity in different societies [16]. Competitive sportsmen are not an exclusion in this respect, however decrease in physical fitness and sport-specific performance can be influenced by extensive participation in sport too. Regular training and competitions require regular monitoring of anthropometric, physiological and sport-specific variables by way of increasing competitiveness and avoiding overtraining. Nevertheless, longitudinal data about the impact of training as chronic stress on the physiology of elite athletes are lacking. Various markers have been proposed by different groups of researchers for observing seasonal changes in physiological fitness and fatigue in competitive sport [1, 6, 7, 12, 15]. Indices of the autonomic nervous system have been used for this purpose with variable success [2, 4, 5, 10, 11, 14]. Buccheit and Gindre showed strong relationship between weekly training load and heart rate recovery (HRR) [4]. Boullosa et al. recently demonstrated relationships correlating autonomic control and running performance [3]. The results of studies in this area of research are based on and adopted for endurance sports where training is prescribed on an individual basis. Such an approach is often unsuitable in team-sport practices where individualisation of training is restricted by extensive use of group drills [7]. Expanding this postulate and keeping in mind the finding of Buccheit and Gindre [4], we suggest that longitudinal measures of HRR could reflect differences in the training load during the in-season in basketball, assuming that the main source of discrepancy in the total training load between the members of the same basketball team is individual competitional playing time. On the other hand, measurement of sport-specific performance in team sport games is complicated. Personal coefficients of effectiveness are used to reflect individual contribution to the team result.

We investigated seasonal changes in autonomic heart regulation in relation to sport-specific measures in a group of basketball players.

The aims of the study were (1) to examine qualitative changes in sympathovagal balance and (2) to assess relationships between indicators of sport-specific effectiveness and post-exercise HRR in high-level basketball players for the whole season.

MATERIAL AND METHODS

Eight well-trained basketball players, with at least 8 years of basketball experience and minimal duration of training 9 hours per week, were recruited to participate in this study. Their medical history and the results of a medical examination were used to exclude subjects with cardiovascular, pulmonary, or metabolic diseases.

All subjects followed the same structured training programme, which included training sessions, competition games and rest days. The investigated athletes took part in two competition frames: a national championship and European Cup for clubs. Each athlete gave written informed consent before the beginning of the study. The study design and the procedures used were in accordance with ethical standards and with the Declaration of Helsinki.

High variability of exercises burdens analysis of the training process in basketball. In a previous study [9] we described basketball-specific exercise related to the athletes' aerobic capacity. For that 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. Coaches motivated the athletes to achieve as high intensity as possible during this exercise. This activity continued for 3.5 minutes until it was stopped by the audio signal. The described exercise was always executed in the last part of the practice. We selected four real practices including a basketball-specific 3.5-minute shooting exercise. All analysed practices took place in the morning.

In the current study we analysed recovery immediately after the cessation of the described basketball-specific exercise. Heart rate was monitored using downloadable, frequency-coded heart rate monitors (Polar Team System, Polar Electro Oy, Kempele, Finland) with 5 s registration intervals. The athletes were provided with a numbered heart rate monitor to wear during the whole practice. An investigator downloaded heart rate data files after the practices. We extracted the values of heart rate at the peak of the sport-specific exercise (HR_{peakE}), and the values of heart rate 60 s after cessation of that exercise ($HR_{post60s}$). The differences between HR_{peakE} and $HR_{post60s}$ were calculated ($HRR = HR_{peakE} - HR_{post60s}$). The HR data were extracted from the files of the practices performed in September, November, January and April, corresponding to the pre-season and the beginning, the middle and the end of the basketball season, respectively.

Analysis of playing time and efficacy was performed using data available at the internet sites of the Lithuanian Basketball League and the Union of European Leagues of Basketball.

Statistical analysis was performed in 3 stages. First, the values of HRR after the sport-specific exercise were used to construct longitudinal trends of heart rate recovery for each participant. The subjects were divided into two groups based on the ascending or descending course of the longitudinal graph. Second, the athletes were ranked retrospectively according to the total number of played minutes and the coefficient of effectiveness for both tournaments. Finally, to reveal differences in the values of sport-specific effectiveness and playing time for the groups, boxplots were fitted separately for each frame of the competition. The *t*-test was performed to show significance of found differences.

Data are presented as mean and standard deviation (SD). Alpha level for this study was $p \leq 0.05$. All calculations were made with SPSS 11.0 (SPSS Inc, Chicago, USA).

RESULTS

The general characteristics of the investigated athletes are shown in Table 1. Their anthropometric characteristics correspond to the requirements of high-level basketball.

The seasonal linear and logarithmic trends of heart rate recovery after the basketball-specific exercise are presented in Fig. 1. According to individual trends, four athletes showed a decreasing pattern of recovery, while the other four showed an increasing pattern. As is evident from Fig. 1, differences occur not only in the course of personal trends of HRR but also in the grade of inclination. The ranges of HR_{peakE} and $HR_{post60s}$ grouped according to the individual trends of HRR are presented in Table 2.

Table 3 presents individual ranks of playing time and effectiveness. These sport-specific variables revealed significant differences between players. Irrespective of the category of evaluation, the individual ranks of the investigated players were relatively stable.

The presented boxplots (Fig. 2, 3) illustrate differences in playing time and basketball-specific effectiveness in relation to the pattern of the HRR trend. The group of players with the descending pattern of HRR was always predominant in terms of playing time and effectiveness. Statistical comparison of the analysed sport-specific variables on the basis of the pattern of recovery is presented in Table 4. The mean values of sport-specific variables were always higher for athletes with the descending pattern of recovery. The *t*-test was employed to find out the significance of differences in sport-specific variables. Differences in effectiveness during the matches of the national championship were significant for the groups of athletes compared ($t=3.925$, $p=0.008$).

Table 1. Baseline characteristics of the basketball players of the study group.

Parameters	Minimum	Maximum	Mean	Std. Error	Std. Deviation
Age (years)	20	30	23.0	1.1	±3.1
Height (cm)	192	210	202.0	2.38	±6.7
Body mass (kg)	80	110	97.31	4.01	±11.3
BMI (kg/m^2)	21.7	25.2	23.75	0.44	±1.3
VO_{2peak}(ml/kg/min)	39.0	57.9	47.35	2.24	±6.3
VE (L/min)	109.8	168.9	133.8	7.78	±22.0

BMI – body mass index, VO_{2peak} – peak oxygen consumption, VE – minute ventilation

Table 2. The dynamics of individual values of heart rate during sport-specific exercise in basketball players.

Parameters	Group	September	November	January	April
HR_{peakE} (bpm) $HR_{post60s}$ (bpm)	Descending	164–178 115–138	154–173 110–148	169–175 115–154	161–172 121–138
HR_{peakE} (bpm) $HR_{post60s}$ (bpm)	Ascending	167–180 114–159	167–178 133–148	171–184 139–160	167–184 115–141

HR_{peakE} – range of heart rate at the peak of exercise, $HR_{post60s}$ – range of heart rate 60s after cessation of exercise.

Table 3. Ranking of the athletes according to basketball-specific variables.

Athletes	t_{EC} (min)	$Rank_{tEC}$	t_{NC} (min)	$Rank_{tNC}$	eff_{EC}	$Rank_{effEC}$	eff_{NC}	$Rank_{effNC}$
ATHL_1	426	1	915	2	13.8	2	11.29	3
ATHL_2	133	5	741	7	5.3	5	10.86	4
ATHL_3	22	8	440	8	2.3	7	3.45	8
ATHL_4	378	2	924	1	16.7	1	13.22	1
ATHL_5	111	6	904	3	3.2	6	11.44	2
ATHL_6	76	7	818	5	2.1	8	5.68	7
ATHL_7	270	3	812	6	6.1	4	7.57	6
ATHL_8	263	4	860	4	6.8	3	9.15	5

ATHL_1... ATHL_8 – investigated athletes, t_{EC} – played minutes in the matches of the European Cup, t_{NC} – played minutes in the matches of the national championship, eff_{EC} – average ranking points of effectiveness in the matches of the European Cup, eff_{NC} – average ranking points of effectiveness in the matches of the national championship.

Table 4. Statistical comparison of analysed sport-specific variables.

Parameter	Group	n	Mean	Std. Deviation	Std. Error
t_{EC} (min)	Descending	4	262.0	163.089	±81.544
	Ascending	4	157.75	127.526	±63.763
t_{NC} (min)	Descending	4	871.0	87.052	±43.526
	Ascending	4	732.5	196.166	±98.083
eff_{EC}	Descending	4	9.75	6.517	±3.258
	Ascending	4	4.33	2.472	±1.236
eff_{NC}	Descending	4	11.7	1.041	±0.521
	Ascending	4	6.46	2.459	±1.229

t_{EC} – played minutes in the matches of the European Cup, t_{NC} – played minutes in the matches of the national championship, eff_{EC} – average ranking points of efficacy in the matches of the European Cup, eff_{NC}– average ranking points of efficacy in the matches of the national championship. Ascending – group of athletes with ascending trend of HRR, Descending – group of athletes with descending trend of HRR.

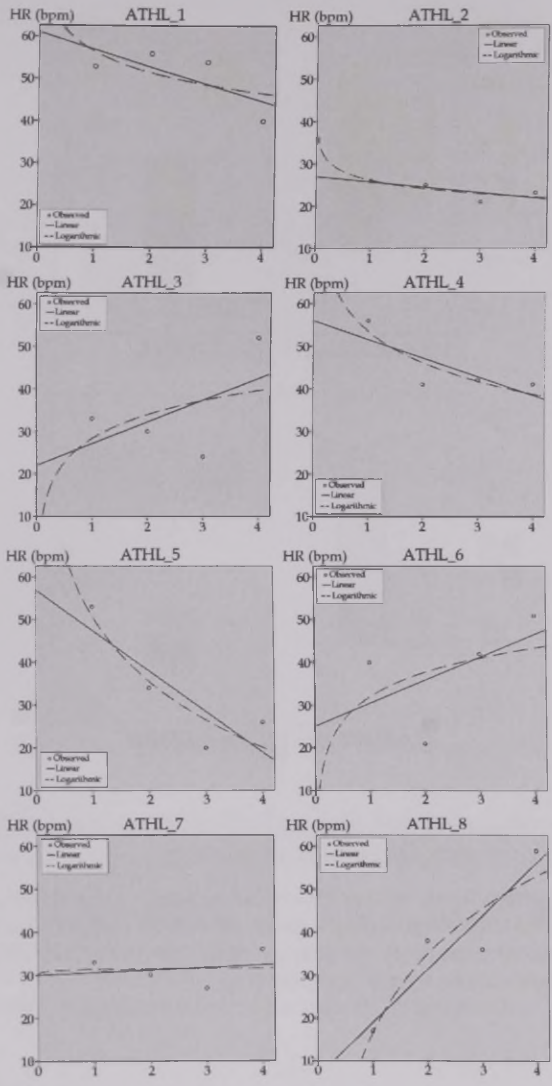

Fig. 1. Individual seasonal trends of heart rate recovery for the basketball players.

ATHL_1 – ATHL_8 – investigated athletes, HR (bpm) – heart rate recovery measured in beats per minute, 1, 2, 3, 4 – points of measurement in September, November, January and April, respectively.

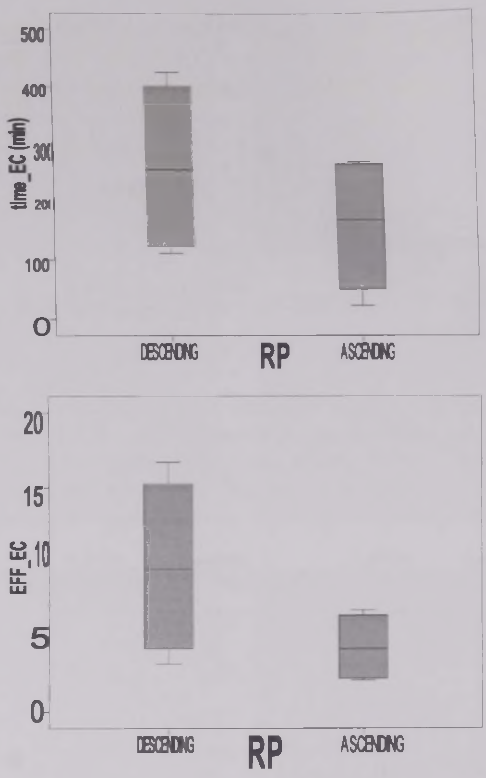

Fig. 2. Comparison of played time and effectiveness in the matches of the European Cup considering the pattern of recovery.

RP – recovery pattern for the whole season, Ascending – group of athletes with the ascending trend of HRR, Descending – group of athletes with the descending trend of HRR, t_{EC} – played minutes in the matches of the European Cup, eff_{EC} – value of effectiveness in the matches of the European Cup.

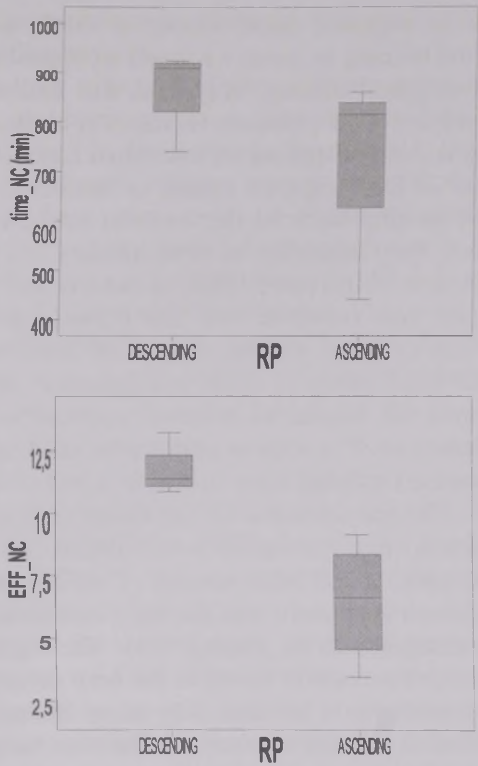

Fig. 3. Comparison of played time and effectiveness in the matches of the national championship matches considering the pattern of recovery.

RP – recovery pattern for the whole season, Ascending – group of athletes with the ascending trend of HRR, Descending – group of athletes with the descending trend of HRR, t_{NC} – played minutes in the matches of the national championship, eff_{NC} – value of effectiveness in the matches of the national championship.

DISCUSSION

This study demonstrates that participation in high-level competitive basketball leads to divergent changes in sympathovagal balance. High inter-individual variability in responses was observed both for the direction of trend and the grade of inclination in HRR of the investigated athletes. Instead of expected improvement in HRR, as a beneficial consequence of the training process, we found an opposite phenomenon in half of the investigated athletes. In general, this finding of our study could be explained using the postulate of Manzi et al. that adaptation to exercise training is dose related on an individual basis [13]. In case of the predominance of the sympathic system or decreased HRR, we can conclude that the training loads for the involved subjects were too high or, on the contrary, the adaptability of those subjects was too low for the applied loads. In case of increased HRR, or the trend of parasympathic predominance, we can conclude that the training process and the adaptability of the involved athletes to applied loads were adequate. Collation of individual trends of HRR and indicators of sport-specific effectiveness could be helpful in practical application of the above theoretical explanations. The total executed physical load in basketball is the sum of executed training loads in practices and executed activities in competitions. Despite attempts to individualize practices in team sports, training loads are often similar for all players [8]. Assuming that this postulate is correct, the main source of differences in the total physical load between the members of the same basketball team is direct participation in competitions or playing time. The right to select and substitute players on the court is vested in the head coach. Although the decision of the head coach is influenced by many factors, it is expected that the most effective players, who are also the most suitable in a given situation, will be on the court. The presented ranks of playing time and effectiveness support this proposition. As is seen from Fig. 2 and 3, players with the descending trend of HRR were more effective and spent more minutes on the court in both frames of competitions. In other words, the "price" of such higher effectiveness was the unbeneficial trend of HRR. The decrease in HRR in a part of the investigated athletes could be attributable to fatigue or fixture overstrain in the second half of the season. Whether this is due to "saturation" of vagal modulation [7] or some other mechanism, can only be suggested. The practical solution in such case could be a significant redistribution of playing time or yet more individualised training process between the members of one team. Such monitoring with the use of measures of performance and physiological variables can be and is applied in endurance sports [5, 6, 10]. However, the goals and means of the team do not always conform to the physiological properties of athletes in team sport games. High effectiveness and relatively long playing time together with non-optimal recovery for those athletes could be the causes of decreasing trends in the HRR of leading players.

The significance of the established differences was proved using the *t*-test for only one category (eff_{NC}). The periods of participation in the European Cup and in the national championship were of different duration. The investigated athletes were involved in the matches of the European Cup from November to February while the national championship covered the period from September to May. Owing to this, the individual values of effectiveness in both frames of competition were based on a different number of games. The statistically significant difference in effectiveness was related to the longer period of the tournament and to a larger number of matches within the national championship. We can only speculate about the possibly significant difference in other categories assuming that participation in the European Cup is longer. Interestingly, the ranking of the investigated players in eff_{NC} fully coincides with the direction of the HRR trends. It seems that lack of significant difference in other compared categories could be associated with the small number of investigated subjects, which is main limitation of our study.

The findings of the current study are based on longitudinal short-term measurements of HRR. The decision to analyse this short-term exercise was caused by the specificity of practices in basketball. When monitoring some physiological variables in basketball, the main challenge is finding comparable episodes in particular training sessions. The analysed 3.5-minute shooting exercise is highly basketball-specific and comparable in terms of duration, time of execution and motivation [9].

In conclusion, our study showed that seasonal variations in heart rate recovery are not necessarily beneficial for all players of the same basketball team. The most effective and most involved players may undergo non-beneficial changes in sympathovagal balance during the season. It seems that the playing time of each athlete and consequent individual effectiveness are not based on the physiological capacity of the athlete but on the goals of the team. Assuming this, the explanation of disturbed balance between the load and recovery is not so sophisticated. Repeat measurement of heart rate recovery is a useful tool for monitoring the sympathovagal status of team-sport athletes. The results of this study can be applied in planning post-season activities for individual players.

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ETHNIC AND GEOGRAPHICAL VARIABILITY OF FINNO-UGRIC PEOPLES' STATURE

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ABSTRACT

The anthropological material used for stature analysis was collected by Karin Mark in 1955–1976. It consists of the measurement data of 112 Finno-Ugric, nine Indo-European and 12 Turkic peoples' groups. In total there were 133 ethnic and territorial groups with 12,236 people. The article gives an overview of the variability of stature in all local territorial groups of all Finno-Ugric and some of their neighbouring peoples. The average statures by summative ethnic groups are also given. The studied peoples are characterised by a rather great variability of stature – from 157.7 cm to 176.9 cm, the shortest peoples being West Siberian Khants and Mansi, the tallest – Finnish Swedes, Estonians and Finns.

***Key words**: Finno-Ugric peoples, Indoeuropeans, Turkic peoples, stature.*

INTRODUCTION

Stature, or height, is one of the foremost indicators of human physical development and a highly heritable conventional variable in anthropometry. Human height, like other phenotypic traits, is determined by a combination of genes, but it is also influenced by environmental factors (as climate, various stress factors, nutrition, especially in childhood and adolescence, etc). The precise relationship between genetics and environment is complex and uncertain. According to several studies on twins, human height is heritable within 60–80% [3]. Adult human height often differs significantly between populations and population groups.

In Estonia, for example, a geographical gradient in stature has existed throughout times [15, 1, 5, etc.]. The mean stature in West Estonians is higher than in East Estonians, regardless secular changes in height [5]. There are also gender differences within a population with men being on average taller than women. In Estonia, for example, the index of gender differences is 92.6 [2].

There are comparatively numerous publications by different researchers on Finno-Ugric peoples' somatology, including stature, since the first half of the 20^{th} century. Nonetheless, all the peoples have not been sufficiently studied [7, 12, 14, 17–19, etc.].

The well-known Estonian anthropologist Karin Mark, for her study of Finno-Ugric peoples, gathered a great bulk of anthropological data, including stature, from a vast habitation territory of the Finno-Ugric peoples, and also of the neighbouring peoples, using the same measuring technique and method. These data were collected during a certain time period – in the third quarter of the past century. During the last century, especially the second half of that, accelerated growth and increase in stature have been observed [5, 21]. The most rapid acceleration and increase in stature, as appeared in the case of West-Estonian islands' rural grown-up population, concerns especially those born in the late 1950s or later. [4]. One may only presume that the accelerated growth and increase in stature of grown-ups on the vast Finno-Ugric territories were not particularly notable, especially during the first 15 years of studies, when the majority of materials was gathered (1956–1970). K. Mark published a greater part of her research results, including stature, on Finno-Ugric peoples in separate publications [9, 10, 20, etc.], but her general manuscript on all Finno-Ugric peoples' anthropology remained unfinished. The unfinished manuscript by K. Mark about all Finno-Ugric peoples' physical anthropology has been edited, completed and prepared for publication by L. Heapost. In the present article, data on Finno-Ugric peoples' stature, analyzed by Karin Mark, are given, to make them available for research.

MATERIAL AND METHODS

The material used in the present study was collected by Karin Mark from all Finno-Ugric peoples. Simultaneously comparative data were collected on neighbouring (Indo-European and Turkic) peoples in 1955–1976. The majority of the materials were collected during the first 15 years from the beginning of the study, only Trans-Carpathian Hungarians, North-Eastern Finns and Komi-Zyrians in Vizinga, Zheshart and Ukhta were studied later, in 1972–1976. Measuring was mostly carried out in villages, using conventional methods [11]. At each location, the study embraced indigenous inhabitants – men aged 20–60 years. K. Mark also measured women at some places; these data have been published earlier [10]. The number of subjects in each group was approximately 100 people. The bulk of stature material consists of the measurement data of 112 Finno-Ugric groups, collected by K. Mark. Data on Livonians' stature have been published earlier [16, 18]. For comparison, data on nine groups of Indo-European peoples and 12 groups of Turkic peoples are provided. Thus, in total there are of 133 ethnic and territorial groups with 12,236 people. Variation in stature in local territorial groups of studied peoples is given in Table 2 and on Fig. 1. The average statures by summative ethnic groups are shown in Table 3 and on Fig 2. Data on stature have been analysed by Karin Mark. The extant text of the manuscript on stature is given almost unchanged.

Table 1. Stature in Finland in various times

Time of measurement	1768–1806	1924 and later	1967–1968
The author and source	Y. Kajava, J. Finne 1926	N. Pesonen 1936	K. Mark 1970
West-Finland:			
Uusimaa	168.8	169.6	173.4
Varsinais-Suomi	169.4	171.7	173.1
Satakunta	169.6	170.8	174.8
Häme	169.1	170.6	174.4
Etelä-Pohjanmaa	169.0	170.5	173.0
North- and East-Finland:			
Pohjois-Pohjanmaa	169.0	167.1	171.3
Savo	168.2	167.4	171.8
Karjala	–	166.3	172.6
Finns	169.1	168.7	172.9
Finnish Swedes		172.3	174.7

Table 2. Stature (cm)

	n	M	m	σ
Finno-Ugric peoples				
Estonians				
1 Haapsalu	92	173.8	0.5	4.8
2 Lihula	98	174.8	0.7	6.6
3 Audru	95	175.7	0.6	6.0
4 Rapla	100	173.4	0.7	6.8
5 Põltsamaa	99	172.0	0.5	5.3
6 Rakvere	100	173.6	0.6	5.7
7 Kohtla-Järve	103	172.3	0.5	5.4
8 Iisaku	91	169.8	0.6	6.0
9 Kilingi-Nõmme	103	173.0	0.6	6.5
10 Karksi	99	173.9	0.6	5.8
11 Otepää	100	171.9	0.6	6.4
12 Põlva	101	173.5	0.6	5.7
13 Võru	99	173.6	0.7	6.6
1–13 in total	1280	173.2	0.2	6.0
Izhorians				
14 Krakolye	61	164.8	0.8	5.9
15 Soikino	95	167.2	0.6	5.8
14–15 in total	156	166.3	0.5	5.9
Ingrian Finns				
16 Kurgolovo	51	167.8	0.9	6.2
Finns				
17 Askola	105	173.4	0.5	5.2
18 Mynämäki	89	173.1	0.7	6.4
19 Kokemäki	85	174.8	0.7	6.6
20 Kurikka	110	173.0	0.6	6.0
21 Hauho	94	176.6	0.8	7.3
22 Keuruu	140	172.3	0.5	6.4
23 Ristiina	143	171.5	0.6	6.8
24 Kiuruvesi	101	172.1	0.7	7.0
25 Kesälahti	110	172.6	0.6	6.3
26 Ylitornio	112	171.3	0.5	5.6
17–26 in total	1089	172.9	0.2	6.8
27 Kuusamo	143	169.6	0.5	5.7
28 Salla	143	169.4	0.6	7.1

Talbe 2. Continuation

	n	M	m	σ
29 Savukoski	81	168.5	0.7	6.1
27–29 in total	367	169.3	0.3	6.4
Karelians				
30 Kalevala	92	166.5	0.6	5.6
31 Kolatselga	45	165.2	1.0	6.7
32 Olonets	95	166.5	0.6	6.3
33 Girva	97	164.3	0.6	5.4
30–33 in total	329	165.7	0.3	6.0
Vepsians				
34 Ozyora	64	163.4	0.8	6.4
35 Sidorovo	41	164.7	0.8	5.4
34–35 in total	105	163.9	0.6	6.1
Sami				
36 Lovozero	61	158.2	0.7	5.5
37 Kolta Sami	40	158.4	1.1	7.2
38 Inari Sami	48	163.6	0.7	4.9
39 Northern Sami	39	163.4	0.9	5.7
36–39 in total	197	160.8	0.4	6.3
Mordvinians-Erza				
40 Lukoyanovo	94	166.8	0.5	5.0
41 Ichalki	102	169.3	0.4	3.8
42 Chamzinka	94	167.2	0.5	5.1
43 Kozlovka	97	167.9	0.6	6.0
44 Atyashevo	98	170.5	0.6	6.0
45 Dubyonki	98	168.1	0.6	5.6
46 Kochkurovo	97	166.6	0.5	5.2
47 Torbeyevo	98	165.6	0.5	5.4
48 Shemysheika	97	165.7	0.5	4.7
49 Sosnovoborsk	93	169.3	0.5	5.1
50 Kuzovatovo	99	168.6	0.6	6.1
51 Novo-Malykla	97	168.9	0.6	6.1
52 Klyavlino	98	167.4	0.5	5.2
53 Podbelskaya	95	168.4	0.6	6.1
54 Aksakovo	101	166.7	0.7	6.7
40–54 in total	1458	167.7	0.1	5.8
Mordvinians-Moksha				

Talbe 2. Continuation

	n	M	m	σ
55 Meltsany	89	167.8	0.6	5.8
56 Staro-Sindrovo	87	165.7	0.6	5.9
57 Krasnoslobodsk	95	165.3	0.6	5.6
58 Artyuryevo	90	165.7	0.6	5.3
59 Rybkino	100	165.6	0.6	6.1
60 Torbeyevo	98	165.3	0.5	4.8
61 Zubovo-Polyana	93	164.5	0.6	5.4
62 Shiringushi	90	166.0	0.6	5.4
63 Insar	96	165.9	0.5	5.3
64 Poim	100	167.6	0.5	4.7
65 Shemysheika	60	166.9	0.8	6.1
66 Sosnovoborsk	98	168.7	0.6	6.1
67 Bolshiye Tarhany	99	166.9	0.6	6.3
55–67 in total	1195	166.3	0.2	5.7
Terjuhan				
68 Bolsh. Teryushevo	43	170.2	0.8	5.3
Karatai				
69 Kamskoye Ustye	63	164.0	0.7	5.8
Mari				
70 Yelassy	99	164.8	0.6	5.9
71 Zvenigovo	85	163.6	0.5	4.6
72 Morki	95	163.3	0.6	6.2
73 Medvedevo	87	162.7	0.6	5.5
74 Orshanka	94	161.0	0.6	5.6
75 Sernur	82	162.1	0.5	4.8
76 Mari-Turek	98	161.7	0.6	5.8
77 Shurma	94	161.3	0.5	5.4
78 Kaltasy	94	160.9	0.6	5.7
79 Mishkino	97	161.5	0.6	5.8
70–79 in total	925	162.3	0.2	5.6
Udmurts				
80 Alnashi	98	162.2	0.5	5.3
81 Mozhga	99	162.6	0.6	6.2
82 Malaya Purga	75	162.2	0.6	5.5
83 Uva	90	161.4	0.6	5.8
84 Selty	104	161.6	0.6	5.7
85 Glazov	90	162.4	0.7	6.4
86 Balezino	95	163.3	0.5	5.1

Talbe 2. Continuation

	n	M	m	σ
87 Kez	94	163.0	0.6	6.3
88 Debyosy	93	163.3	0.7	6.5
89 Igra	94	162.8	0.6	6.0
90 Yakshur-Bodya	96	161.8	0.6	5.8
91 Sharkan	101	162.3	0.6	5.6
92 Zavjalovo	98	163.6	0.7	6.7
93 Kaltasy	97	162.5	0.5	5.0
80–93 in total	1324	162.5	0.2	5.9
Bessermen				
94 Yukamensk	73	160.6	0.7	6.3
95 Balezino	61	162.6	0.9	6.9
94–95 in total	134	161.6	0.5	5.9
Komi-Permiaks				
96 Kudymkar	100	163.5	0.5	5.0
97 Kossa	88	162.8	0.8	8.0
98 Kochovo	98	162.1	0.5	5.4
96–98 in total	286	162.9	0.3	5.5
Komi-Zyrians				
99 Letka	95	164.2	0.6	5.8
100 Syssola	100	164.2	0.5	4.9
101 Vizinga	106	166.5	0.5	5.6
102 Zheshart	96	167.1	0.6	5.9
103 Ust-Kulom	100	163.9	0.6	6.1
104 Troitsko-Pechorsk	73	163.0	0.8	6.3
105 Uhta	81	166.1	0.7	6.7
106 Izhma	99	162.2	0.6	5.7
107 Muzhi	46	164.4	0.9	5.8
99–107 in total	796	164.7	0.2	5.9
Mansi				
108 Konda	24	164.5	1.2	5.8
109 Sosva	47	158.4	0.8	5.3
108–109 in total	71	160.5	0.7	6.2
Khants				
110 Beryozovo	90	157.7	0.7	6.4
Hungarians				
111 Uzhgorod	98	168.8	0.5	5.3
112 Beregovo	100	168.6	0.7	6.6
111–112 in total	198	168.7	0.4	6.0

Talbe 2. Continuation

	n	M	m	σ
Indo-European peoples				
Finnish Swedes				
113 Åland	123	176.9	0.6	6.3
114 Närpes	146	174.9	0.5	5.7
115 Lilyendal	139	172.7	0.6	6.8
113–115 in total	408	174.7	0.3	6.2
Russians				
116 Poim	100	166.1	0.6	6.1
117 Kuzovatovo	98	167.4	0.6	5.8
118 Aksakovo	101	167.7	0.5	5.5
119 Saransk	97	165.3	0.5	5.3
120 Medvedevo	95	164.4	0.6	6.2
121 Igra	112	165.2	0.5	5.6
116–121 in total	603	166.0	0.2	5.9
Turkic peoples				
Chuvash				
122 Oktyabrskoye	76	164.5	0.6	5.7
123 Sundyr	97	166.0	0.6	6.3
124 Batyrevo	97	164.8	0.5	4.8
122–124 in total	270	165.1	0.3	5.7
Tatars				
125 Shiringushi	93	166.4	0.6	5.7
126 Bolshiye Tarhany	99	164.9	0.5	5.1
127 Arsk	100	165.2	0.5	5.3
128 Mari-Turek	95	164.8	0.6	6.2
129 Chekmagush	102	164.6	0.6	6.5
125–129 in total	489	165.2	0.3	5.8
Bashkirs				
130 Chekmagush	97	162.7	0.5	5.2
131 Burayevo	98	162.5	0.5	5.2
132 Makarovo	100	163.0	0.5	5.5
133 Baimak	99	165.2	0.5	4.6
130–133 in total	394	163.5	0.3	5.2

Table 3. Stature by summative ethnic groups (cm)

	n	M	m	var	D
Khants	90	157.7	0.7	–	–
Mansi	71	160.5	0.7	158.4–164.5	6.1***
Sami	197	160.8	0.4	158.2–163.6	5.4***
Bessermen	134	161.6	0.5	160.6–162.6	2.0
Mari	925	162.3	0.2	160.9–164.8	3.9***
Udmurts	1324	162.5	0.2	161.4–163.6	2.2*
Komi-Permyaks	286	162.9	0.3	162.1–163.5	1.4*
Bashkirs	394	163.5	0.3	162.5–165.2	2.7***
Vepsians	105	163.9	0.6	163.4–164.7	1.3
Komi-Zyrians	796	164.7	0.2	162.2–167.1	4.9***
Chuvash	270	165.1	0.3	164.5–166.0	1.5
Tatars	489	165.2	0.3	164.6–166.4	1.8*
Karelians	329	165.7	0.3	164.3–166.5	2.2**
Russians	603	166.0	0.2	164.4–167.7	3.3***
Izhorians	156	166.3	0.5	164.8–167.2	2.4*
Mordvinians-Moksha	1195	166.3	0.2	164.5–168.7	4.2***
Mordvinians-Erza	1458	167.7	0.1	165.6–170.5	4.9***
Hungarians	198	168.7	0.4	168.6–168.8	0.2
NE Finns	367	169.3	0.3	168.5–169.6	1.1
Finns	1089	172.9	0.2	171.3–176.6	5.3***
Estonians	1280	173.2	0.2	169.8–175.7	5.9***
Finnish Swedes	480	174.7	0.3	172.7–176.9	4.2***

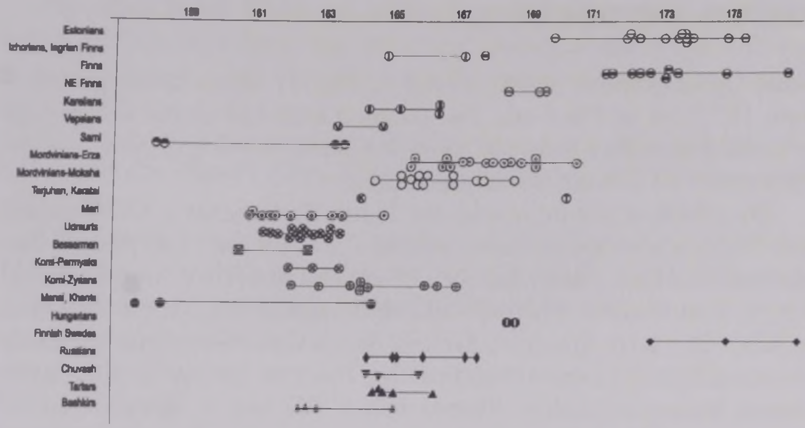

Fig. 1. Stature (cm)

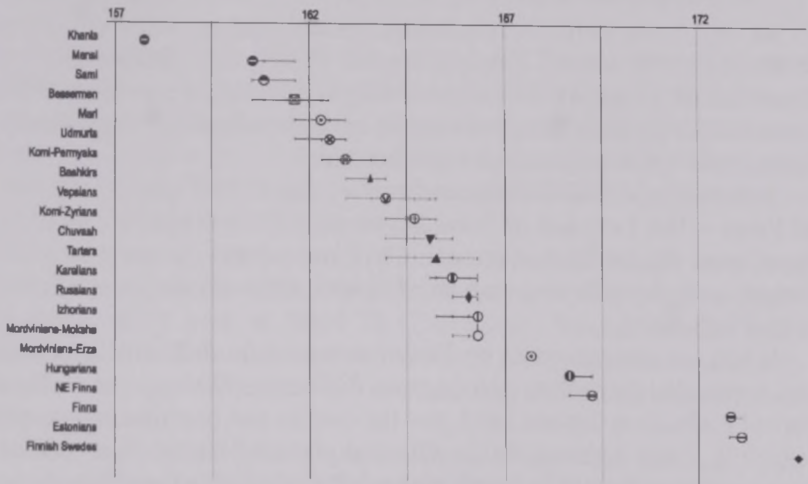

Fig. 2. Stature by summative ethnic groups (cm)

RESULTS AND DISCUSSION

Finno-Ugric peoples' stature (Table 2, Fig. 1) varies rather greatly – from 157.7 cm to 176.6 cm. The standard error (m) of the arithmetical mean in the studied groups is most frequently 0.5–0.6. In this case the differences 1.3–1.6 cm are not significant.

The tallest in stature among the Finno-Ugric peoples are Estonians and Finns, whose group means exceed 170 cm almost everywhere. The maximums of the groups (about 175 cm and more) are concentrated in South-West Finland (Hauho, Kokemäki) and in West-Estonia (Audru, Lihula). The other groups in Finland and in the western part of Estonia do not differ from them significantly. Towards the east and the north stature becomes smaller. Stature below 173 cm is characteristic of Estonians in East-Estonia (Iisaku, Kohtla-Järve, Otepää) and of Finns in East- and North-Finland (Kesälahti, Ristiina, Keuruu, Kiuruvesi, Ylitornio, Kuusamo, Salla, Savukoski). Stature is the shortest in Finns of Savukoski (168.5 cm). These groups differ significantly from the above-mentioned tall-statured groups.

According to the present study, Estonians have the mean stature of 173.2 cm, Finns (without North-East Finland groups) 172.9 cm. Even taller is the stature of Finnish Swedes (174.7 cm). Discrepancy of Swedes from Finns and Estonians is fully significant, if we compare the mean values for these peoples; they do not, however, differ significantly from south-western Finns and west-Estonians.

Before World War II Estonians' stature was 172.03 cm [15, 51], that of Finns – 168.7 cm and of Finnish Swedes – 172.3 cm [12]; thus all of them were shorter than at present. Obviously, stature is not a constant feature, as it depends on a number of factors, although the genetic factor is also influential.

When we compare data on Finns' stature from different times, we can notice that there have always been differences between the western part of Finland on the one hand, and the eastern and northern part on the other [7]. Table 1 shows that in different periods Finns in East Finland (Savo and Karelia) and in North Finland (Pohjois-Pohjanmaa) have been shorter than Western Finns; similar differences exist between Finns and Swedes – the latter have always been taller.

According to J. Aul's data [15] Estonians, measured in 1932–1936, were taller in West-Estonia (173–174 cm) than in East-Estonia (170–171 cm).

Livonians' stature, according to the data of various authors, was also tall: 172–174 cm [14, 13, 16].

The other Baltic Finns are of medium stature, or even somewhat below medium. Karelians' and Izhorians' stature is about 164–167 cm, that of Vepsians' but 163–165 cm. The shortest are Ozjora' (Vps. Järved) Vepsians (163.4 cm).

Similar to the latter are Inar's and Northern Sami, among whom the Kola and Kolta (Skolt') Sami differ significantly by a still shorter stature (about 158 cm).

Among Volga and Permian Finns the tallest people are Mordvinians. That applies, first of all, to the greater part of Erzas (Erza-Mordvinians), Terjuhans and a few groups of Mokshas (Moksha-Mordvinians) whose stature is above the average (168–170 cm). They do not differ considerably from the shortest Estonians (Iisaku) and Finns (Kuusamo, Salla, Savukoski). The rest of Mordvinians' groups – the greater part of Mokshas and of Karatais have smaller stature (164–167 cm). In that respect they resemble Karelians and Izhorians.

The centre of relatively short-statured people comprises the western part of Mordovia, population of Mokshas. Towards the south, the north and especially the east, stature increases. Differences between the relatively shorter stature (below 166 cm) and taller stature (above 168 cm) of Mordvinian groups are significant.

Stature is short in Maris, Udmurtians and Komis. The stature of different groups varies in Maris between 161–165 cm, in Udmurtians 161–164 cm and in Komis it is mostly in the limits of 162–164 cm. Exceptional are some of the Komi-Zyrians groups (Uhta, Vizinga ja Zheshart) where the stature is medium (166–167 cm). These were measured 16 years later than the others.

In comparison with other Maris, the Mountain Maris in Jelassy district are somewhat taller, 164.8 cm. Some groups of Meadow Maris in the southern part of Mari El (Zvenigovo, Morki) do not differ significantly from the former either. The rest of Maris have considerably smaller stature, mostly 161–162 cm, and they differ significantly from Mountain Maris.

That quite small-statured zone extends from Mari El and Kirov oblast (Shurma) territory to the western part of Udmurtia, where the Udmurtians of Uva and Selty districts and Jukamensk' Bessermen reside. The latter are even smaller in stature (160.6 cm). In North-East Udmurtia there is another zone where the stature is somewhat taller (163–164 cm). This area includes the Udmurtians of Kez, Debjossy and Balezino. The stature is also the same in Zavyalovo, which is located southwards from them, and also in the eastern part of Udmurtia.

Differences between the mentioned extreme variants are mostly significant.

Perm Komis are similar to most of Udmurtians concerning their stature. Komi-Zyrians are mostly somewhat taller, about 164 cm or above that. The Northern Izhma group, where the stature attains its minimum for Zyrians (162.2 cm), differs significantly from them.

The shortest are Khants (157.7 cm), among whom the Sos'va Mansi are not considerably taller (158.4 cm). On the contrary, the southern, Konda Mansi have noticeably taller stature (164.5 cm), which is below the average but not small on the Finno-Ugrians' scale. Trans-Carpathian Hungarians have a stature noticeably above the average (about 169 cm), thus resembling the greater part of Erza-Mordvinians and North-Eastern Finns.

Russians in Central Volga districts have a medium stature or below the average (164–168 cm). The tallest among them are residing in the vicinity of Mordvinians, being shorter from the latter. The Russians residing in the same district as Maris (Medvedevo) and Udmurtians (Igra) are shorter in stature than other Russians groups, but taller than the Maris and the Udmurtians of the same district.

Turkic peoples have a stature mostly below the average (164–166 cm). The Shiringush Tartars resemble by stature the Moksha Mordvinians of the same district and the Oktjabrskoye Tshuvashes residing in the vicinity of Zvenigovo are similar to Maris. However, the Moksha Mordvinians in the vicinity of Bolshiye Tarhany are considerably taller than the Tartars of this district. In the Mari-Turek district, on the contrary, Maris are much shorter than Tartars. The Northern Bashkirs differ from the other Turkic groups by a considerably shorter stature (somewhat below 163 cm). The neighbouring Udmurtians resemble them, but the East-Maris residing there are still shorter in stature. The difference between the Maris in Kaltassy and the Bashkirs in Burayevo district is significant.

When we observe the ethnic groups in ascending order of stature (Table 3, Fig. 2), we get a number of groupings of peoples within which there are no significant differences.

1) Khants have the shortest stature among all the peoples studied (157.7 cm); they also differ significantly from all the other peoples.
2) Mansi, Sami and Bessermen are also of short stature (160.5–161.6 cm).

3) Mari, Udmurts and Komi-Permyaks (162.3–162.9 cm). The first two of them do not differ significantly from Bessermen; Komi-Permyaks, however, do not differ significantly from the peoples of the following grouping.
4) Bashkirs and Vepsians (163.5–163.9 cm) are also peoples of relatively short stature.
5) Komi-Zyrians, Chuvash and Tatars (164.7–165.2 cm) are already of medium height for Finno-Ugrians. They do not differ significantly between themselves and from Vepsians.
6) Karelians, Russians of the Volga area, Izhorians and Moksha (165.7–166.3 cm), between whom there are no significant differences. Neither do Karelians differ significantly from Chuvash and Tartars, nor Izhorians from Tartars.
7) Erza, whose stature is above the average (167.7 cm), differ significantly from all the other peoples studied.
8) Transcarpathian Hungarians and north-eastern Finns have relatively tall stature (168.7–169.3 cm). They do not differ significantly between themselves, but differ from the other peoples.
9) Finns (excluding north-eastern Finns) and Estonians have rather tall stature (172.9–173.2 cm). There are no significant differences between them, but they differ significantly from the others.
10) Finnish Swedes (174.7 cm) are the tallest among the peoples studied and differ significantly from all the others.

CONCLUSIONS

1. This is the first publication of all the data on stature of Finno-Ugric and some neighbouring peoples collected by K. Mark.
2. Finno-Ugric peoples' stature varies greatly by groups – from 157.7 cm to 176.6 cm.
3. The shortest stature among the studied peoples is observed in Khants in western Siberia (157.7 cm), followed by Mansi, Sami and Bessermen (160.5–161.6 cm), Mari, Udmurts and Komi-Permyaks (162.3–162.9 cm); Bashkirs and Vepsians are also peoples of relatively short stature. Medium growth for Finno-Ugrians characterises Komi-Zyrians, Chuvash and Tartars (164.7–165.2 cm) followed by Karelians, Russians of the Volga area, Izhorians and Moksha (165.7–166.3 cm). Above the average is the stature of Erza (167.7 cm). Transcarpathian Hungarians and North-eastern Finns

have a taller stature (168.7–169.3 cm); Finns (excluding north-eastern Finns) and Estonians have a rather tall stature and Finnish Swedes are the tallest (174.7 cm) among the peoples studied.

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TRAUMAS OF VILNIUS ADULT MALES AND FEMALES IN THE 16^{TH}–17^{TH} CENTURIES: IMPLICATIONS ON GENDER AND LIFE STYLE

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ABSTRACT

Objective: To evaluate the trauma prevalence of Vilnius adult males and females in the 16^{th}–17^{th} centuries from skeletal data. *Material and methods*: 393 adult skeletons (228 males and 165 females) aged from 17 to 50+ years were analyzed in this study. Materials were pooled into groups according to confession (Orthodox or Catholic) and social status (higher or lower, regular burials or supposedly epidemic victims). *Results and conclusions*: In general, healed trauma incidence increases with age – a cummulative effect of life history events. Male's lifestyle was more physically traumatic. By anatomical location, males had a much higher prevalence of injuries to the head, ribs and hand bones compared with females. The highest incidence of traumatic events was recorded for the individuals from orthodox cemeteries, while it was the lowest, poorest city dwellers' sample. Lesion prevalence for different age at death groups was difficult to relate with lifestyle's peculiarities.

Key words: *paleopathology, trauma, gender, Vilnius.*

INTRODUCTION

Humans are living psycho-physiological creatures, therefore psychical and physical (biological) health status is a measure indicating the quality of life or well-being. Unfortunately, attempts to evaluate past peoples' psychical health status is only speculative; however, the human skeletons are the most direct evidences of human biological health [17].

Having in mind that biological human's health state is vitally influenced by sociocultural agents and vice versa, osteological data is like a mirror reflecting the extremely important information concerning human adaptation to particular environment.

Physical traumas constitute one of the most common pathologies found in skeletons [30; 31]. These studies are important and provide useful information because: a) most of all the traumas is a result of adverse sudden human relationship with sociocultural or natural environment, and specific injuries are a certain reflection of this interaction; b) people with serious physiological injuries, at least for some time we cannot fully accomplish some of their tasks to society and for themselves; c) people with serious injuries need other people's attendance, and nursing could be interpreted as society's support and attention to patients; d) possible causal relations with other diseases (for instance, metabolic complaints such as osteoporosis, vitamin D deficiency and others) [4].

The Grand Duchy of Lithuania (GDL) (the Eastern and Central European state from the 13^{th} century until 1795) was a country of remarkable cultural diversity, established on the Latin and the Byzantine civilizations boundary. Vilnius, the capital, was full of events that had a strong influence on the health status of the inhabitants in the 16^{th} and 17^{th} centuries. They experienced permanent and cruel conflicts with the Russian and Swedish armies ("the Deluge"), periodic infectious diseases and famine outbreaks, fluctuations in population size, social differentiation, shift in relationships with rural populations, social structure developments, and migrations. Those centuries are completely different in the history of this town. The 16^{th} century was a blossom time for Vilnius: the town underwent a period of expansion; it was the main transitional town between Russia and the western world; many nations lived together in one place; the first University was established and many other aspects demonstrate that Vilnius was a prosperous town. However, from the 17^{th} century, particularly from "the Deluge", welfare of Vilnius began to decline. Combinations of famines, plagues and wars hit very heavily the Vilnius dwellers with particularly terrible social, biological and historical consequences [13]. The population size in the city for mentioned periods varies according to different studies. The estimated values vary from 14 to 120 thousand of people in the 16^{th} century, with "standard" values being about 20 to 30 thousand. Half of the people died or escaped during "the Deluge" in the middle of 17^{th} century [13; 14; 15; 23].

Vilnius differed from other big medieval towns because of one significant aspect: the famous medieval proverb that "the air of the town makes people free" practically was not valid here. Townspeople never had a real independence from the local nobility that is witnessed in many historical records by many complaints concerning lawlessness in the 16^{th}–17^{th} centuries [1]. Vilnius was multinational and, definitely, socially hierarchical city. Furthermore, males were socially in a higher position than females in the society: women were responsible only for the home space [24]. Vilnius was a messy town and the local authorities did not seek to change the situation very much. Simple townspeople lived in a crowded environment, all the dirt had been thrown away directly to the streets or drained to the waters pools or rivers. Infectious epidemic diseases were a very common phenomenon in the dwellers' daily life, repetitious by periods of seven or eight years with the enormous influence to many dimensions of social life [2]. In addition to this, Vilnius was a multinational transitional town, including that Russian and Swedish armies occupied it several times. The most common and probably most effective way to escape from these disasters was just to run away from the focal outbreak locations for that time. Nevertheless, according to the historical records, higher social status people had more possibilities to avoid and survive outbreaks of these disasters. Conversely, the underclass usually stayed in the city during these periods with a very high risk to die [13; 26].

Besides of infectious epidemic diseases and famines, the second biggest health problem for local dwellers had been various types of traumas. Males were fond of solving their problems in fights or interpersonal conflicts: there are plenty of historical complaints concerning physical abuse against females, lower social status people, work conflicts, etc. Other possible causes of multiple traumas were unintentional incidents, such as road traffic accidents and so on. A historical record tells the story where an old lady complains about the carrier who overrides her daughter, who now has a serious medical treatment [1]. Undoubtedly, intensive and very cruel wars of the 17^{th} century had traumatized or killed many Vilnius dwellers. In addition, fires were a huge problem for the dwellers living in the wooden town: there are plenty of historical records telling about devastating fire accidents [1; 13; 22].

The Barbers' guild was the prime agent responsible for most of the injured dwellers care. Their medical care was very diverse, for instance, they restituted dislocations, extracted teeth, attended fractured bones, etc. They worked as forensic medicine agents, too [21]. On the other hand, we can only suppose about the quality of medical treatment for simple dwellers. Only high social status people could afford the professional services of doctors.

Summarizing the available data of historical records, it is expected that Vilnius had to be the favorable place to spread various infectious diseases in the 16^{th}–17^{th} centuries. It is expected that the males' way of life should have been more traumatic than the females'. Little can be said about the quality of medical treatment.

This paper is an attempt to perform the detailed analysis of traumatism in Vilnius during those two centuries.

MATERIAL AND METHODS

393 adult skeletons (228 males and 165 females) aged from 17 to 50+ were analyzed in this study. The remains are from eight sites in Vilnius, Lithuania, all dated the 16^{th} and 17^{th} centuries. In this study, data was being included only from the dated, registered and undisturbed graves with more or less complete skeleton preservation. All the data was recorded according to our standard protocols. Sex, age and pathologies were determined using conventional morphological methods [3; 9; 10; 19; 27]. Human remains were grouped by age, sex, site and sites clusters. In this study, we consider as a trauma (including post-traumatic complications) those signs: fractures, dislocations, compressions, skull vault depressions and signs of stabs, the Schmorl's nodes and avascular necrosis. The term multiple trauma is used for three or more traumatized bones per person.

Disorder prevalence was estimated by the formula: n / N * 100, where n – the affected particular bone or a person with a disorder, N – all the particular preserved bones or all the persons. To check the independency between comparable variables, we used chi square (X^2) for 2*2 tables, the Fisher's exact test for less than five expected cases, the non-parametric Kruskall Wallis test to compare 3 or more groups and the Pearson's correlation for the degree determination to which the variables are related [6; 7]. The values with p-value below 0.05 will be considered as significant, in addition, p-values above 0.05 and below 0.1 will be discussed and be considered as marginally significant. The statistical comparison by age is made only for younger (<40 years) and older (>40 years) age at death groups. SPSS 9.0 software was used for statistical elaboration.

Description of Sites

The samples, analyzed in this study, were from eight sites. According to archaeological and historical records, we grouped all the cemeteries into four clusters: orthodox cemeteries, the remains buried inside churches, epidemic diseases victims and poor catholic dwellers' cemeteries (Mindaugo/Kauno str. site).

Orthodox cemeteries (151 individuals). While discussing orthodoxies, it is important to note Orthodox church and monastery of the Holy Spirit in Vilnius (HSCM). Subačiaus str. parish cemetery (105 individuals) belonged to HSCM and operated between the beginning of 17th century the 3rd–4th decades of the 17th century. Archaeological investigations revealed that simultaneously clustered individuals were buried in the cemetery. However, few places show that there were signs of mass graves [29]. The Polocko str. cemetery (21 individuals) also belongs to HSCM. Burials were dated to the 16th century. [11]. The Bokšto str. (25 individuals) cemeteries' territory belonged to the Vilnius area better known as the "Russian city". Therefore, it is expected that this site also belonged to the Orthodox church [25].

Epidemic diseases victims' cemeteries (154 individuals). The mass graves, where remains were buried more or less on the same level, were found in the Aguonų str. (127) and the Čiurlionio str. (27) cemeteries. Archaeologists suggest that the victims of plague or other epidemic diseases were buried in both of these sites. Aguonų str. sample is dated to the 15th–16th centuries. [32], Čiurlionio – to the 16th and the beginning of the 17th century. [5].

Remains from Roman Catholic churches (45 individuals). We analyzed the remains found in two churches: St. Francis and Bernardine (19) and Franciscan (26) churches. According to archeological data, the remains from both churches are dated to the 16th–17th centuries. [8; 28]. Most likely, they had a high social status by social dependency (monks or/and laymen) in local society.

Poor catholic dwellers' cemetery (Mindaugo/Kauno str. sample) (45 individuals). The archaeological excavations of this site were finished at the end of 2009. Therefore, all the data is fragmentary and suppositional by now. According to archaeological findings, people could be buried in cemeteries probably from the first half of the 17th century until the beginning of the 18th century. However, historical records mention that St. Stephen Church (very close to this site) was built for the victims of plague near active poor dwellers' cemeteries in 1600. Therefore, it is possible that exactly these cemeteries were mentioned (information from J. Ramanauskienė).

RESULTS

Almost 30% of all the individuals had at least one bone trauma in their lives; trauma prevalence had a very strong positive correlation with the age at death for both sexes (Pearson's $r=0.964$, $p=0.008$); 18.97% of individuals had multiple fractures. Both sex older individuals had a significantly higher frequency of total traumas than the same sex younger individuals (Table 1). Older males had a higher multiple trauma prevalence than the younger ones.

Table 1. General incidence of traumas between age-at-death groups

Age at death	*n / N*	%
17–20	5/26	19.23
20–30	19/98	19.39
30–40	27/101	26.73
40–50	39/86	45.35
50+	23/46	50.00
<40	49/242	20.25
>40	66/141	46.81
Total	116/393	29.52

Males of both age groups obviously had significantly higher prevalence of at least one trauma than corresponding age females. In addition, males had experienced more multiple traumas in their lives than females, albeit only at $p<0.1$ level (Table 2).

Half of older males and one third of older females had at least one trauma in their lives. However, the highest change in trauma prevalence was between 20–30 and 30–40 years age-at-death for males and between 30–40 and 40–50 years group for females, when the cases of prevalence increased about twofold.

Table 2. Statistical comparisons of all and multiple trauma prevalence by sex and age-at-death groups (M – males, F – females)

Age and sex groups	*At least one trauma*	*Multiple traumas*
M vs. F, pooled	**0.000**	**0.060**[1]
M vs. F (<40 years)	**0.023**	0.687*
M vs. F (>40 years)	**0.021**	0.170
M (<40 years) vs. M (>40 years)	**0.000**	**0.003**
F (<40 years) vs. F (>40 years)	**0.005**	0.155*
M+F (<40 years) vs. M+F (>40 years)	**0.000**	**0.000**

Values in bold are significant at $p<0.05$ level (X^2 p-values).
[1] – value is significant at $p<0.1$ level.
* – Fisher's exact test.

Trauma localization

Skull traumas

23 of 327 skulls (7.03%) had signs of injuries (Table 3). Older people were affected significantly more often than the young ones. With respect to injuries' localization, the list of affected bones is presented in Table 4. There were no significant statistical differences between the injuries to the cranial vault and the facial part ($X^2 = 0.308$; $p = 0.579$).

Table 3. Distribution of head trauma by age at death

Age at death	*n / N*	*%*
17–20	0/21	0.00
20–30	2/81	2.47
30–40	5/93	5.38
40–50	12/79	15.19
50+	4/43	9.30
<40	7/199	3.52
>40	16/125	12.80
Total	23/327	7.03

In 15 of 23 cases, the type of cranial injuries was determined: two were the wounds in the facial part (one depression and one stab) and others were the traumas in the vault. Depression fractures were recorded in 8 cases, slashed – 7 cases and stabbed injuries – 2 cases. Two individuals had two types of cranial injury, i.e. depressions and slash wounds to the skull vault. Other two individuals had both the affected skull vault and the facial part – parietal with the left maxilla, frontal and nasal bones (the depression and slash wound of the vault and the injury of nasals). Post-traumatic complications, for instance, infections, had not been found. However, two individuals with cranial injuries to the vault (occipital and parietal bones) did not show healing signs.

Table 4. Distribution of injuries to different bones in the skull

Bone	*Males, n/N*	*Females, n/N*	*Pooledl, n/N*	*Males, %*	*Females, %*	*Total, %*
Ocipital	2/158	0/119	2/277	1.27	0.00	0.72
Parietals	7/169	1/128	8/297	4.14	0.78	2.69
Frontal	6/163	0/124	6/287	3.68	0.00	2.09
Nasal	8/122	1/88	9/310	6.56	1.14	2.90
Maxilla	2/143	1/115	3/258	1.40	0.87	1.16

More than half of the individuals with cranial injuries had postcranial traumas (13 of 23 cases, 56.52%). The most commonly affected bones were ribs (8 individuals – 39.13%) and ulna (4 – 21.74%). Besides, more than one third of individuals with cranial injuries had signs of multiple traumas (7 – 34.78%).

21 male and 2 female skeletons show signs of skull injuries. This difference was statistically significant: males in all the age groups had a significantly higher number of skull injuries than females. Both older females and males had a higher prevalence of trauma (Table 5). The highest prevalence was in the 40–50 years group for both sexes (10/48, 20.83% for males and 2/31, 6.45% for females).

Table 5. Statistical comparisons of skull trauma prevalence by sex and age-at-death groups (M – males, F – females)

Age and sex groups	X^2	*df*	*p*
M vs. F, pooled	12.341	1	**0.000**
M vs. F (<40 years)			**0.014***
M vs. F (>40 years)	4.398	1	**0.036**
M (<40 years) vs. M (>40 years)	4.970	1	**0.026**
F (<40 years) vs. F (>40 years)			**0.099*[1]**
M+F (<40 years) vs. M+F (>40 years)	10.031	1	**0.002**

Values in bold are significant at $p<0.05$ level;
[1] – values are significant at $p<0.1$ level;
* – Fisher's exact test

Though only two females were affected, the character of injuries is conspicuous. The first one, a 40–45 years old female had an unhealed injury to the right parietal and this is the only trauma sign in all her skeleton. Possibly, that injury was the main cause of her death. The second female of the same age had a healed trauma of the nasals and the right maxilla together with fractures of the left forearm, the right foot and both ribs.

Postcranial traumas

Older individuals had many more signs of trauma than the younger ones. Males were affected by postcranial trauma significantly more often than females (Table 6).

Table 6. Statistical comparisons of postcranial trauma prevalence by sex and age-at-death groups (M – males, F – females)

Age and sex groups	X^2	*df*	*p*
M vs. F, pooled	9.134	1	**0.003**
M vs. F (<40 years)	2.491	1	0.114
M vs. F (>40 years)	3.803	1	**0.051**
M (<40 years) vs. M (>40 years)	17.115	1	**0.000**
F (<40 years) vs. F (>40 years)	6.469	1	**0.011**
M+F (<40 years) vs. M+F (>40 years)	26.752	1	**0.000**

Values in bold are significant at $p<0.05$ level.
[1] – value is significant at $p<0.1$ level.

The most traumatized bones were ribs, vertebrae and ulnas (Table 7). Fractures of ribs and ulnas were more frequent in the older than the younger individuals irrespective of sex (for females ulna fractures differ only marginally). Males obviously had many more ribs traumas than females. Older males had marginally noticeable hand bones fractures than younger individuals. There were significant discrepancies with the vertebrae trauma. First of all, the most vulnerable vertebra was thoracic for both sexes. Secondly, while females had only thoracic vertebrae fractures, males additionally had lumbar traumas. The male skeletons had marginally a statistically higher prevalence of the Schmorl's nodes than females ($p=0.084$, the Fisher's exact test). However, there was no significant difference between the younger and the older individuals ($p>0.1$). The right fibula was affected significantly more than the left.

Although not statistically significant, but there were few noticeable differences. Females had more fractures of the left ulna than the right (5/131, 3.82% and 1/134, 0.75%, respectively). Clavicle fractures were more common in males than females (7/176, 3.98% and 1/136, 0.74%, respectively). Older males had more hand bone fractures than older females (11/167, 6.59% and 4/122, 3.28%, respectively).

Humerus, tibia and coxal bone fractures were recorded for six individuals. All of these injuries had no statistically significant differences at p=0.1 level with respect to age, sex or site. Fractures of the humerus were seen in 3 individuals (2 males and 1 female). All the individuals were aged 30 and above. Two individuals had injuries of the pelvic bones: a 20–25-year-old female had fractures of both inferior pubis ramus and had a thoracic vertebra fracture; another 30–35-year-old female had a healed impression injury on the right os coxae. Only one 40–50-year-old female had tibia affected by fracture. She suffered from the trauma to the right distal end of the tibia and fibula, the left humerus surgical neck fracture and ulna diaphysis fractures. Probably, she had experienced some sudden dangerous accident that caused such an extreme multiple postcranial bone fractures.

Femur fractures are very dangerous or even life threatening, especially for old persons; 4 of 8 traumas were recorded in the proximal part of femur, others in diaphysis; 4 individuals with femur fractures were 20–30 years old (3 males and 1 female), 4–50+ years old (2 males and 2 females, two cases were injuries to femur diaphysis and one to proximal end). It is important to note that six of eight fibula fractures were recorded in the distal part. All the unfortunates have been under 30 years of age (5 males and 3 females). In addition, 6 of 8 individuals with fibula fractures had 3 or more fractures in their lives. All the fractures of ulna, radius and clavicle were in diaphysis.

Table 7. Distribution and statistical comparison of postcranial fractures

Comparable variables	*Clavicle*	*Radius*	*Ulna*	*Hand bones*	*Femur*	*Fibula*	*Feet bones*	*Ribs*	*Vertebrae*
Total prevalence	8/312 (2.56%)	13/322 (4.04%)	20/328 (6.10%)	15/289 (5.19%)	8/304 (2.63%)	8/264 (3.03%)	5/245 (2.04%)	42/265 (15.85%)	24/320 (7.50%)
Unhealed	1	0	0	0	1	0	0	1	0
Post traumatic complications	1	0	0	1	2	0	2	1	0
Bilateral trauma per person	1	1	1	0	0	0	0	10	–
Individuals with mult. trauma	2	4	10	4	1	6	2	15	3
M vs. F, pooled	0.144*	0.788	0.206	0.211	1.000*	1.000*	0.651*	**0.014**	0.179
M vs. F (<40 years)	0.248*	0.422*	0.605*	1.000*	0.626*	1.000*	0.501*	0.164	0.330
M vs. F (>40 years)	0.648*	1.000*	0.194	0.150*	1.000*	1.000*	1.000*	0.120	0.709*
M (<40 years) vs. M (>40 years)	0.455*	0.137*	**0.000**	**0.058*[1]**	1.000*	0.365*	0.648*	**0.000**	0.738
F (<40 years) vs. F (>40 years)	0.331*	1.000*	**0.089*[1]**	1.000*	0.651*	1.000*	0.278*	**0.007***	1.000*
M+F (<40 years) vs. M+F (>40 years)	0.267*	0.229	**0.000**	**0.094[1]**	0.467*	0.449*	0.345*	**0.000**	0.725
Right vs. Left (C. vs. T. vs. L.)	0.761*	0.554	0.238	0.793	1.000*	**0.037***	0.372*	0.976	**0.000****
Males (R. vs. L.) (C. vs. T. vs. L.)	0.723*	0.715*	0.738	0.783	0.372*	0.209*	0.623*	0.769	**0.005****
Females (R. vs. L.) (C. vs. T. vs. L.)	1.000*	1.000*	0.117*	0.622*	0.247*	0.246*	0.492*	0.553	**0.001****

Values in bold are significant at $p<0.05$ values (X^2 p-values, ** – Kruskall-Wallis test p-values)

[1] – values are significant at $p<0.1$ values

* – Fisher's exact test p-values

Complications

There were 5 individuals with post traumatic complications. One individual had healed fingers' fractures and osteoarthritis as a complication. Two of five with feet bone injuries had post traumatic complications: aseptic necrosis and inflammation. An individual with a healed injury of stabbing to costae had huge exostosis. One individual had had neoarthrosis of both claviculas. One male (25–30 years old) had post traumatic aseptic necrosis of femoral head. A male (>50 years old) had a healed greenstick fracture and as a consequence his right femur was shortened.

Dislocations

Three male and none of female skeletons had signs of shoulder dislocation. All the 3 male skeletons with shoulder dislocation had injuries to the head, too (two of them to the nasalia bone). Two of them had multiple traumas. None of them had unhealed traumas.

Unhealed cases

Five (2 males and 3 females) individuals had fractures without healing signs. One individual had a fracture with incomplete healing.

Extreme cases: four or more fractured bones per skeleton

Seven skeletons had four or more fracture signs: 5 males and 3 females. 6 individuals were under 40 years old. All the 7 had ulna fractures; in addition, 5 individuals had rib fractures (Table 8). All of the fractured bones were healed.

Comparison between sites

With respect to site, there were statistically significant differences at $p<0.05$ level between the total prevalence of trauma for both sexes and the total sample; injuries to the head for males and the total sample; the postcranial trauma for both sexes and the total sample. Still, there were no significant differences between different sites and individuals with multiple traumas. The highest total prevalence of trauma was apparently in the Subačiaus str. sample population and the lowest in the Mindaug/ Kauno str. sample. The individuals (hold only for males) buried inside the Bernadine church demonstrably had the highest rate of injuries to the head while the lowest rates were recorded for the Aguonų, Mindaugo/ Kauno and the Franciscan samples.

Table 8. Individuals with 4 to 8 traumas per person

Site	Polocko str.	Subačiaus str.	Subačiaus str.	Subačiaus str.	Franciscan church	Aguonų str.	Mindaugo/ Kauno str.
Sex	Male	Female	Male	Male	Female	Male	Female
Age	50+	40–45	40–45	50–55	40–45	30–35	35–40
Number of fractures	7	4	5	5	8	7	4
1	Nasals	L. humerus	R. parietal	Nasals	R. maxilla	L. clavicle	L. ulna
2	R. clavicle	L. ulna	L. parietal	L. radius	L. maxilla	R. ulna	L. radius
3	R. ulna	R. tibia	L. mandible	L. ulna	Nasals	L. ulna	R. fibula
4	R. hand	R. fibula	L. ulna	R. rib	L. ulna	L. radius	Th vertebra
5	R. rib	–	L. rib	L. rib	L. radius	L. hand	–
6	L. rib	–	–	–	R. rib	L. fibula	–
7	R. shoulder disclocation	–	–	–	L. rib	R. rib	–
8	–	–	–	–	R. foot	–	–

The individuals from the Bernardine Church were exceptional. All the individuals with injuries to the head were 45 years old and above at the death time. One individual had one depression and two slashed fractures on the right forehead and nasalia. The second individual had a nasalia fracture and shoulder dislocation. The third was with one depression and slashed fractures on the left parietale. The last had slashed fracture signs on the left parietale and frontale, also lower the third of femur diaphysis fracture. All the fractures were healed.

Postcranial traumas were most common for the remains buried in the Subačiaus str. population. Meanwhile, the Bernadine and the Mindaugo/Kauno str. samples had the lowest rate of all traumas.

The Čiurlionio str. sample was particularly exceptional for a very high rate of traumatism for males (58.33% for total and postcranial trauma; 16.67% for multiple trauma and injuries). However, this could be accidental due to a small sample size (Table 9).

When different sites were grouped into four clusters, there were statistically significant differences between the general trauma prevalence for males and the pooled samples, injuries to the head for the pooled samples and the postcranial trauma for the pooled sample and for sepaprate sexes. The highest incidence of traumatic events was recorded for the individuals from the Orthodox cemeteries, while the lowest for the Mindaugo/Kauno str. sample. The highest prevalence of injuries to the head was recorded for the skeletons buried inside churches and Orthodox cemeteries, the lowest for other two clusters. Postcranial traumas were apparently the highest for the people buried in Orthodox cemeteries while the lowest for the Mindaugo/Kauno str. sample. The other two samples had central meanings (Tables 10, 11, 12).

Table 9. Differences in total trauma, multiple traumas, injuries to head and postcranial trauma incidence by different sites

Site	*Total Trauma*	*Multiple traumas*	*Injuries to head*	*Postcranial trauma*	*Total Trauma (%)*	*Multiple traumas (%)*	*Injuries to head (%)*	*Postcranial trauma (%)*
Polocko str.	5	3	2	4	23.81	14.29	10.00	19.05
Subačiaus str.	54	7	10	49	51.43	6.67	10.99	46.67
Franciscan church	8	3	1	8	29.63	11.11	4.00	29.63
Čiurlioni o str.	7	2	2	7	31.82	9.09	9.52	31.82
Bokšto str.	8	1	2	7	29.63	3.70	7.69	25.93
Aguonų str.	23	3	1	23	18.11	2.36	1.11	18.11
SFB	4	1	4	2	21.05	5.26	23.53	10.53
Mindaugo/Kauno str.	6	1	1	6	13.33	2.22	2.70	13.33

Table 10. Statistical comparison of total trauma distribution among the site clusters

Comparable variables	*Orthodox (%)*	*Epidemic (%)*	*Church burials (%)*	*Mindaugo/ Kauno str. (%)*	*P*
Male	50.00	32.05	28.13	12.5	**0.002**
Female	9.57	5.13	9.38	4.17	0.623
Total	29.79	18.59	18.75	8.33	**0.004**

Values in bold are signifant at $p<0.05$ level (Kruskall Wallis test p-values)

Table 11. Statistical comparison of injuries to the head abundance among the sites clusters

Comparable variables	*Orthodox (%)*	*Epidemic (%)*	*Inside church (%)*	*Mindaugas (%)*	*p*
Male	15.29	5.56	14.81	5.56	0.262
Female	1.92	0.00	6.67	0.00	0.244
Total	10.22	2.70	11.9	2.70	**0.049**

Value in bold is statistically significant at $p<0.05$ level (Kruskall Wallis test p-values)

Table 12. Statistical comparison of postcranial trauma by different sites clusters

Comparable variables	*Orthodox (%)*	*Epidemic (%)*	*Inside church (%)*	*Mindaugas (%)*	*P*
Male	42.55	32.05	21.88	12.5	**0.016**
Female	33.90	7.04	21.43	14.29	**0.001**
Total	39.22	20.13	21.74	13.33	**0.000**

Values in bold are statistically significant at $p<0.05$ level (Kruskall Wallis test p-values)

DISCUSSION

Significant differences between the sexes, age groups and different sites regarding the prevalence of traumas were found.

According to the data, we may suggest that life in Vilnius was indeed physically traumatizing in the 16th–17th centuries. Almost 30% of the individuals had experienced at least one physical traumatic event in their lives. However, the male's lifestyle was obviously much more physically dangerous for all the age groups. By anatomical location, males had a much higher prevalence of injuries to the head, ribs and hand bones compared with females. These injuries are very often considered as tightly connected with interpersonal conflicts [18]. If so, it also may indicate that males were more aggressive than females.

Concerning females' traumas, there was one important difference. Though not statistically significant, females experienced the left ulna fractures more often than the right. How to explain "parry fracture"? Two most familiar answers are the defense against assaults and/or unintentional daily traumatic life events [12; 16; 18; 20]. The historical sources provide enough proof of women beating episodes [1]; therefore, there is a reason to suggest such an explanation for at least a part of the injured females.

Older females had a higher prevalence of trauma than the younger individuals. The same rule holds regarding multiple traumas. We may suggest two distinct explanations for these differences. First, to state that this discrepancy reflects a true situation. It makes sense, because senile bones are more fragile and susceptible to fractures. Moreover, usually younger individuals react faster to various disasters, such as army or other deliberate attacks, house fires. Thus, they had bigger possibilities to escape and survive. However, we have to admit that skeletons represent dead individuals, i.e. represent a cumulative life experience, including the health status. Therefore, it is very likely that those who died in the younger age did not have much time to undergo what older individuals experienced. This proposition could be justified by the fact that there is a very strong positive linear correlation between trauma prevalence and age at death.

Also, there were individuals with 4 to 8 fractured bones per person and, what is most surprising, all of them were healed (and without any serious infectious complications). It showed the ability of these individuals to survive extremely severe physical life events. A few aspects about the past Vilnius dwellers may be proposed. First of all, the medical situation was good enough to help people to recover fast. Secondly, it shows that unfortunates were important for someone to take care, offer them compassion and care. Still, there were five cases without healing signs. All those unfortunates had only one bone fracture that may suggest that the sudden severe episode of trauma was the cause of their death.

There were clear differences between the sites regarding the prevalence of trauma. Apparently, the lowest values were for the Mindaugo/Kauno str. sample. Having in mind that trauma had a positive correlation with age, the most likely explanation could be based on demographical data, i.e. most of the remains from this sample were under 40 years, and they simply did not have enough time to cummulate scars from previous traumas. However, the remains aged under 40 from other samples had many more signs of trauma. The alternative suggestion could be that the poorest inhabitants' life (at least for those who were buried in this sample) could have been not only shorter but also less traumatic or they were lucky enough to live in the more peaceful period. Other samples (only the Aguonų str. sample had less than 20% of general trauma prevalence) confirm the assumption that life, particularly for males, was indeed traumatic.

The results concerning the injuries to the head emphasized two very noticeable differences: the lowest values were in the Mindaugo/Kauno str. and the Aguonų str. samples again, and exceptionally high rates in the SFB Church. We can explain low values for the Aguonų and the Mindaugo/Kauno samples by the above-mentioned considerations. The older males of a higher social status, buried inside the SFB Church, certainly had some interpersonal conflict evidences on their heads.

As expected, our results suggest that the adult male's lifestyle in all the age groups had been much more physically traumatic than the females'. Likely, it was a reflection of the social environment in Vilnius in the 16^{th}–17^{th} centuries, i.e. females were less physically active and responsible only for home space activities. Nevertheless, the fact that most of the traumas (even multiple) healed indicates that society coped well enough with this problem. Higher trauma incidence for older individuals can be explained by two opposite facts: it reflects a real situation or cumulative effects during life.

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HELPING CHILDREN WITH SPECIAL EDUCATIONAL NEEDS AS A COOPERATION BETWEEN THE FIELDS OF EDUCATION, SOCIAL WORK, AND MEDICINE

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INTRODUCTION

I have been in contact with children with special educational needs since my first working day on September 1, 1986 at the psychoneurological department of Tartu Clinical Children's Hospital. Oftentimes children with special educational needs differ from their peers in terms of their abilities, cultural or social background, and personal characteristics to such an extent that they need the reorganization of the learning environment in order to realize their developmental potential. My work experience at Tartu Herbert Masing School which educates children with physical disabilities, somatic diseases, and psychiatric disorders (including autism, Asperger's syndrome, attention disorders, hyperactivity, behavioural disorders, emotional disorders, etc.) shows that many of them have been given several diagnoses at the same time and this makes the creation of a suitable learning environment very difficult (Kallavus 2006, 2007 I, 2007 II).

What also presents difficulties is the estimation of the number of pupils with special needs and even the formulation of the relevant concept which differs between different agencies as well as fields (Riigikontroll 2006; Kallavus 2006). Contrary to popular understanding, the majority of children with special educational needs have a normal intellect, but for various reasons they are not able to realize their talents in a normal classroom setting. Oftentimes this is coupled with social reasons and therefore the support measures offered by the school do not function adequately (see Riigikontroll 2006; Tiko, Rannala, Kallavus 2007).

The Estonian Ministry of Education and Research uses two different terms for children with special needs – "a special developmental need" for pre-school children with special needs and "a special educational need" for pupils with special needs (Kõrgesaar, 2002). In addition, what is taken as the basis is not the medical diagnosis but the special need of a child in terms of a particular learning aid method, for example "the child needs logopedic aid", "needs physical aids to move", etc. On the other hand, the social system divides special needs into the following levels of the severity of the disability according to the necessity of outside help: (1) profound disability when the person needs constant outside help, guidance, or supervision around the clock; (2) severe disability when the person needs outside help, guidance, or supervision every day and night; (3) moderate disability when the person needs regular outside help or guidance outside his/her place of residence at least once a week.

Children with special health services needs are those who have developed or who are at a risk of developing such a chronic physical, developmental, behavioural, or emotional state which requires health and other services in such a way and to such an extent that exceeds the needs of an average child. According to literature, the terms "chronic disease state" and "disability" have a similar meaning, but every sick person has not been diagnosed with a disability. A child with a chronic disease needs more frequently specialised medical care than general medical care. A disabled child needs medical intervention (the diagnosis, treatment, medicines, medical rehabilitation) and psycho-social influencing in order to achieve as good of a health status and coping as possible.

The task of educational institutions in helping children with special needs is to organize the learning environment (physical as well as mental), to prevent the abuse of a sick child, and to provide children with physical disabilities with additional constructions, aids, and personal assistants if necessary. Schools can support the treatment by organizing physical education while taking into account the limitations arising from the special needs, by offering psychological and family counselling, socio-pedagogical and logopedic help in schools, by checking the compliance with the treatment for chronic diseases, by determining the need for first aid, by securing the existence of necessary medicines, by providing first aid and fulfilling the treatment plan. Combining the treatment with studies needs additional resources in terms of time, money, know-how, and staff. All this has to be taken into consideration, regardless of whether the child goes to a regular school or a special-needs school, i.e. a special-needs classroom. This is also one of the reasons why the number of children who go to a special-needs school or classroom is not decreasing despite all the attempts (Availability of social services and education to disabled children and young people. 2009).

What makes organizing the teaching of children with special needs particularly difficult is the fact that according to data protection law, the diagnosis of a pupil cannot be disclosed. A teacher thus has to be a specialist who is able to teach while taking into account the individual traits of a child but without knowing the diagnosis. Lack of official statistics concerning children with health problems (because the data of the Estonian Ministry of Education and Research does not reveal the exact medical diagnoses) in the education system is also one of the obstacles to organizing medical and social assistance in educational institutions that corresponds to the children's needs. Special-needs schools are therefore mostly alone in finding ad hoc solutions and reaching agreements with the providers of health care and rehabilitation services in order to provide medical and social assistance of a certain level to children with special needs.

DIAGNOSING SPECIAL NEEDS AND SENDING CHILDREN INTO SPECIAL-NEEDS CLASSROOMS AND SCHOOLS

Many problems are associated with the process of sending children into special-needs schools and classrooms. The first problem here is that the law requires it to be **dependent on the parent's wish** and this sets high standards for the parent's competence. At the same time, it is no secret in the day-to-day work of a special-needs school that the symptoms oftentimes recur across generations and they also tend to worsen. In addition, families with social problems also reproduce themselves in the event of lack of external help and support. Today we are facing the situation where the attempts of the support system fail if the parents are not competent to form their opinions. More typical is the situation where such a family works hard against the system or is just carelessly inconsiderate.

The decision of the counselling committee has to be preceded by pedagogical-medical-psychological tests which act as the basis for the decision. Giving a competent diagnosis requires sufficient time and a certain period of studying and monitoring. Today the period psychiatrists have for that purpose has been shortened to a half-an-hour appointment. Basically what we are increasingly dealing with is the fulfilment of the parent's orders because it is precisely the parent who gives the psychiatrist the main and emotionally-oriented input (Riigikontroll 2006).

In practice, it often happens that the decision of the counselling committee which sends a child to a special-needs school simply states in general terms that "for reasons of health status" or "for mental health reasons". Even the parents do not always know what is wrong with the child and what the exact diagnosis is. At the same time, because of mental problems, a pupil may even suffer from fits of unconsciousness while at school and the teacher has to know that this is possible because it is frightening to the teacher as well as to fellow pupils. The cooperation between the school physician and the family physician concerning health problems is also not the smoothest. The relevant principles of cooperation have not been agreed upon.

What is important to schools and kindergartens is the communication of the symptoms related to the teaching regulations, the learning environment, the curriculum, and social interaction so that they are informed of them. Creating a monitoring system and support network which would work on a single method requires the coordinated cooperation of different agencies and a legislation which has been drawn up based on a single method.

The variable and oftentimes poor quality of diagnosing special educational needs deprives the counselling committee of the opportunity to guarantee a constantly high quality of the decisions with its current method of work organization. Neither does the school where a pupil with special educational needs is sent to receive from the counselling committee an analytical description of the previous teaching regulations, learning environment, curriculum, and social interaction that would quickly enable to build a pedagogical support system suitable to the pupil's development (Riigikontroll 2006).

Differently from diagnosing visual, hearing, physical, mental disabilities and determining the special educational needs arising from them, which do not cause any big problems, there does not exist a similar method for the diagnoses of pupils with emotional and behavioural disorders. This in turn makes it very easy (for example, as a result of manipulation by the parents or the pupil) to influence the diagnosing process [parents are usually of the opinion that they can always get a diagnosis for their child if necessary]. Since emotional life and behavioural problems are revealed in context, the quality of giving a diagnosis depends on the application of the method of contextual case analysis. This in turn requires the participation of all the other parties (the kindergarten, school, hobby school, informal groups, etc.) in addition to the pupils and their parents. The parent and the child represent only two (even though important) parts of the whole context spectrum analyzed.

In addition, the health of every pupil has to be taken under consideration and this sets high standards for the teacher's preparation. Above all, the teacher has to be familiar with different diseases, how to cope with them and support and encourage the pupil. In order to assess the need of special needs children for medical and social services, the only statistical data available for use are those of the Estonian Ministry of Education and Research concerning how many children study at general education schools on the basis of a particular curriculum or the broad definition of a health disorder. 76% of all children with special educational needs study at a regular class of a regular school. 50% of all children with special educational needs (except for pupils who have difficulties in speaking, reading, or writing), i.e. around 14 000 pupils at regular and special-needs schools need first contact care (monitoring the health status, checking and changing the treatment schedule) as well as regularly specialised medical care (additional tests, specialised monitoring in the case of certain illnesses, checking the treatment schedule and disease compensation, etc.) more frequently than the average pupil.

In his memoranda, the Chancellor of Justice has repeatedly referred to the poor organization of the psychiatric help available to children with special needs. Attention has also been drawn to the fact that monitoring the treatment of children with mental disorders is weak. Paying for the medicines that children in special-needs schools need is not regulated in a single way. Checking the general health of children (of all children, not just children with special needs) is not obligatory for family physicians at the moment. Guidelines for checking the health of children between the ages of 0 and 7 that were drawn up in 2004 in cooperation between paediatricians and family physicians are simply advisory and do not guarantee that all children are checked according to the guidelines for early discovery of health and developmental disorders. Therefore, already in the first contact care there is a lack of a systematic overview of the development and health of a child. Only 60% of pre-school child care institutions have a medical staff (Riigikontroll 2006). Since an educational institution or its medical staff do not have the status of a health care provider, regular communication of a child's medical information between the family physician and the kindergarten's medical staff is not possible in the same way as for example between the family physician and a medical specialist or the school's health care provider. We can see that problems in discovering the special needs of children start already with the organization of the first contact care and the lack of cooperation between families, pre-school child care institutions, and family physicians.

Making the school environment suitable to pupils with special educational needs is a complex process that requires close cooperation between pupils, their parents, and the school staff, oftentimes also compromises between them. The team's task is to monitor the pupil's development and to consult the parents since the pupil's harmonious development depends first and foremost on whether the school education is also supported by the parents' competence in child raising.

Despite the support of several support specialists, it is still the teacher who spreads knowledge to the pupil, teaches him/her skills, and exercises dealing with social situations. Teacher training therefore also has to include knowledge of the fields of education, social affairs, and medicine. Knowledge of psychology, preferably psychotherapy, is doubtless important. Knowledge in the field of counselling is necessary to communicate with parents, other specialists, and colleagues.

THE AVAILABILITY OF REHABILITATION SERVICES TO PUPILS WITH SPECIAL NEEDS

School is a developmental environment that influences the child in a significant way. For the all-round development of a pupil with special educational needs what is important is his/her thorough rehabilitation which serves the purpose of enabling the young person entering into life from school to cope in society as a citizen and with the society's changing expectations (Anthony, Cohen, Farkas 1998; Kallavus 2006; Kallavus, T., Tiko, A. …).

What is generally meant by the psychosocial rehabilitation taking place at school is the process of the restoration of the optimal level of a pupil's independent functioning with the purpose of increasing his/her ability to cope. The rehabilitation process is based on the individual as a whole and on a complex approach to providing services (the educational sphere, the social sphere, etc.) The psychosocial rehabilitation taking place at schools for pupils with special needs represents a shift from the medical model (treatment based on the diagnosis) to the social model (supporting the person's process of recovery by intervening in the relationship between the individual and the environment). Psychosocial rehabilitation is based on systems theory and several psychological theories (Carl Rogers's client-centred approach, Albert Ellis's rational-emotive approach, and William Glasser's reality therapy). The emphasis is on the pupil's and family's own choice and responsibility as well as on the continuous guidance by the teacher.

Similarly to specialised health care services, this is also a place where the school has to look for ad hoc solutions and agreements in order to provide the necessary aid. In many cases, special-needs schools have a team made up of several specialists which probably corresponds to the requirements set up for the teams of rehabilitation institutions by the Social Welfare Act; however, in order for a disabled child attending such a school to receive the services set out in the rehabilitation plan, he/she has to be transferred to another institution registered as a rehabilitation establishment.

In today's rehabilitation plans, what is prevailing is the medical approach (medical goals set out in the rehabilitation plan form 48%, psychosocial goals 30%, and educational goals 22%). Many service providers operate in hospitals (in 2006, 20 establishments out 39 offering services to children were hospitals). This is not conducive to social and educational rehabilitation which is something that the parents of disabled children are looking for.

Educational special needs are not reflected enough in rehabilitation plans and this needs to be intensified (cooperation with the Estonian Ministry of Education and Research in order to bring together the work of the counselling committee and that of the rehabilitation team). The target group of rehabilitation services is very wide and because of that the financial resources are not sufficient and there are limits set on the services.

Within the framework of the state rehabilitation services, they are trying to solve the problems and fill the gaps of other areas – the unavailability of medical rehabilitation service, sanatorium treatment, etc. to disabled people. Massage and physiotherapy do not directly fall under social rehabilitation and, therefore, these services are and remain limited in the budget for social services. Lack of the support services of the local government and of the services directed at children with special needs cannot be compensated merely by rehabilitation services.

RESPONSIBILITY AND COOPERATION IN ORGANIZING ASSISTANCE THAT CORRESPONDS TO THE CHILD'S SPECIAL NEEDS

In Estonia, the principle of the division of responsibility does not work very well – the taking of responsibility on every level of decision making (the state, local government, child care institution, family) – even though the responsibility has been assigned by the law (the constitution, the Education Act, the Child Protection Act, etc.). The cooperation between family physicians, medical specialists, and the (medical) staff of pre-school child care institutions is poor. The early discovery of special developmental needs is made difficult and therefore also the provision of necessary aid. Oftentimes parents hide important information concerning health and are not willing to send their child to additional medical examinations.

An ideal situation is where the medical system, the social system, the education system, as well as the child and the family act in a coordinated way, with a clear division of responsibility and tasks for the purpose of achieving the child's maximum developmental, intellectual, and health potential and good coping.

- Medical care assesses the need for medical aid (determining the cause of the health disorder, treatment with medicines, surgical treatment, rehabilitation, health check, etc.) and guarantees the availability of the necessary aid.
- The social sphere assesses the person's need for external help and support services in order for him/her to cope and guarantees the necessary social assistance.
- The education system determines the child's special educational needs and secures the availability of the relevant pedagogical assistance (appropriate form of study, curriculum, etc.).

There are problems in the early discovery of a child's special developmental needs between the ages of 0 and 3 and in the pedagogical counselling (supporting) of the parent in creating an environment conducive to the child's development, as 2/3 of such children are at home during the day. According to studies, the first one to notice a child's special developmental needs is usually a parent, less frequently a kindergarten teacher, and much less frequently the family physician. Children who stay at home during the day may be left without the necessary developmental support and may therefore face learning difficulties at school which could have been prevented by timely detection.

Noticing the peculiarities of children with special needs requires competence and an opportunity, i.e. sufficient time. It is unfortunate if the problem becomes apparent only when the child enters school where it becomes evident that he/she would have needed help from a speech therapist, a special education teacher, and other specialists a long, long time ago.

Early discovery and intervention have to do with the right of infants and young children and their parents to receive the necessary support. This serves the purpose of supporting the child, the family, and the institutions related to the field and of giving them the necessary skills. It helps to establish a participatory and closely connected society that does not ignore the rights of children and their families.

Today's approach to early intervention brings together the fields of health care, education, and social affairs. The new approach focuses on the child's development and the influence of social interaction on a human being and, more specifically, on a child's development. What is employed instead of intervention mostly directed at the child is a broader approach that incorporates the child, the family, and the environment and corresponds to a general trend in the attitude towards disabled people, moving from the medical model to the social model.

The common characteristics of the early discovery and intervention system that is widespread in Europe are availability (i.e. financial availability), closeness, and diversity:

- there are several services and/or opportunities available and accessible to the family;
- such opportunities and services should be offered as soon as possible, they should be free of charge for the family or for a minimum charge, and they should be offered at a place and time they are needed, preferably as close to the home as possible. The services should correspond to the family's needs and enable family-centred intervention;
- the diversity of the services offered by different states/local governments indicates that there is a need to organize the

cooperation of different institutions in order to guarantee the quality of the services, and to bring the services into line with the means;

- the health care system, the social system, and the educational system should share responsibility for early intervention. This corresponds to the theoretical background of early intervention that is rooted in different areas and scientific fields. Health care and social services are intertwined in the case of a child's development and this should be taken into consideration. A single model cannot be taken as the basis: the broader early intervention approach that focuses on the child, the family, and the community and that moves from the medical model to the social model has been influenced by different theories and models (Soriano 2005: 4, 5).

Unfortunately, every problem does not always have an ideal solution because of the lack of several necessary opportunities or services: the organization of the studies of children and young people with difficult behavioural problems; individual approach to pupils is insufficient because of the lack of the necessary resources – individual curricula are possible, but at the moment they are not financed; the support staff at schools depends on the resources of the local government; the number of services varies across local governments, etc. The development of a child with special needs depends first and foremost on the parent's awareness and energy to coordinate the possibilities in the fields of medicine, social affairs, and education.

In the Finnish welfare centres, a child's development is monitored up until the age of 18 and the necessary specialists are called for if the need arises. The family physician is part of the team. At every meeting, which are obligatory at certain ages, the child and the family are dealt with and a summary from the kindergarten or school is brought along. The parent is the information carrier and, of course, an expert when it comes to his/her child. In Norway, there is a whole team that follows the development of a child and its every member has certain tasks.

Therefore, it has to be decided in which way we go forward with our small-numbered and precious children.

In the case of special-needs children, communicating information about his/her progress is necessary. Something like a progress card should start from the family physician and go from there to the kindergarten and the school. This provides the opportunity to monitor and to organize the activities of teachers and the school staff while bearing in mind previous positive experiences, or to take into consideration special needs when teaching (aggressive behaviour, pervasive traits, different fits – of epilepsy, an allergy, etc.).

It was revealed in a questionnaire conducted in three counties in 2002 that the specialists (doctors, nurses, teachers-lectures, coaches, social workers, speech therapists, juvenile police officers, etc.) whose job descriptions included "work with children" greatly outnumbered the children. Preparing the relevant staff for work with special-needs children requires a single organization system. No one can be a great specialist in all areas, but it is possible to change the attitudes with a common training. What matters most when working with children with special educational needs is the teacher's attitude and understanding of the pupil which is supported by the support network gathered around the pupil with special educational needs. Studies have shown that the attitude of an adult towards special needs and differences determines a lot in the school culture (Christinasen, Kukk, Soll 2007).

CONCLUSIONS

What is revealed from the aforementioned information is that the fundamental problem of the field of special educational needs and which is also the basis for most other problems is the lack of preventive action, lack of a system, and fragmentation, which is also pointed out by the report of the National Audit Office (2006). The need for services concerning a particular person is a single whole that can be programmed in time and which, at the same time, is connected by the dependence on the events that occurred in the past, i.e. the future is dependent on the present and the present is dependent on the past. Therefore, even though it can be programmed in time, every need for a service is historically determined (see Bronfenbrenner 1979, 1992). Following the principle of the arc of life requires the developmental planning of a person's need for services that enables to significantly optimize the actual need for services and to make the state "cheaper" through timely preventive action. In the context of education and special educational needs, following the principle of the arc of life means developing various educational services on the basis of the model practices of case analyses, developing and enforcing the minimum standards for the corresponding educational services that bring together the curriculum, the school environment (physical and social), and the human resources (teaching and support staff).

In today's Estonia, the support network of a child's development is not uniformly provided with information as a result of which the decisions oftentimes repeat themselves, work against each other, or are simply incompetent. As the information does not travel enough within the network, the decisions specialists make are mainly based on the description of a moment and not on a process and the analysis of the development and change of the symptoms.

This situation has been caused by the lack of a comprehensive and systematic system for monitoring the development of a child in Estonia (in the same form as it operates in the Nordic Countries). This kind of a monitoring system has to begin from the maternity hospital and gather all the specialists who are going to be working with the child into a single information system. The second targets of the monitoring have to be the parents because a lot of the problems in the future can oftentimes be traced back to them.

The most suitable central figure for the monitoring system (similarly to the Nordic Countries) is the family physician. For that purpose, it always has to be the family physician who sends a child to a medical specialist (as it takes place, for example, in Finland), or at least the corresponding information has to be transferred to the family physician. The psychiatrist and the family physician have to work hand in hand. This is one of the key pieces of the monitoring system of a child's development.

The system for monitoring a child's development also has to be supported by different competence centres (counselling centres, etc.) which give an input to the family physician, parents, as well as the kindergarten and the school. After certain periods, interim reports have to be prepared on the child's development. Until the child reaches school age, this is best done by a counselling centre or, in its the absence in rural areas, by the family physician. These reports should be forwarded to the family physician and parents (and the kindergarten, if the child goes there). The competence and activity of parents and the need to apply support systems in their case should also be assessed (this assessment should begin already during the preparation for the birth).

A systematic, consistent, and documented monitoring system that has been devised based on a single method creates a basis for competent decisions when finding a solution to questions related to special needs and unites the support systems and services into a harmonious whole. This gives the opportunity to apply the principles of case management in the field of education. In social work, case management is a way of providing services where a social worker assesses the needs of a client and his/her family and, when necessary, organizes, coordinates, monitors, assesses, and speaks for them in order to offer different services which would satisfy the complicated (or complex) needs of a particular client (Selg 2007). This is exactly the way case management should function when working with pupils with special educational needs.

The following models are distinguished in case management (Selg 2007): (1) the role-based model where the case manager (e.g. the class teacher) himself/herself does a lot of the client work and performs different roles as the need arises, for example the intermediary, adviser, coordinator, etc.; (2) the organization-based or case management working group model where every member of an interdisciplinary group has a function with a clear aim in providing services (developing the individual curriculum, social work, physiotherapy, speech therapy, etc.); (3) obligation-based case management or supportive caretaking which takes place in the client's close network where the tasks of the case manager are performed by a family member, network member, etc. who has been prepared for this.

What is urgently needed is that all these principles were written out in a systematic and concerted way in documents regulating education.

In conclusion, school is a stage that prepares the child for life where it is not so important with what marks the child finishes school but that the leaving certificate would give information concerning the fact that a difficult socializing phase has been completed and it can be expected that the young person develops into a successful adult (Kallavus 2006).

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DERMATOGLYPHIC SEXUAL DIMORPHISM IN DIFFERENT GEOGRAPHIC POPULATIONS: A REVIEW

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ABSTRACT

This review paper reports sexual dimorphism of dermatoglyphic characters (both qualitative and quantitative) based on our previous studies in different geographic populations – Indians, Chuvashians and Turkmenians. We have studied different ethnic populations to confirm the pattern of sex differences of dermatoglyphic characters. The present communication summarizes the major findings based on individual traits and principal factors through various univariate and multivariate analyses. The results between fingers and palms are not exactly the same in all the studied populations perhaps due to embryological development having relatively a longer growth period compared to fingers [Cummins 192]. The overall homogeneity of sex differences with respect to dermatoglyphic traits with their asymmetries within populations-Indians, Chuvashians and Turkmenian is well pronounced, which strongly indicates that some common genes are responsible for the dermatoglyphic characters in different geographic populations between sexes. However, sex differences display different levels when compared with other racial groups, which indicates that sex differences are different in diverse populations. This would explain the existence of the possible role of environmental prenatal factors in the realization of the level of dermatoglyphic sex differences.

INTRODUCTION

Dermatoglyphic characters are frequently used to characterize human populations in anthropological research [Cummins and Midlo 1961, Igbigbi and Msamati 1999, 2005, Nagy and Pap 2005, Gasiorowski 2005], because of its prenatal origin [Babler 1978] which remain unchanged during postnatal life. It is also known that the extent of the response to environmental conditions is generally different in the two sexes; particularly in the prenatal period the males present a greater environmental sensitivity [Stinson 1985] than females. In the studies among various racial samples, sex-differences in dermatoglyphic characters, females almost universally differ from males [Cummins and Midlo 1961, Schauman and Alter 1976, Schwidetzky and Jantz 1979]. From this standpoint, in this article we report the nature of sex dimorphism of both qualitative and quantitative dermatoglyphic traits (digital and palmar) among different geographic populations from our previous 12 publications among: Indians [Karmakar et al 2001, 2002a, b; 2003; 2005]; Chuvashians [Karmakar et al. 2007, 2008a, b; 2009a] and Turkmenians [Karmakar et al 2009b, 2009c, 2009d].

We also report sexual dimorphism in dermatoglyphic asymmetry, because asymmetry is considered as a good indicator of overall developmental homeostasis [Palmer and Strobeck 1997]. According to the literature, there are mainly two types of asymmetry, namely (1) fluctuating asymmetry (FA), which is a random deviation, i.e., irrespective of sign, from perfect bilateral symmetry [Arrieta et al. 1993]; and (2) directional asymmetry (DA), which reflects a consistent bias of a character toward systematically greater development on one side, i.e., considering sign [Palmer and Strobeck 1986].

Apart from asymmetry, we have studied another interesting type of variable- “intra-individual diversity”(Div) introduced by Holt [1968] as a measure of digital differences evaluated by finding the sum of squares of deviations of the ten separate digital counts from their mean ($S/\sqrt{10}$). The importance of this trait was emphasized by earlier authors [Micle and Kobyliansky 1986, Jantz 1975, Dittmar 1998, Leguebe and Vrydagh 1979, 1981].

Furthermore, we also report the sex dimorphism based on the principal factors extracted from dermatoglyphic traits because, the composite score of dermatoglyphic traits may be a more adequate measure of developmental homeostasis than any single trait.

Indian populations

(Studied subjects 2435 belong to 5 populations of West Bengal)

Qualitative
With the aim of determining sexual dimorphism in *qualitative* dermatoglyphic pattern types on fingers and palms among the same populations were analyzed [Karmakar et al. 2002a]. The pattern types are not uniformly distributed on 10 fingers and palmar configurational areas. However, most of these observations are homogeneous in nature in both sexes among all 5 populations, suggests common characteristics of dermatoglyphic patterns. But the two sets of results on fingers and palms are not exactly the same, palmar dermatoglyphic relationship reflects the better caste affinities perhaps due to embryological development having relatively a longer growth period compared to fingers [Cummins 1929].

Quantitative
Finger and palmar dermatoglyphic traits include 38 asymmetry and diversity variables [Karmakar et al. 2001]. Sex dimorphism is homogeneous in nature in all populations, indicating common characteristics of dermatoglyphic variables within the same geographic area. But sex differences display different levels when compared with other racial groups. Therefore, sex differences are different in diverse populations. This would explain the existence of the possible role of environmental prenatal factors in the realization of the level of dermatoglyphic sex differences. Sex differences in asymmetry indices are less pronounced, which indicates that Indian populations are less asymmetric compared to some other racial groups. Fluctuating asymmetry (FA) support the hypothesis of Livshits and Kobyliansky (1991) that heterozygosity increased in males compared with females.

PCA

22 quantitative dermatoglyphic traits [Karmakar et al. 2001, 2002b] were analyzed by means of the analysis of variance (ANOVA) and the principal component analysis (PCA) to estimate male-female dimorphism. A common features between the sexes of the principal component factor1 ‘digital pattern size ‘in diverse populations strongly indicates its degree of universality, which suggests that the variability of finger ridge counts is determined by the same genes. The nature of the

variation of asymmetry (DA and FA) component factors among these populations and between sexes appears with a good similarity which suggests their biological validity of the underlying component structure. The overall homogeneity of sex dimorphism among 5 populations is well pronounced.

Discriminant analysis

To compare the pattern of sex differences between the two different sets of dermatoglyphic traits (22 digital and palmar quantitative; and 38 indices of diversity and asymmetry) 5 Indian populations were analyzed [Karmakar et al. 2003]. The cluster, the Discriminant analysis and the Mantel test of matrix correlations were performed. The nature of variation between sexes within population groups and the two types of variable sets has a good similarity in all 5 populations [Brahmin, Mahisya, Padmaraj, Muslim and Lodha]. The percentage of correctly classified cases of the Discriminant analysis between males and females for 22 quantitative traits in five populations are 61.49%, 61.57%, 62.72%, 58.18%, 66.00%; and for 38 traits are 63.75%, 60.87%, 63.39%, 60.00%, 61.01% respectively. These results strongly suggest that the two categories of dermatoglyphic variables provide similar possibilities to discriminate between the sexes in populations.

Chuvashian populations
(Studied subjects 547: 293 males and 254 females of Russia)

Qualitative
Finger and palmar dermatoglyphics was studied to determine sexual dimorphism [Karmakar et al. 2007]. The pattern types are not uniformly distributed on 10 fingers. Sex difference is homogeneous in all the fingers whereas palmar patterns reflect the better sex variations for three palmar configurational areas (II, III, and IV). This is perhaps due to the embryological development, having a relatively longer growth period compared with fingers [Cummins, 1929]. The results of the Chuvashian population are not similar to the results of the five Indian populations of our previous study [Karmakar et al. 2002a], perhaps due to a major ethnic difference.

Quantitative
Finger and palmar dermatoglyphics were analyzed [Karmakar et al. 2008a] to examine sexual dimorphism. The sex differences for PII, TRC

and AFRC are similar to Indian and Jewish populations. Correlation coefficients between individual finger ridge counts are little lower than with Jews but are almost equal to Indian populations. The Mantel test of the matrix correlation between sexes for 22 traits has shown a very good similarity. These results suggest that there are the same genes, which control the pattern type. However, sex differences of palmar traits display different levels when compared with other human populations. This may be due to the possible role of environmental (prenatal) factors in the realization of dermatoglyphic sex differences. The development of palmar dermatoglyphics has had a relatively longer growth period compared with using fingers [Cummins 1929]. The palmar dermatoglyphic pattern of affinities therefore corresponds better than fingers to the ethno-historical background of the populations, ascertained by numerous studies.

PCA

The principal component analysis was carried out to determine the sexual dimorphism in the component structures on finger and palmar dermatoglyphics [Karmakar et al. 2008b]. The sex differences in two categories (22 quantitative and 38 asymmetry and diversity traits) of dermatoglyphic traits are reflected differently, contradictory with other ethnic groups. However, a common feature of the factor 1 "digital pattern size factor" (finger ridge counts from the first category of traits) indicate its degree of universality, which suggests that the variability of finger ridge counts is determined by the same genes that control the pattern types. The factors "intra-individual finger diversity factor", "bi-lateral asymmetry factor" (from the second category of traits) is also similar in both sexes. However, these components are hardly described in the literature. The nature of variation of these components (from two categories of traits) appears with a good similarity between sexes, which suggests their common biological validity of the underlying component structures of the finger and palmar dermatoglyphic characters.

Discriminant Analysis

This study [Karmakar et al. 2009a] was an attempt to compare the pattern of sex differences/similarities between two different sets of dermatoglyphic traits: first – 22 usually studied quantitative traits (12 digital ridge counts, 2 palmar a-b ridge counts, 3 pattern intensity indices (PII), 4 palmar main lines (A and D) endings, and MLI – the main line index); second – 38 variables that represent the indices of diversity and asymmetry (11 intra-individual diversity indices, 13 directional asymmetry traits, and 14 indices of fluctuating asymmetry). Multivariate analyses include the Cluster, the Discriminant and the Mantel test of matrix correlations. The percentage of correctly classified individuals of the Discriminant analysis between males and females is 64.14% (for 22 traits) and 65.47% (for 38 traits) respectively. The nature of sex differences revealed very similar between two types of variable sets and thus the two categories of dermatoglyphic variables can be used for sex discrimination in different populations.

Turkmenian population

(Studied subjects 745: 309 males and 436 females of Turkmenia)

Qualitative

Finger and palmar dermatoglyphic traits [Karmakar et al. 2009d], mainly four basic pattern types- whorl (W), ulnar loops (UL), radial loops (RL), and arches (A) and 22 digito-palmar quantitative traits were considered in this paper. There is variation in the distribution of pattern types on finger and palmar configurational areas between sexes and between the right and the left sides. However, a trend of similarity is also observed in these areas. The Turkmenian population is characterized by having high frequencies of ulnar loops and whorls, and low frequencies of arches and radial loops that are not uniformly distributed on all fingers in both sexes. The presence of the palmar pattern only on the left or the right hands varies in different palmar areas in both sexes. However, the present population shows significant sex difference only for hypothenar area.

Quantitative traits

Significant sex differences [Karmakar et al. 2009d] appear for total (TFRC) and absolute (AFRC) finger ridge counts while the results of palmar traits reveal extreme homogeneity. These results are similar to the earlier studies in various populations. The difference between the palm and the finger may be due to the possible role of environmental (prenatal) factors in the realization of dermatoglyphic sex difference. The development of palmar dermatoglyphics has a relatively longer growth period compared with fingers [Cummins 1929]. Thus, the palmar dermatoglyphic pattern of affinities corresponds better than fingers to the ethno-historic background of the populations [Reddy et al. 1988].

PCA

To determine the sexual dimorphism in the component structures, the two different sets of dermatoglyphic traits (22 quantitative and 42 indices of diversity and asymmetry) were analyzed [Karmakar et al. 2009b]. The important similarities between the two categories of dermatoglyphic traits in both sexes were observed. A degree of universality is observed in the first factor- “digital pattern size factor”, which possibly indicates that the genetic factor has more influence on these variables than environmental factors in male and female. A similarity was also observed by the two factors- “intra-individual diversity” and “bilateral asymmetry” extracted from 42 traits in different population/studies. This result indicates that, biological validity perhaps exists in the underlying component structure of dermatoglyphic characters.

Discriminant Analysis

The aim of this study [Karmakar et al. 2009c] was to compare the pattern of sex differences between the two different sets of dermatoglyphic traits (22 quantitative and 42 indices of diversity and asymmetry). Multivariate analyses include the Cluster, the Discriminant and the Mantel test of matrix correlations. All the variables (two groups) are scattered into a number of small clusters which are markedly similar between males and females. These results were confirmed by the Discriminant analysis- the two groups of variables are almost similar, the percentages of correctly classified individuals between males and females are 62.55% (for 22 traits) and 66.32% (for 42 traits); and the Mantel statistics- the Z values are within the level of non-significance, very good similarities in 22 (0.95) and good similarities in 42 (0.87) traits. Therefore, sex dimorphism is similar between the two categories of dermatoglyphic variables which may be used for sex- discrimination in different populations.

DISCUSSION

In the next stage of this review report we check the possible inter-relationships between the above studied populations as well as with other earlier studies in different ethnic populations to understand the real pattern of sex-difference in dermatoglyphic characters.

Qualitative traits

The Indian, Chuvashian and Turkmenian populations are characterized by having high frequencies of ulnar loops and whorls, and low frequencies of arches and radial loops that are not uniformly distributed on all the fingers in both sexes. These findings are corroborated by earlier studies in various populations [see among others, Micle and Kobyliansky 1987, Kobyliansky and Micle 1987, 1988, Arrieta et al. 1991, Crawford and Duggirala 1992, Dittmar 1994, Sivakova et al. 1995]. The obtained results of Indian populations are fully agreed with earlier observations and interpretations [Holt 1968, Newman 1974, Plato et al. 1975, Arrieta et al. 1989, 1990, 1991, Crawford and Duggirala 1992, Dittmar 1994] which indicate that certain qualitative digital patterns may be constant for any population due to the outcome of a developmental process in which individual digits of the same genetic fields, but at different locations occur [Holt 1968]. Similarly, the results of qualitative palmar dermatoglyphic traits have also been supported by earlier studies [Pons 1964, Glanville 1965, Kumbnani 1969, Plato et al. 1975, Vrydagh-Laoureux 1979, Loesch 1978, Karev 1991].

Quantitative

The results of sex differences in Indian, Chuvashian and Turkmenian populations are incomplete agreement with all the earlier studies of diverse Jewish groups [Kobyliansky and Micle 1988, 1989] as well as with other diverse populations [Holt 1959, 1968; Mavalwala 1962, Singh et al. 1977, Jantz 1977, Jantz and Owsley 1977]. Therefore, we have the same interpretation as suggested by Kobyliansky and Micle [1983, 1986; Arrieta et al. 1993] that the variability of finger ridge counts is conditioned by the frequencies of the same genes that are responsible for the presence of different finger pattern types. The results on palmar dermatoglyphics however, display differently from a finger in all the populations and are similar to earlier studies in various populations [see among others, Reddy and Malhotra 1985, 1987, Demarchi et al. 1997, Gomez and Martin 1992, Karmakar et al. 2002, 2006].

PCA

A degree of universality with respect to principal components of dermatoglyphic traits in the studied populations between male and female fully agree with earlier findings among different ethnic populations [Froehlich 1981, Chopra 1971, 1979, Roberts and Coope 1975, Galaktinov et al. 1982, Das Chaudhuri and Chopra 1983, Krishnan and Reddy 1992, Micle and Kobyliansky 1986, 1991] which strongly indicate that common genes are responsible for the component structures of the finger and palmar dermatoglyphic characters.

Discriminant analysis

The present results in all the studied populations with respect to different sets of dermatoglyphic traits between sexes are quite similar (very good similarity) which support fully earlier studies [Kobyliansky and Micle 1988; Micle and Kobyliansky 1991] and indicate a common genetic background and the possible influence of environmental factors on the realization of sexual dimorphism.

General Conclusion

Sexual dimorphism in dermatoglyphic characters is very prominent and homogeneous in nature within populations- Indians, Chuvashians and Turkmenians. This result strongly indicates a common genetic background in the realization of dermatoglyphic sex differences in different geographic populations, but displays different levels when compared with other racial groups, perhaps due to the existence of the possible role of environmental prenatal factors in the realization of the level of dermatoglyphic sex differences and thus both sexes may be quite useful to discriminate different geographic populations.

SUMMARY

Table 1. Sex-comparison of qualitative traits within populations

Populations	Finger patterns	Palmar patterns	References (for details)
Indians	Not significant	Not significant	Karmakar et al (2002a)
Chuvashians	Not significant	Not significant	Karmakar et al (2007)
Turkmenians	Not significant	Not significant	Karmakar et al (2009d)

- Sex comparisons are homogeneous within all populations, but display different when compared with other racial groups
- The two sets of results on fingers and palms are not exactly similar

Table 2. Sex-comparison of quantitative traits within populations

Populations	Statistical tests	Quantitative traits	Asymmetry traits	Diversity traits	Sexdifference	References (fordetails)
Indians	PCA	4 factors	10 factors	3 factors	Non-significant (with some minordifferences between finger and palmar traits)	Karmakar et al (2001; 2002a,b; 2003; 2005)
	ANOVA	Homogeneous	Homogeneous	Homogeneous		
	Discriminant	Goodsimilarity of sex-differences between different sets of variables	Goodsimilarity of sex-differences between different sets of variables	Goodsimilarity of sex-differences between different sets of variables		
Chuva-shians	PCA	4 factors	10 factors	3 factors	Non-significant (with some minor differences between finger and palmar traits	Karmakar et al (2007;2008a,b;2009a)

Talbe 2. Continuation

Populations	Statistical tests	Quantitative traits	Asymmetry traits	Diversity traits	Sexdifference	References (fordetails)
	ANOVA	Homogeneous	Homogeneous	Homogeneous		
	Discriminant	Goodsimilarity of sex-differences between different sets of variables	Goodsimilarity of sex-differences between different sets of variables	Goodsimilarity of sex-differences between different sets of variables		
Turkme-nians	PCA	4 factors	10 factors	3 factors	Non-significant (with some minor differences between finger and palmar traits	Karmakar et al (2009b,c,d)
	ANOVA	Homogeneous	Homogeneous	Homogeneous		
	Discriminant	Goodsimilarity of sex-differences between different sets of variables	Goodsimilarity of sex-differences between different sets of variables	Goodsimilarity of sex-differences between different sets of variables		

- Sex comparisons are homogeneous within all populations, but display different when compared with other racial groups

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ON ASSESSMENT TABELS OF ESTONIAN SCHOOL STUDENTS' PHYSICAL DEVELOPMENT IN THE 1950s

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By the 1950s, due to the coincidence of several extremely unfavourable factors, the research of Estonian school students' physical development was in a decline, as there were no necessary standards or assessment tables.

Still, by that time, the results of studies on school students' physical development, carried out in Russia and Germany before and after the last war were accessible; corresponding studies had also been carried out in Latvia.

Therefore, Estonian schools, medical and sports institutions, etc. used mostly the standard tables for assessment of physical development of German and Russian children. These, however, were not most suitable, or proved even inappropriate in our situation, as the anthropometric variables of each nation reflect correctly only the physical development of that nation [11].

A stimulus for the following rise in Estonian anthropology may have come the complex expedition organized in 1952–1954 by the USSR Academy of Sciences where, simultaneously and using the same methodology, the Soviet Baltic republics and the neighbouring areas of Russia and Belarus were anthropologically studied. To conclude the expedition, a conference was held in Vilnius in 1955, and the results of the expedition were published in two volumes [14].

Considering the above mentioned and the great the significance of the problem, the hygiene sector of Tallinn Scientific Research Institute of Epidemiology, Microbiology and Hygiene conducted a study of school students' physical development from January to April 1954. The subjects were 1225 schoolboys and 1266 schoolgirls aged 8–17 years; the anthropometric variables measured were body mass, standing and sitting height, chest and head circumference, biacromial and pelvic breadth. All the measurements were taken according to internationally accepted rules and recorded on individual cards.

The anthropometric data were analysed by methods of variation statistics; the results were presented in two general tables, separately for boys and girls. Both tables present each anthropometric variable in ten age groups. In each age group the number of subjects is given, followed by the minimum and maximum value of the variable, arithmetic mean (M), arithmetic mean error (± m), standard deviation (σ) and variation coefficient (V).

In addition, there are assessment tables for assessing school students' physical development, separately for boys and girls, in ten age groups for standing height, body mass and chest circumference – divided into the following classes: average, above average, high, below average and low. The limit of average height was considered the arithmetic mean within the limits of one standard deviation (σ) – ± 1σ. By such a classification, five classes were created in each age group by which it was possible to determine the physical development of individual schoolboys and -girls. The study was published by Elmire Helene Närska at the end of 1956 [11].

In the autumn of the same year, 1956, the Department of Zoology of the then Tartu State University began studies of Estonian school students aged 7–18 years covering all Estonia. The supervision of the above-mentioned research was undertaken by Juhan Aul who worked as an associate professor with half a teaching load (from 1957 Professor of Zoology).

When a student of zoology at the university, he simultaneously worked as a teacher at Tartu Teacher Training College and, on its headmaster's recommendation, thoroughly studied twins. One might say that from there it was not a long way to anthropology.

Quite soon J. Aul, still a student of zoology, started anthropological research in a few smaller regions of Estonia. His first research territory was Sõrve peninsula where he, in the summers of 1927 and 1928 measured nearly the whole local population, including 55 boys and 51 girls aged 12–15 years, and 77 young men and 84 girls aged 16–19 years. In 1929, based on this material, he published his first anthropological research paper.

In the following years he broadened his study to get an anthropological overview of men, women and schoolchildren of whole Estonia.

From 1932–1936 he measured more than 15,000 men of the same age (mostly 22 years) who were leaving military service; so he acquired an overview of anthropology of men from whole Estonia. Estonian women were not excluded from his studies either.

In 1932 he started a wide-ranging programme for collecting anthropological material from schools all over Estonia, which lasted until 1940.

In the academic year 1939/40 he supervised measuring of school students' body height and weight in schools of Tallinn and Harju County.

Meanwhile, in 1935–1937 he had received a scholarship of the university on anthropology, had successfully defended his doctoral thesis *Anthropological characteristics of Estonians of West-Estonia and their racial features* (1938) and taken an eight-month research trip to Western Europe. In April 1939 he had founded the Anthropology Section of the Estonian Naturalists' Society, and in October of the same year he was qualified as Associate Professor of Anthropology.

Much of his work remained unfinished as the war started in June 1941; the collected data could not be analysed and research results published in time.

Still, Estonia had become one of the anthropologically best-researched countries in the world, as said in the interview with J. Aul published by the newspaper *Eesti Sõna* in December 1942. He had managed to do all of this along with his main work – teaching at the Institute of Zoology at the university.

After the war J. Aul continued as a senior lecturer at the Department of Zoology; thereafter he was appointed to the post of acting associate professor. In 1948 the Higher Attestation Commission of the USSR conferred on him the degree of Doctor of Biology and the qualification of Associate Professor. He also did part-time work at the Teacher Training Institute and the Institute of Biology of the Estonian SSR Academy of Sciences.

The onslaught launched by Lysenkoists against "Mendelists-Morganists" and "bourgeois nationalists" hit J. Aul, too. In 1950 he was dismissed from the above-mentioned posts, from the university as "not meeting the requirements of the university". He was unemployed for a few days more than four years and one month.

In September 1954 he was restored to the post of zoology lecturer at the university, He could continue anthropological research of schoolchildren and youth, the work that he had cherished since the time he worked as a teacher at Tartu Teacher Training College [12].

The measurements started in the town of Tartu and Tartu and Elva districts (the present Tartu county). These were followed by studies in other regions of Estonia (districts of Põlva, Rapla, Võru, Harju, Kohtla-Järve, Haapsalu, Keila and Pärnu, and the towns of Tallinn and Pärnu). During the research that lasted until 1967, a total of 14,862 schoolboys and 15,195 schoolgirls at the age of 7–18 years were measured.

The data were collected during expeditions in September. The measurements were taken according to the generally known rules of R. Martin and with instruments taken into use by him. The data of each subject were recorded on a separate observation sheet [9].

Among the archive materials on J. Aul, part of which are stored at the Centre for Physical Anthropology, we found observation sheets (Form No. 3) for school students anthropometric research. The sheets, sized 21×15 cm, were printed at different times.

The oldest was printed in 7000 copies at K. Mattiesen's printery in January 1944 [1]. The following were printed at Pioneer printery (address: 38 Kastani St., Tartu) — 3000 copies in July 1956 [2], 3000 copies in November 1956 [3] and 5000 copies in March 1959 [4]. In 1961, 6000 copies were printed at H. Heidemann printery [5] and, in 1963, 1700 copies at Tartu State University Rotaprint [6].

Next, we present an overview of Form No. 3 printed in 1944. On this observation sheet, after the number of the subject, the sections of personal data, measurements and observations could be filled in.

Overview of personal data: Surname, first name, patronymic .... Year and date of birth .... Age .... years .... months. Studies at .... school .... class. Permanent place of residence .... Parents descend from .... Parents' trade: farmer, small farmer, cottager, farm labourer, merchant, teacher, woodworker, factory worker, ... Parents' economic status: miserable, poor, average, wealthy, rich; self-employed, wage labourers. Parents' ethnicity .... Number of living siblings (the subject included) .... Which child in family (in order of birth) .... Academic achievement: poor, below average, average, good, excellent, ...

Overview of measurement data: Body height .... Sitting height .... Biacromial breadth .... Hips breadth .... Chest circumference .... Head length .... Head breadth .... Facial breadth Facial height .... Weight .... Lung capacity .... Dynamometry ....

These are followed by blanks for some indices: Rohrer index .... Quetelet index .... Pignet index .... Relative sitting height .... Head index ..... Morphological facial index ....

Overview of the section of observations: Hair: black, brown, blond, sandy, fair, dark, yellowish, ashen, ... Eye colour: brown, motley, blue, grey; light, dark; greenish, yellowish, whitish, ... Nasal bridge: straight, convex, wavy; slightly, expressly. *Men(arche)* .... Constitution: lepto-, meso-, eurysomic; muscular, respiratory, digestive, cerebral. *Mam(ma)* 0 1 2 3 4 Race .... Notes: .... 194..... year .... Measured by .... [1].

On the anthropological observation sheet printed in July 1956 several changes and additions had been made, which remained for the whole period of research.

Among personal data: Parents' economic situation has been left out. Parents' place of work has been added. Parents' trade where it was possible to underline the given variant has been renamed parents' occupation, followed by a blank for filling in. Academic achievement has been transferred to the section of observations:

In the part of measurements: body height is followed by a new measurement – shoulder height. This is followed by sitting height and biacromial breadth; after the latter, chest measurement (which should be chest breadth) has been added. In the section of indices Pignet index and relative sitting height have been left out.

In the section of observations, the new items are assessment of nutrition on a five-point scale (1, 2, 3, 4, 5), existence of pubic hair and underarm hair and their assessment on a five- and four-point scale respectively (*Pubes* 0 1 2 3 4 and *Axilla* 0 1 2 3). Determination of race has been left out. Back and upper arm skinfolds, however, have been added to this section.

During measurements, data on finger height were added to shoulder height; to chest measurement, i.e. chest breadth – data on chest depth, and to facial breadth – data on lower chin breadth.

These items had been left out by the compiler of the observation sheet before it went to print. Later *spina iliaca anterior* height and upper leg circumference were also added to the measurements [2, 3, 4, 5, 6].

To prevent mistakes resulting from different measuring techniques, the overwhelming majority of subjects were measured by Dr. J. Aul himself. At each expedition he was accompanied by two or three biology students who acted as his assistants, carried out observations and assessments and took some measurements. The data from different regions were analysed by expedition members [9].

Biology student Viivi Schüts, who participated in measuring the school students of the town of Tartu, wrote, after analysing the collected data, her graduation thesis *On physical development of school students of the town of Tartu* (1958) [13]. Evi-Mai Kirhäiding who participated in expeditions in Tartu and Elva districts wrote the graduation thesis *On physical development of students of schools of general education in Tartu and Elva districts* (1959) [10].

The material for the first mentioned graduation thesis, by V. Schüts, was collected in 1956 and 1957 at four secondary schools, four 7-year schools, practice school of the teacher training school, nursing school and construction school. A total of 2906 school students of Estonian ethnicity and descending from Tartu (parents' permanent residence in Tartu) – 1394 boys and 1512 girls aged 7–18 years – were measured [13].

The research material for the second graduation paper was collected during the anthropological expeditions in 1956, 1957 and 1958 (mostly in September) at eleven 7-year schools and five secondary schools of Tartu and Elva districts. A total of 2480 school students of Estonian ethnicity were measured – 1215 boys and 1265 girls aged 7–18 years [10].

According to R. Martin's (1928) method, which has been most often used for assessment of children's physical development, the ordered sample is divided into classes with fixed boundaries, based on arithmetic mean (M) and standard deviation (σ). Martin took $\pm$ 3 σ as the range of variation, which includes 99.73% of the measured subjects. Thereafter he divided the ordered sample into seven unequal classes.

Therefore, when compiling the assessment tables for the first graduation thesis, on J. Aul's recommendation, $\pm$ 3 σ was taken for the variation range, which is 99.73% of the whole variation, and is divided into five equal classes. A certain variable of a subject should be considered as averagely developed if the value of the variable is within the range of M $\pm$ 3/5. In the assessment tables given as an appendix to this graduation thesis, the numerical limits for the five corresponding classes (very small, small, average, big, very big) for body height, sitting height, body mass, chest circumference, chest breadth and depth, biacromial and hip breadth, upper extremity length and right hand dynamometry are given in 12 age groups for both boys and girls; for lung capacity for the age of 8–18 years in both cases [13].

In the second graduation paper, instead of the methods devised by R. Martin et al., a simpler and more rational method recommended by J. Aul has been applied, where he divides the whole ordered sample into five equal classes where the range of a class is 1 σ. Thus, the range of the ordered sample is 5 σ, which covers 98.8% of all the measured subjects. Thus, there is no need for artificial and time-consuming "divisions" of the ordered sample. A certain variable in a subject should be considered as averagely developed if the value of the variable is within the range of M ± ½ σ. In the assessment tables given as an appendix to this graduation thesis the numerical limits for the five corresponding classes (very small, small, average, big, very big) for body height, sitting height, body mass, chest circumference, chest breadth and depth, biacromial and pelvic breadth, upper extremity length and right hand dynamometry are given for 12 age groups in both boys and girls; for lung capacity for the age of 11–18 years in both cases [10].

These assessment tables made it possible to assess objectively the physical development of students of Estonian ethnicity in the town of Tartu and Tartu and Elva districts.

The correspondence of anthropological variables in both papers has been established by correlation calculations. In all age groups, for both schoolgirls and -boys, the correlation coefficient (r) and its mean error (m) have been calculated for body height and body mass, and for body height and chest circumference. Likewise, the regression coefficients have been calculated for body height (x) and body mass (y), and body height (x) and chest circumference (y1) [10, 13].

The annual anthropological expeditions of the Department of Zoology under Prof. J. Aul's supervision continued. Based on the collected materials, students continued to write graduation theses on Estonian school students' physical development [9].

By 1964 observations and measurements had been carried out on 9,688 schoolboys and 9,829 schoolgirls, a total of 19,517 school students aged 7–18 years.

The article published in that year by Prof. J. Aul gives data on four anthropological variables – body height, body mass, chest circumference and sitting height – in the form of respective general and assessment tables [7].

In 1974 he published *Assessment tables of physical development of Estonian school students* (20 pp.) about eight variables, based on the data of anthropological research of nearly 30,000 school students [8].

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COMPARISON OF CRANIOFACIAL MEASUREMENTS IN VARIOUS FEMALE ETHNIC GROUPS

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ABSTRACT

The analysis of craniofacial measurements has been used for many scientific and medical problems. Various studies have indicated differences between populations and ethnic groups. Ethnicity has been indentified as an important factor in the analysis of data on craniofacial morphology. The aim of this study was to compare and discuss the presently available data for some craniofacial measurements in various female ethnic groups. In this study nine craniofacial measurements (physiognomical face height, morphological face height, maximum facial breadth, mandible breadth, intercanthal width, biocular width, nose height, nose width and labial fissure width) were selected and their mean values were compared between six ethnic groups (Latvian, North American whites, Germany, Iranian, Indian and Angolan females). The face index was calculated and compared parallelly. The results of the present study showed that Latvian and Iranian females had hyperleptoprosop-type of the face shape, but North American whites and females from Germany had the leptoprosop-type face. Indian females had the mesoprosop-type face, while Angolan females had the euryprosop-type face. The results of the study demonstrated statistically significant differences between the selected groups of subjects in all variables.

Keywords: *anthropometry, craniofacial measurements, women, ethnicity*

INTRODUCTION

Anthropometry is the technique method in the biological science for measuring the size, weight and proportions of the human body, and it provides data to the craniofacial morphology evaluation, through a series of head and face measurements [1, 4]. Anthropometry presents many possibilities for the evaluation of craniofacial morphology by using simple, noninvasive and inexpensive techniques.

The craniofacial complex is one of the most varying parts of the human body [5, 12, 17]. The development of the human head and face depends on a variety of genetic and environmental factors. The results of single measurements indicate the person`s place within or outside the normal range. Therefore, it is important to use references based on the studies in different populations. Nowadays ethnic differences are obtaining greater importance in multicultural society. Many previous studies attempted to apply craniofacial analyses to various etnic and racial groups [9, 16]. Such data provide valuable information about the major craniofacial characteristics.

This study focuses on the craniofacial measurements between six groups of women. The greatest part of data comes from Farkas` work on the various ethnic groups/races in the world [7]. This international anthropometric project studied the facial morphology of 25 ethnic groups/races in the world.

The aims of the present study were: to compare some craniofacial measurements in various female ethnic groups and discuss available data on the basis of the most significant differences of craniofacial parameters and the face index.

MATERIAL AND METHODS

In Part 1 of the study we included 50 female (group 1) subjects measured in 2002–2004. In this group all the women were healthy original inhabitants of Latvia with the normal craniofacial configuration.

GPM Anthropological Instruments, Siber Hegner&Co.AG were used for taking head and face measurements. Measurements were performed at the Department of Biology and Microbiology of Riga Stradiņš University and at the University of Daugavpils. Facial, orbital, nasal and mouth measurements were derived from the measurements using landmarks. For the identification of landmarks and measuring techniques we have followed the instructions given by Farkas L.G. (personal communication) and the guidelines described by Kolar J.C., Salter E.M., Martin R. and Saller K. [11, 14]. We selected nine measurements and compared them with other ethnic groups in this study. The definitions of measurements are shown in Table 1.

Table 1. The definition of measurements using various landmarks on the face, orbit, nose and mouth region.

Landmark	Measurement definition	Region
tr-gn	physiognomical face height	face
n-gn	morphological face height	
zy-zy	maximum facial breadth	
go-go	mandible breadth	
en-en	intercanthal width	orbit
ex-ex	biocular width	
n-sn	nose height	nose
al-al	nose width	
ch-ch	labial fissure width	mouth

The basic variables were used to calculate the values of the face index (FI) according to the following formula [14]:

FI = (n-gn / zy-zy) x 100

In the category of the female face types the distribution of the mean basic face indexes was as follows: hypereuriprosop (x–76.9), euryprosop (77.0–80.9), mesoprosop (81.0–84.9), leptoprosop (85.0–89.9) and hyperleptoprosop (90.0–x) [14].

In Part 2 of the study the results were compared with the previously published standards for North American whites or NAW (group 2) females and the data of other four different ethnic groups from Europe (group 3 or the subjects from Germany), the Middle East (group 4 or the subjects from Iran), Asia (group 5 or the subjects from India) and Africa (group 6 or the subjects from Angola) [7].

Data were entered on spreadsheets and analysed using SPSS for Windows, version 17.0. Means and standard deviations were used for evaluating the differences between groups. All the variables were tested for the arithmetic mean differences between the groups by Student t-test. Statistical significance was assumed at $p < 0.001$.

RESULTS

The results of our study are presented in Tables 2–7. Table 2 shows the comparison of mean values of craniofacial measurements in six various female ethnic groups:

Table 2. Comparison of mean values of craniofacial measurements in various female ethnic groups.

Measurement (mm)	Group 1 (n = 50)	Group 2* (n = 720)	Group 3* (n = 30)	Group 4* (n = 30)	Group 5* (n = 30)	Group 6* (n = 30)
	m ± SD	m	m	m	m	m
tr-gn	177.0 ± 7.9	172.5	170.9	175.9	163.0	172.4
n-gn	117.6 ± 6.2	111.8	109.5	120.3	101.5	106.5
zy-zy	122.4 ± 8.0	129.9	123.4	131.7	124.9	132.8
go-go	96.9 ± 7.5	91.1	91.5	102.7	97.4	90.3
en-en	26.6 ± 2.4	31.6	28.6	24.6	30.9	36.6
ex-ex	100.6 ± 6.0	86.8	86.4	79.8	97.5	87.0
n-sn	56.7 ± 5.7	48.9	51.4	58.5	43.7	46.6
al-al	32.8 ± 2.7	31.4	31.0	32.1	33.8	40.8
ch-ch	46.5 ± 3.4	49.8	48.2	45.0	46.5	36.1

n – number of women; m – arithmetic mean; SD – standard deviation; group 1 – Latvian females; group 2 – NAW females; group 3 – Germany females; group 4 – Iranian females; group 5 – Indian females; group 6 – Angolan females; *data of Farkas et al [7]

Table 3. Differences between means of craniofacial measurements in Latvian females and other females groups.

Measurement (mm)	Groups 1/2	Groups 1/3	Groups 1/4	Groups 1/5	Groups 1/6
	D	D	D	D	D
tr-gn	+4.5	+6.1	+1.1	+14.0	+4.6
n-gn	+5.8	+8.1	–2.7	+16.1	+11.1
zy-zy	–7.5	–1.0	–9.3	–2.5	–10.4
go-go	+5.8	+5.4	–5.8	–0.5	+6.6
en–en	–5.0	–2.0	+2.0	–4.3	–10.0
ex-ex	+13.8	+14.2	+20.8	+3.1	+13.6
n-sn	+7.8	+5.3	–1.8	+13.0	+10.1
al-al	+1.4	+1.8	+0.7	–1.0	–8.0
ch-ch	–3.3	–1.7	+1.5	0	+10.4

n – number of women; group 1 – Latvian females; group 2 – NAW females; group 3 – females from Germany; group 4 – Iranian females; group 5 – Indian females; group 6 – Angolan females; D – difference

Table 4. Differences between means of craniofacial measurements in NAW females and other females groups.

Measurement (mm)	Groups 2/3	Groups 2/4	Groups 2/5	Groups 2/6
	D	D	D	D
tr-gn	+1.6	–3.4	+9.5	+0.1
n-gn	+2.3	–8.5	+10.3	+5.3
zy-zy	+6.5	–1.8	+5.0	–2.9
go-go	–0.4	–11.6	–6.3	+0.8
en-en	+3.0	+7.0	+0.7	–5.0
ex-ex	+0.4	+7.0	–10.7	–0.2
n-sn	–2.5	–9.6	+5.2	+2.3
al-al	+0.4	–0.7	–2.4	–9.4
ch-ch	+1.6	+4.8	+3.3	+13.7

n – number of women; group 2 – NAW females; group 3 – females from Germany; group 4 – Iranian females; group 5 – Indian females; group 6 – Angolan females; D – difference

Table 5. Differences between means of craniofacial measurements in Germany females and other females groups.

Measurement (mm)	Groups 3/4	Groups 3/5	Groups 3/6
	D	D	D
tr-gn	–5.0	+7.9	–1.5
n-gn	–10.8	+8.0	+3.0
zy-zy	–8.3	–1.5	–9.4
go-go	–11.2	–5.9	+1.2
en-en	+4.0	–2.3	–8.0
ex-ex	+6.6	–11.1	–0.6
n-sn	–7.1	+7.7	+4.8
al-al	–1.1	–2.8	–9.8
ch-ch	+3.2	+1.7	+12.1

n – number of women; group 3 – Germany females; group 4 – Iranian females; group 5 – Indian females; group 6 – Angolan females; D – difference

Table 6. Differences between means of craniofacial measurements in Iranian, Indian and Angolan females.

Measurement (mm)	Groups 4/5	Groups 4/6	Groups 5/6
	D	D	D
tr-gn	+12.9	+3.5	–9.4
n-gn	+18.8	+13.8	–5.0
zy-zy	+6.8	–1.1	–7.9
go-go	+5.3	+12.4	+7.1
en-en	–6.3	–12.0	–5.7
ex-ex	–17.7	–7.2	+10.5
n-sn	+14.8	+11.9	–2.9
al-al	–1.7	–8.7	–7.0
ch-ch	–1.5	+8.9	+10.4

n – number of women; group 4 – Iranian females; group 5 – Indian females; group 6 – Angolan females; D – difference

Table 7. Basic shapes of the face according to the face index (FI) in all the study groups.

Face index (FI)	Group 1 (n = 50)	Group 2* (n = 720)	Group 3* (n = 30)	Group 4* (n = 30)	Group 5* (n = 30)	Group 6* (n = 30)
	96.1	86.1	88.7	91.3	81.3	80.2

n – number of women; *calculated

Face

Of the two vertical measurements (tr-gn, n-gn), in the Latvian females (group 1) the physiognomical face height (tr-gn) was significantly greater rather than in other female groups. Identical mean values of the physiognomical face height measurements were seen in NAW (group 2) and Angolan females (group 6).

In Iranian females (group 4) the mean value of morphological face height (n-gn) was significantly greater than in other groups. This value was significant and the smallest in Indian females (group 5).

The compared mean values of the maximum facial breadth (zy-zy) between groups, the greatest and the significant mean value was in Angolan females (group 6). When the facial breadth of Latvian females (group 1) was compared with the mean values of this measurement in other groups, the result showed significant and the smallest value in our females.

The mandible breadth (go-go) showed significant and the greatest value in Iranian females (group 4), but in Angolan females (group 6) it was significantly smaller than in other groups.

Orbits

The greatest and significant intercanthal width (en-en) was in Angolan females (group 6). In Iranian females (group 4) the mean value of this measurement was significant and the smallest. In Latvian females (group 1) the intercanthal width (en-en) showed a significantly greater mean value than in Iranian females (group 4).

In Latvian females (group 1) the biocular width (ex-ex) was significantly greater than in other groups. In NAW (group 2) and German females (group 3) the mean values of biocular width measurements were identical.

Nose

Significant and the greatest mean values of the nose height (n-sn) were in Iranian females (group 4) and in Latvian females (group 1). In Indian females (group 5) and Angolan females (group 6) the mean values of nose height were significant and the smallest.

The width of the nose (al-al) was significant and the greatest in Angolan females (group 6). In NAW females (group 2) and German females (group 3) the mean values of nose width were identical. In Latvian females (group 1) the mean value of nose width was greater than in NAW females (group 2) and German females (group 3).

Mouth

The labial fissure width (ch-ch) was significant and the greatest in NAW females (group 2), but it was significant and the smallest in Angolan females (group 6). In Latvian females (group 1) and Indian females (group 5) the mean values of the labial fissure width were identical.

The distribution of arithmetic mean differences of the studied variables for all the groups are presented in Tables 3–6.

Face index (FI)

Table 7 shows the main face types based on face indexes for all the groups. Latvian (group 1) and Iranian (groups 4) females had the hyperleptoprosop-type face, but NAW (group 2) and Germany (group 3) females had the leptoprosop-type face. Indian females (group 5) had the mesoprosop-type face, but Angolan females (group 6) had the euryprosop-type face.

DISCUSSION

Many authors have noticed quantitative differences between the groups for particular craniofacial measurements. The craniofacial measurements can be successfully created and used in order to compare the head and face morphology of various ethnic populations. Racial and ethnic differences in craniofacial traits have been reported by many researchers [2, 3]. As the data of Farkas et al. [6, 7, 8] were easily extracted for comparison, we undertake to make a descriptive comparison between these data and our current findings.

The measurements, selected for this study, were analyzed to develop the image of some craniofacial parameters from four regions with nine measurements. These measurements were selected to describe the differences between six ethnical groups. In order to determine if differences existed between all of the various groups, we analyzed the absolute differences between them, and it was clear that differences do indeed exist. Interesting observations can be made between females in six ethnical groups. Based on the data analysis of nine measurements all the females can be classified into different morphological types. The differences were in facial, orbital, nasal and mouth regions.

When analyzing the data by their means, it can be noted that in several parameters like the physiognomical face height (tr-gn) and the biocular width (ex-ex) Latvian females recorded greater means than in other groups. In NAW females (group 2) the significantly greater mean value of the labial fissure width (ch-ch) compared with other female groups was observed.

In Iranian females (group 4) significantly greater values of the morphological face height (n-gn), the mandible breadth (go-go) and the nose height (n-sn) were registred. The greatest mean values of the maximum facial breadth (zy-zy), the intercanthal width (en-en) and the nose width (al-al) were found in Angolan females (group 6).

The facial framework is expressed by the face index, which is the ratio of morphological facial height to the maximum facial breadth. This index indicated a proportionally more balanced facial frame (hyper-leptoprosop) for the Latvian females and for Iranian females (face index 96.1 and 91.3). Comparing to a similar study by Farkas [7] only the NAW female (group 2) and German female (group 3) had the leptoprosop-type face (face index 86.1 and 88.7), whereas the Indian females (group 5) had the mesoprosop-type face (face index 81.3), but Angolan females (group 6) had the euryprosop-type face (face index 80.2).

All the analyzed and compared data showed that the values of craniofacial measurements reflected their specific biological and sociocultural history in different ethnic groups. Anthropometric studies are mostly conducted with the aim of obtaining the characteristics of ethnic groups inhabiting a particular geographical region, and it does not only assist in understanding the frequency distribution of human morphologies, but also in providing the basis for a comparison among different races [10, 15, 18]. This analysis demonstrated that these morphological differences were related to different geography and habitats. The craniofacial variation existing between ethnic groups might be attributed to genetic and environmental influences and also food habits [13]. The present study was based on the group means and not on individual data, and it had some limitations, because it compared six specific ethnic groups and also because our sample was relatively small, but it should be an important step for future investigations. For these purposes, the standards based on local data are desirable, since these standards reflect the different patterns of the craniofacial growth resulting from racial, ethnic, social and dietary differences.

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PECULARITIES OF NUTRITION OF KIDNEY TRANSPLANT PATIENTS

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ABSTRACT

The study was carried out in 2003–2006 at the Department of Internal Medicine of the University of Tartu. Our research investigated the dynamics of the relations of anthropometric measurement results with bone density, clinically significant biochemical data, nutrition habits and consumed food energy in kidney transplant patients. The current paper deals only with the nutritional aspect. A special food questionnaire compiled by the Centre of Physical Anthropology at the University of Tartu was used for nutrition research. Dietary assessment using a 3-day menu was carried out in kidney transplant patients twice: the first follow-up data were collected 1.2 years after the transplantation and the second follow-up data 1.5 years after the first follow-up. The daily intake of food energy and nutrients was calculated by the program Micro-Nutrica software and the food composition database. Preventive nutritional counselling and dietary consultation by a dietitian was carried out for all the transplant patients during the first year after the transplantation. The main results were the following: the analysis of menus showed that after the follow-up the consumption of proteins and phosphates had decreased among both men and women, which means that patients needed nutritional counselling. The questionnaire on nutrition habits and analysis of menus showed the greater proportion of animal protein compared to vegetarian food.

Conclusion. Optimal counselling by a dietician is important after the kidney transplantation in order to improve the patient's nutritional habits and to avoid unbalanced and excessive food consumption if the patient has a tendency to weight increase.

Key words: *renal transplant patients, food frequency questionnaire, nutritional habits, nutrient content of menus*

INTRODUCTION

Several authors have shown that the first post-transplant year is a crucial period in kidney transplant patients. Optimal control of metabolic abnormalities and prevention of metabolic syndrome should be considered in the optimal management of renal transplant patients [1, 5, 9, 10]. Hypercholesterolemia and hypertriglyceridemia are common risk factors for cardiovascular disease in renal transplant patients. All possible complications may be prevented through early nutritional intervention and follow-up [3, 4, 5].

The studied patients were generally in a satisfactory nutritional status after the transplantation, which may be associated with regular monitoring, cooperation points with treatment and with good collaboration between specialists. Our research investigates the dynamics of the relations of anthropometric measurement results with bone density, clinically significant biochemical data, nutrition habits, and consumed food energy in kidney transplant patients. The current article deals only with the nutritional aspect.

The purpose of the study was to examine and analyse nutritional habits as well as food intake during several years after kidney transplantation.

MATERIALS AND METHODS

Subjects

The study was carried out in 2003–2006 at the Department of Internal Medicine at the University of Tartu. Twenty-eight clinically stable consecutive non-diabetic first renal transplant patients (glomerulonephritis n=15, pyelonephritis n=6, polycystic kidney disease n=5, other chronic kidney disease n=3) were studied: 12 males aged 42.8±16.1 years (min 18, max 70, over 50 years of age n=3) and 16 females aged 47.0±14.9 years (min 21, max 71, post-menopausal patients n=6).

Nutrition research

A special food questionnaire compiled by the Centre of Physical Anthropology at the University of Tartu was used [11]. The questionnaire consisted of six parts and 222 variables which covered the questions on the socio-economic situation, nutritional traditions of the family, the patient's own nutritional habits, how much the kidney patients consumed drinks and bread a day, the attitude of patients to eating and movement, and the consumption frequency of foodstuffs. The questionnaire on foodstuffs included questions on nine groups of 133 products: 16 milk and dairy products, 12 cereal and flour products, 15 meat products, 8 fish products, 20 vegetables, 15 seasonal fruits and berries, 11 sweets, 19 drinks, 17 ready-made foods. The frequency of consumption of each foodstuff was assessed on a five-grade scale: daily, often (2–3 times a week), sometimes (1–2 times a week), seldom (1–2 times a month), never. The patients filled the questionnaire once. The first follow-up data (FU1) were collected 1.2 years after the transplantation.

Dietary assessment

Dietary assessment using a 3-day menu was carried out in kidney transplant patients twice: the first follow-up data (FU1) were collected 1.2 years after the transplantation and the second follow-up data (FU2) 1.5 years after the first follow-up data. Preventive nutritional counselling and dietary consultation by a dietitian was carried out for all the transplant patients during the first year after the transplantation [3, 5, 7, 8, 12]. Patients were advised to consume 0.8 to 1 g/kg/day of protein and 25 to 35 kcal/kg/day [1, 2]. The normative value of the basic nutrients was in accordance with the Estonian Nutritional Recommendations and Food-Based Dietary Guidelines and with methods of diet therapy [6].

Statistical analysis

Statistical analysis was performed using the Statistical Package System (SAS). The daily intake of food energy and nutrients was calculated by the program Micro-Nutrica software and the food composition database. The following basic statistical characteristics were given about nutrients: means (mean), standard deviations (SD), minimum (min) and maximum (max). The dynamics of the mean values of the three-day menu food energy and nutrient intake were studied at different time-points: the FU1 and the FU2 observation period. The data were analysed using the t-test. The $P<0.05$ level was selected as the criterion of statistical significance.

RESULTS

The data on individual nutritional habits were obtained by a food-frequency questionnaire.

The questionnaire revealed that the patients consumed different foodstuffs at different frequencies, but there was a tendency to excessive consumption of foodstuffs rich in proteins and carbohydrates. Consumption of fat-rich foodstuffs showed a tendency of decrease. Consumption of vegetables and fruit was modest compared to Estonian food and nutrition recommendations. The same tendency could be noticed in literature.

Part 1. Analysis of the socio-economic situation of kidney transplant patients (percentage)

Patients' marital status. The majority of men and women were married or cohabited (58.4% of men and 43.8% of women); 25% of female patients were divorced. 41.7% of male patients and 31.3% of female patients were single.

Patients' education. 91.7% of men and 87.6% of women had primary, secondary or specialized secondary education. Patients with higher education were only among women – 12.5%

Patients' occupations and working load. 2/3 of male and 2/3 of female patients did not work as they were categorized as disabled; 1/3 of subjects worked either constantly or sometimes, either full- or part-time.

Patients' assessment of their families' economic status. The economic situation of the family was considered poor by 16.7% of men and 12.5% of women, satisfactory by 75% of men and 68.8% of women, and only 8.3% of men and 18.8% of women considered their economic status good.

Patients' economic situation. 16.7% of men and 6.3% of women were not able to freely choose the foodstuffs they consumed. For 25% of men and 6.3% of women the choice of food was limited; they were able to afford only indispensable and unbalanced food. 25% of men and

43.8% of women could choose satisfactory and varied basic food (potato, bread, milk, vegetables). 8.3% of men and 6.3% of women did not have any limitations to choosing their food.

Part 2. Analysis of the nutritional traditions of the family (percentage)

Attention to eating in the family. Great attention was paid to eating in the families of 8.3% of men and 6.3% of women.

Number of mealtimes a day. The greatest percentage of families had four or more meals a day (8.3% of men and 12.5% of women). 25% of men and 6.3% of women did not keep to regular meals.

Regularity and character of breakfast. The majority of men (75%) and women (93.8%) preferred a light meal (sandwiches, coffee, milk, juice). Hot breakfast was eaten in few families (16.7% of men and 6.3% of women).

The richest meal in the family was lunch and supper. 66.7% of men ate mostly at noon, and in the evening 6–8 PM. 25% of men and 6.3% of women did not keep to regular mealtimes. Only 8.3% of men ate after 8 PM, but women didn't.

Family gatherings or other parties with alcohol. 16.7% of men and 6.3% of women consumed alcoholic drinks frequently; 58.3% of men and 85.1% of women did it seldom. 25% of men and 18.8% of women did not consume any alcoholic drinks at all.

Part 3. Analysis of kidney transplant patients' own nutritional habits (percentage)

Number of meals. The patients ate 3–4 times a day, seldom twice a day.

Usual number of warm meals. 68% of female patients cooked a hot meal at least twice a day. Among male patients, 33.3% had a hot meal once a day, 33.3% twice a day and 33.3% three times a day.

The time of the first meal in the morning. 66.7% of men and 62.6% of women had a meal between 7– 8 o'clock; 6.3% of women ate after 10 o'clock.

Morning appetite. 75% of men and 62.5% of women had good appetite. Some subjects (8.3% of men and 31.3% of women) had no appetite but still forced themselves to eat. Complete lack of appetite was mentioned by 6.3% of women.

Character of lunch and of supper. Hot lunch was eaten by the majority of subjects (91.7% of men and 93.8% of women). Hot supper was eaten by 66.7% of men and 81.3% of women.

Eating in the evening before going to bed. Part of men (8.3%) and women (12.5%) ate before going to bed. 33.3% of men and 25% of women did it never.

Eating sweets, fruit, berries, etc. between meals. Sweets, fruit, berries, etc. were eaten between meals seldom by 75% of men and 81.3% of women.

Unpleasant feeling after a meal. The majority of men and women did not experience an unpleasant feeling after eating certain foodstuffs. An unpleasant feeling after a meal was experienced seldom by 16.7% of men and 18.8% of women.

Complaints connected with a food. 37.7% of female patients complained of nausea, heartburn, belching or flatulence. 91.7% of men and 56.3% of women did not have any food-related complaints. Men (8.3%) complained only of flatulence.

Eating sweet foods. Sweet foods were eaten mostly by women, less by men (25% of men and 43.8% of women). 16.7% of men and 6.3% of women did not consume any sweet foods at all.

Adding salt to ready-made food. 5% of men and 43.8% of women did not add salt to ready-made food. Seldom was salt added to ready-made food by 50% of men and 37.5% of women. Often was salt added by 18.8% of female patients.

Adding pepper and other hot spices to ready-made food. 6.3% of women added pepper or spices to ready-made foods. Often were hot spices consumed by 8.3% of men and 12.5% of women.

Frequency of stool. Frequency of stool in all subjects was once daily or every other day.

Part 4. Analysis of kidney transplant patients' daily consumption of drinks and bread (percentage)

Daily consumption of milk, milk drinks, juice and bean coffee. Two or three glasses of milk and other milk drinks were daily consumed by 50% of men and 25% of women. Two or three glasses of juice were daily consumed by 58.3% of men and 50% of women. One cup of bean coffee was daily consumed by 41.7% of men and 37.5% of women. Two or three cups of bean coffee were daily consumed by 33.3% of men and

56.3% of women. 8.3% of men and 6.3% of women drank more than three cups of bean coffee a day.

Daily consumption of black and white bread. 66.7% of men consumed 3–4 slices of rye bread daily. 3–4 slices of white bread were consumed by 50% of men. 43.8% of female patients consumed 1–2 slices of rye bread and 50% 2–3 slices of rye bread daily. White bread and products made of it was not eaten by 25% of men and 12.5% of women. Some subjects consumed larger quantities of bread – 5–6 slices daily (8.3% of men and 6.3% of women).

Part 5. Analysis of the patients' attitude to eating and movement (percentage)

Fear of being overweight. 50% of male patients and 25% of female patients were not afraid of being overweight. 16.6% of men and 37.6% women watched their body weight.

Control of body weight and weighing oneself. 50% of men and 43.8% of women did not watch their body weight. Only 6.3% of women always watched their body weight.

Awareness of the nutritional value of the food. 25% of men and 50% of women were aware of the nutritional value of the food they consumed. 33.3% of men and 6.3% of women did not have this knowledge.

Keeping to diet. Consumption of dietary food was not needed by 50% of men and 50% of women. Only 6.3% of women kept a diet.

Constipation and diarrhoea. 6.3% of women had constipation and 6.3% had diarrhoea. Men and most women did not have any digestive complaints.

Moving much to spend excessive calories. Male and female patients tried to move a lot to spend excessive calories (58.3% of men and 43.8% of women). 41.6% of men and 66.3% of women did not get much exercise.

Part 6. Analysis of the food frequency table (percentage) of the kidney transplant patients. We start the analysis with food frequency in Table 1.

Table 1. Frequency of consumption of foodstuffs by kidney transplant patients (%).

No	Frequency of consumption of main food groups (%)	Daily	Often, 2–3 times a week	Some-times, 1–2 times a week	Seldom, 1–2 times a month	Never	Daily	Often, 2–3 times a week	Some-times, 1–2 times a week	Seldom, 1–2 times a month	Never
		4	3	2	1	0	4	3	2	1	0
	Subjects	Males (n=12)					Females (n=16)				
No	**Milk and dairy products**										
1	Whole milk 4.5%	8.3	16.7	16.7	8.3	50.0	6.3	18.8	12.5	12.5	50.0
2	Milk 2.5%	16.7	25.0	25.0	8.3	25.0	25.0	12.5	18.8	25.0	18.8
3	Milk 1%	8.3	16.7	0.0	75.0	0.0	0.0	0.0	18.8	81.3	0.0
4	Kephir 1%	8.3	0.0	0.0	16.7	75.0	6.3	6.3	18.8	18.8	50.0
5	Kephir 2.5%	0.0	0.0	16.7	16.7	66.7	0.0	0.0	12.5	18.8	68.8
6	Buttermilk	8.3	8.3	8.3	16.7	58.3	6.3	6.3	18.8	12.5	56.3
7	Sour cream 20%	0.0	16.7	16.7	25.0	41.7	18.8	31.3	18.8	12.5	18.8
8	Sour cream 10%	8.3	8.3	25.0	25.0	33.3	0.0	25.0	18.8	18.8	37.5
9	Coffee cream 10%	16.7	0.0	25.0	16.7	41.7	12.5	18.8	6.3	50.0	12.5
10	Whipping cream 35%	0.0	0.0	0.0	41.7	58.3	0.0	0.0	12.5	31.3	56.3
11	Bioyoghurt 2.5%	8.3	16.7	8.3	16.7	50.0	12.5	6.3	18.8	18.8	43.8
12	Yoghurt 2.5%	0.0	16.7	16.7	16.7	50.0	6.3	12.5	25.0	18.8	37.5
13	Butter 80%	16.7	16.7	8.3	0.0	58.3	18.8	18.8	6.3	18.8	37.5
14	Butter margarine 40%	41.7	8.3	25.0	0.0	25.0	37.5	18.8	12.5	0.0	31.3
15	Cottage cheese	0.0	16.7	58.3	16.7	8.3	12.5	12.5	50.0	18.8	6.3
16	Cheese	8.3	33.3	33.3	8.3	16.7	6.3	31.3	31.3	25.0	6.3

	Cereal and flour products										
17	Rye bread	41.7	16.7	0.0	0.0	41.7	18.8	18.8	25.0	18.8	18.8
18	Fine rye bread	0.0	16.7	25.0	0.0	58.3	18.8	25.0	6.3	18.8	31.3
19	Whole meal seed bread	33.3	16.7	16.7	0.0	33.3	25.0	12.5	6.3	18.8	37.5
20	White bread	50.0	16.7	0.0	16.7	16.7	68.8	6.3	6.3	18.8	0.0
21	Muesli	0.0	0.0	18.7	25.0	58.3	0.0	6.3	0.0	31.3	62.5
22	Rolls, buns	0.0	8.3	41.7	16.7	33.3	6.3	12.5	37.5	31.3	12.5
23	Pasta	0.0	0.0	88.7	16.7	16.7	0.0	12.5	56.3	25.0	6.3
24	Corn and rice flakes	0.0	0.0	16.7	33.3	50.0	0.0	6.3	6.3	56.3	31.3
25	Popcorn	0.0	0.0	0.0	33.3	66.7	0.0	0.0	0.0	6.3	93.8
26	Kama	0.0	0.0	8.3	16.7	75.0	0.0	0.0	6.3	37.5	56.3
27	Bran	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	12.5	87.5
28	Cereal sprouts	8.3	0.0	0.0	0.0	91.7	0.0	0.0	0.0	18.8	68.8
	Meat products										
29	Pork	0.0	25.0	50.0	16.7	8.3	6.3	31.3	43.8	18.8	0.0
30	Beef	0.0	8.3	25.0	33.3	33.3	0.0	6.3	18.8	37.5	37.5
31	Mutton	0.0	0.0	16.7	16.7	66.7	0.0	0.0	0.0	6.3	93.8
32	Poultry	0.0	8.3	66.7	0.0	25.0	0.0	18.8	37.5	37.5	6.3
33	Rabbit	0.0	0.0	8.3	25.0	66.7	0.0	0.0	0.0	6.3	93.8
34	Game	0.0	0.0	0.0	25.0	75.0	0.0	0.0	0.0	12.5	87.5
35	Liver	0.0	0.0	16.7	41.7	41.7	0.0	0.0	18.8	56.3	25.0
36	Offal (heart, lungs)	0.0	0.0	16.7	33.3	50.0	0.0	0.0	0.0	18.8	81.3
37	Sausage	16.7	50.0	16.7	0.0	16.7	25.0	25.0	18.8	18.8	12.5
38	Wiener	0.0	41.7	50.0	8.3	0.0	0.0	43.8	25.0	25.0	6.3
39	Smoked sausage, ham	8.3	25.0	25.0	25.0	16.7	12.5	37.5	25.0	18.8	6.3
40	Meat paste	0.0	8.3	16.7	50.0	25.0	0.0	6.3	37.5	50.0	6.3

41	Black sausage	0.0	0.0	0.0	58.3	41.7	0.0	0.0	6.3	56.3	37.5
42	Meat balls	0.0	0.0	50.0	33.3	16.7	0.0	12.5	43.8	37.5	6.3
43	Tinned meat	0.0	0.0	8.3	41.7	50.0	0.0	0.0	6.3	37.5	56.3
	Fish products										
44	Freshwater fish	0.0	8.3	33.3	33.3	25.0	0.0	0.0	25.0	62.5	12.5
45	Small herring	0.0	8.3	41.7	25.0	25.0	0.0	12.5	37.5	31.3	18.8
46	Seawater fish	0.0	0.0	41.7	33.3	25.0	0.0	0.0	18.8	68.8	12.5
47	Salted fish (herring)	0.0	0.0	0.0	25.0	75.0	0.0	12.5	31.3	25.0	31.3
48	Smoked fish	0.0	8.3	8.3	41.7	41.7	0.0	6.3	18.8	56.3	18.8
49	Dried fish	0.0	0.0	0.0	25.0	75.0	0.0	0.0	0.0	0.0	100.0
50	Fish burgers	0.0	0.0	16.7	50.0	33.3	0.0	0.0	25.0	43.8	31.3
51	Tinned fish	0.0	8.3	8.3	33.3	50.0	0.0	0.0	18.8	43.8	37.5
	Vegetables										
52	Potato	33.3	58.3	8.3	0.0	0.0	50.0	50.0	0.0	0.0	0.0
53	Fresh cabbage	16.7	25.0	33.3	0.0	25.0	0.0	31.3	56.3	6.3	6.3
54	Sauerkraut	8.3	8.3	16.7	25.0	41.7	0.0	0.0	37.5	56.3	6.3
55	Swede, turnip	8.3	8.3	0.0	41.7	41.7	0.0	0.0	37.5	37.5	25.0
56	Carrot	8.3	41.7	41.7	0.0	8.3	18.8	31.3	43.8	6.3	0.0
57	Beet	8.3	8.3	50.0	16.7	16.7	6.3	12.5	43.8	37.5	0.0
58	Radish	0.0	0.0	0.0	25.0	75.0	0.0	0.0	0.0	25.0	75.0
59	Celery	0.0	0.0	0.0	25.0	75.0	0.0	6.3	18.8	12.5	62.5
60	Parsley	0.0	16.7	8.3	33.3	41.7	6.3	6.3	31.3	43.8	12.5
61	Onion	0.0	33.3	41.7	0.0	25.0	37.5	31.3	18.8	12.5	0.0
62	Garlic	16.7	0.0	50.0	16.7	16.7	18.8	25.0	18.8	31.3	6.3
63	Pumpkin, zucchini	0.0	0.0	16.7	41.7	41.7	0.0	6.3	18.8	37.5	37.5
64	Fresh cucumber	8.3	16.7	41.7	16.7	16.7	25.0	25.0	31.3	18.8	0.0

65	Tomato	8.3	16.7	50.0	0.0	25.0	25.0	18.8	25.0	25.0	6.3
66	Pepper	0.0	16.7	25.0	8.3	50.0	6.3	18.8	6.3	43.8	25.0
67	Garden beans	0.0	8.3	16.7	25.0	50.0	0.0	6.3	0.0	37.5	56.3
68	Field beans	0.0	0.0	33.3	8.3	58.3	0.0	6.3	0.0	25.0	68.8
69	Green peas	0.0	0.0	16.7	41.7	41.7	0.0	6.3	12.5	62.5	18.8
70	Lettuce	0.0	25.0	16.7	33.3	25.0	0.0	6.3	37.5	37.5	18.8
71	Dill	8.3	0.0	33.3	25.0	33.3	12.5	18.8	31.3	25.0	12.5
	Fruits, berries (seasonal)										
72	Apples	8.3	33.3	33.3	16.7	8.3	6.3	56.3	12.5	12.5	12.5
73	Plums	0.0	16.7	8.3	41.7	33.3	0.0	18.8	12.5	50.0	18.8
74	Pears	0.0	16.7	16.7	25.0	41.7	0.0	25.0	12.5	37.5	25.0
75	Cherries	0.0	0.0	33.3	25.0	41.7	0.0	6.3	18.8	31.3	43.8
76	Strawberries	0.0	8.3	16.7	33.3	41.7	0.0	25.0	18.8	37.5	18.8
77	Raspberries	0.0	0.0	25.0	25.0	50.0	0.0	18.8	12.5	31.3	37.5
78	Currants	0.0	0.0	16.7	41.7	41.7	0.0	18.8	12.5	37.5	31.3
79	Gooseberries	0.0	0.0	16.7	33.3	50.0	0.0	18.8	12.5	18.8	50.0
80	Wild berries	0.0	0.0	16.7	25.0	58.3	0.0	18.8	12.5	31.3	37.5
81	Bananas	0.0	0.0	33.3	16.7	50.0	0.0	12.5	18.8	37.5	31.3
82	Citrus fruits (orange)	0.0	8.3	16.7	33.3	41.7	0.0	12.5	25.0	43.8	18.8
83	Grapes	0.0	0.0	16.7	41.7	41.7	0.0	12.5	0.0	68.8	18.8
84	Raisins	0.0	0.0	0.0	58.3	41.7	6.3	12.5	12.5	43.8	25.0
85	Water melons	0.0	0.0	8.3	33.3	58.3	0.0	12.5	6.3	50.0	31.3
86	Dried fruits	0.0	0.0	0.0	41.7	58.3	0.0	6.3	6.3	25.0	62.5

	Sweets										
87	Ice-cream	0.0	0.0	25.0	58.3	16.7	0.0	6.3	31.3	43.8	18.8
88	Sherbet, zephyr	0.0	0.0	0.0	33.3	66.7	0.0	0.0	6.3	18.8	75.0
89	Halvah	0.0	0.0	0.0	41.7	58.3	0.0	0.0	6.3	25.0	68.8
90	Chocolate	0.0	8.3	16.7	33.3	41.7	0.0	6.3	31.3	43.8	18.8
91	Caramel sweets	0.0	8.3	25.0	16.7	50.0	0.0	18.8	12.5	31.3	37.5
92	Marmalade, jellies	0.0	0.0	8.3	16.7	75.0	0.0	6.3	0.0	37.5	56.3
93	Jam, compote	0.0	8.3	25.0	16.7	50.0	0.0	12.5	25.0	37.5	25.0
94	Nuts	0.0	0.0	16.7	25.0	58.3	0.0	0.0	18.8	31.3	50.0
95	Cream cakes	0.0	0.0	0.0	41.7	58.3	0.0	6.3	12.5	50.0	31.3
96	Short pastry products	0.0	0.0	16.7	41.7	41.7	0.0	6.3	31.3	43.8	18.8
97	Creams, puddings	0.0	0.0	8.3	33.3	58.3	0.0	18.8	12.5	31.3	37.5
	Drinks										
98	Apple juices (natural)	0.0	0.0	41.7	16.7	41.7	0.0	6.3	18.8	25.0	50.0
99	Citrus fruit juices	0.0	8.3	16.7	16.7	58.3	0.0	6.3	25.0	31.3	37.5
100	Fruit juices	0.0	8.3	33.3	25.0	33.3	0.0	12.5	50.0	18.8	18.8
101	Berry juices, fruit water	0.0	0.0	25.0	8.3	66.7	0.0	18.8	25.0	25.0	31.3
102	Fresh fruit juices	0.0	8.3	16.7	16.7	58.3	0.0	0.0	0.0	18.8	81.3
103	Lemonade	0.0	0.0	8.3	25.0	66.7	0.0	12.5	6.3	18.8	62.5
104	Tea	33.3	25.0	8.3	8.3	25.0	43.8	18.8	12.5	6.3	18.8
105	Herb tea	16.7	25.0	8.3	16.7	33.3	12.5	18.8	6.3	18.8	43.8
106	Pure coffee	0.0	33.3	8.3	16.7	41.7	0.0	75.0	12.5	6.3	6.3
107	Grain coffee	0.0	0.0	0.0	0.0	100.0	0.0	6.3	0.0	0.0	93.8
108	Cocoa	0.0	0.0	8.3	33.3	58.3	0.0	0.0	25.0	18.8	56.3
109	Mineral water	25.0	33.3	16.7	8.3	16.7	12.5	12.5	25.0	18.8	31.3
110	Coca-cola	0.0	0.0	16.7	16.7	66.7	0.0	0.0	0.0	12.5	87.5

111	Tonics	0.0	0.0	0.0	8.3	91.7	0.0	0.0	0.0	6.3	93.8
112	Beer	0.0	0.0	8.3	8.3	83.3	0.0	0.0	0.0	0.0	100.0
113	Wine	0.0	0.0	0.0	8.3	91.7	0.0	0.0	0.0	25.0	75.0
114	Strong alcoholic drinks	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	87.5
115	Liqueur	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	100.0
116	Gin long drink	0.0	0.0	0.0	8.3	91.7	0.0	0.0	0.0	6.3	93.8
	Ready-made foods										
117	Meat soups	0.0	25.0	50.0	8.3	16.7	12.5	37.5	31.3	12.5	6.3
118	Milk soups	0.0	25.0	16.7	25.0	33.3	0.0	18.8	18.8	37.5	25.0
119	Porridges	33.3	16.7	41.7	0.0	8.3	6.3	43.8	18.8	25.0	6.3
120	Meat dishes	0.0	33.3	33.3	8.3	25.0	25.0	37.5	25.0	6.3	6.3
121	Fish dishes	8.3	8.3	50.0	0.0	33.3	0.0	12.5	50.0	25.0	12.5
122	Vegetable dishes	8.3	33.3	33.3	0.0	25.0	18.8	18.8	50.0	0.0	12.5
123	Mushroom dishes	0.0	0.0	8.3	41.7	50.0	0.0	0.0	12.5	56.3	31.3
124	Raw salads	16.7	8.3	41.7	0.0	33.3	12.5	56.3	25.0	6.3	0.0
125	Egg dishes	0.0	0.0	50.0	16.7	33.3	0.0	25.0	25.0	43.8	6.3
126	Mixed salads	0.0	0.0	8.3	58.3	33.3	0.0	6.3	37.5	50.0	6.3
127	Macaroni	0.0	16.7	58.3	8.3	16.7	6.3	25.0	50.0	18.8	0.0
128	Salad dressing	0.0	8.3	16.7	8.3	66.7	0.0	6.3	31.3	31.3	31.3
129	Mayonnaise	0.0	0.0	25.0	25.0	50.0	0.0	25.0	31.3	31.3	12.5
130	Ketchup	0.0	0.0	33.3	33.3	33.3	6.3	6.3	18.8	37.5	31.3
131	Curds dishes, cheese	0.0	0.0	33.3	33.3	33.3	0.0	31.3	31.3	31.3	6.3
132	Desserts, kissels	0.0	8.3	33.3	33.3	25.0	0.0	6.3	50.0	31.3	12.5
133	Bakings	0.0	8.3	41.7	8.3	41.7	0.0	12.5	37.5	50.0	0.0

The patients were asked how often they ate the following foods.

Milk and dairy products. Consumption of milk products depended on the fat content of milk. Kephir and low-fat milk were consumed every day by 16.6% of men and 6.3% of women. Milk was not consumed by 25% of men and 18.8% of women. Drinking yoghurt was consumed seldom. No yoghurts were consumed at all by 50% of men and 43.8% of women. Butter was consumed daily by fewer patients (16.7% of men and 18.8% of women) than margarines (41.7% of men and 37.5% of women). Cottage cheese was consumed seldom, once or twice a week (men 58.3%, women 50%). Cheese products were consumed by 1/3 of subjects 2–3 times a week or more seldom. Cheese was consumed daily by 8.3% of men and 6.3% of women.

Cereal and flour products. Rye bread was consumed more often by men; women preferred white bread products. Buns, pasta, muesli, kama (mixture of rye-, oat-, barley- and peasemeal) and cereal sprouts were not consumed daily.

Meat products. Men and women consumed mostly pork once or twice a week (50% of men and 43.8% of women). Wieners were consumed daily by 6.7% of men and 25% of women. Tinned meat, meat paste, meat balls and black sausage were not consumed daily.

Fish products. Fish and different fish products were consumed mostly once or twice a month. Tinned fish was not consumed by 50% of men and 37.5% of women. 1/3 of subjects did not consume fish burghers.

Vegetables. Potatoes were consumed with great frequency, daily by 33.3% of men and 50% of women. Cabbage, carrots, swede and beet were consumed daily by 8.3% of men and 18.8% of women. Tomatoes and fresh cucumbers were consumed daily by 8.3% of men and 25% of women.

Fruits, berries (seasonal). 8.3% of men and 12.5% women did not eat apples. Consumption frequency of locally grown fruit and berries depended on the season.

Sweets. Sweets were not consumed daily. Ice-cream, zephyr, halvah, chocolate, jam and nuts were consumed once or twice a week or month. Ice-cream was not consumed by 16.7% of men and 43.8% of women.

Drinks. Apple juice was not consumed by 41.7% of men and 50% of women. Tea was consumed daily by 33.3% of men and 43.8% of women. Mineral water was consumed by 25% of men and 12.5% of women.

Ready-made foods. Ready-made foods were consumed at different frequencies. Porridge was consumed every day by 33.3% of men and 6.3% of women, while 8.3% of men and 6.3% did not eat porridge.

The analysis results of male patients' 3-day menus are given in Table 2.

The daily average energy intake (kcal) in the male group did not reveal any statistically significant difference (FU1, 2689.7±467.5; FU2, 2424.9±291.4). Energy content (kcal) per kg of body weight (kg) decreased statistically significantly (FU1, 35.5±12.7; FU2, 30.2±6.2).

The food protein intake (g) in menus had decreased, but no statistically significant difference was found (FU1, 106.7±22.4; FU2, 91.6±10.7). The percentage of proteins received from daily food energy intake remained within the norm (FU1, 15.9; FU2, 15.2). Research data of kidney transplant patients' menus indicated that the mean consumption of proteins received from food (g/kg) decreased in male patients statistically significantly (FU1, 1.5±0.4; FU2, 1.1±0.3).

The amount of food fats decreased but not significantly (FU1, 101.3±21.4; 88.3±14.6). Percentage of fats in food energy was found decreased after FU2 (FU1, 34.1%; FU2, 32.8%).

The food cholesterol content exceeded the norm, although decreased insignificantly.

The amount of carbohydrates in food decreased but not significantly (FU1, 329.3±74; 311.8±49.4). Percentage of carbohydrates in food energy increased significantly (FU1, 48.9±5.5%; FU2, 51.4±5.4%).

Fat-soluble vitamins. Retinol content in food (μg-equiv) exceeded the recommended norm. Vitamin D content (μg) was lower during the whole period, constituting 50% of the norm. Vitamin E content (mg) was within the norm (FU1, 10.8±4.1; FU2, 9.3±2.7).

Water-soluble vitamins. Thiamine, riboflavin, niacin, pyridoxine, pantothenic acid, cyanocobalamin and folic acid intake in kidney transplant patients was within the range of norm. Biotin values were lower than the norm. Vitamin C content (mg) in food exceeded the norm (FU1, 72.4±34.6; FU2, 84.6±27.6).

Table 2. Comparison of energy and main nutrients content in menus of male renal transplant patients (n=12)

No	**Nutrient**	Reference nutrient	Follow-up 1				Follow-up 2				*P*
		intake**	Min	Max	Mean	SD	Min	Max	Mean	SD	Value*
1	Energy content (kcal)	2700±200	2030.4	3675.7	2689.7	467.5	1966.4	2910.2	2424.9	291.4	0.1380
2	Proteins (kcal)	200–360	299.6	612.5	426.8	89.4	288.2	431.6	366.5	42.9	0.0610
3	Fats (kcal)	450–810	622.5	1304.0	912.1	192.4	560.3	1035.5	794.5	131.8	0.0836
4	Carbohydrates (kcal)	1000–1400	953.2	1964.7	1317.0	295.8	793.9	1499.6	1247.2	197.8	0.4093
5	Proteins (g)	50–90	74.9	153.1	106.7	22.4	72.0	107.9	91.6	10.7	0.0610
6	Fats (g)	50–90	69.2	144.9	101.3	21.4	62.3	115.1	88.3	14.6	0.0836
7	Carbohydrates (g)	250–350	238.3	491.2	329.3	74.0	198.5	374.9	311.8	49.4	0.4093
8	% of proteins in food energy	10–15%	13.6	18.0	15.9	1.5	13.3	18.0	15.2	1.5	0.2357
9	% of fats in food energy	25–30%	25.6	45.3	34.1	5.3	24.1	40.4	32.8	4.2	0.2430
10	% of carbohydrates in food energy	55–60%	35.7	58.3	48.9	5.5	40.4	60.5	51.4	5.4	0.0001*
11	Energy/body weight (kcal/kg)	25–35	21.2	55.7	37.2	8.9	18.6	38.2	30.2	6.2	0.0143*
12	Proteins/body weight (g/kg)	1.0	1.0	2.3	1.5	0.4	0.6	1.6	1.1	0.3	0.0093*
13	Cholesterol (mg)	200–300	221.1	557.8	356.1	88.4	175.0	478.0	337.4	96.9	0.6028
14	Dietary fibres (g)	25–35	20.2	37.3	30.5	6.1	20.6	46.4	32.0	7.7	0.6275
15	Retinol (µg-equiv)	900	404.5	6685.7	1449.2	1749.3	436.5	11844.7	2719.2	3806.5	0.3300
16	Vitamin D (µg)	7.5	1.1	21.7	4.4	5.9	0.7	9.7	3.5	3.3	0.5345
17	Vitamin E (mg)	10	4.4	19.0	10.8	4.1	4.6	13.0	9.3	2.7	0.2222
18	Tiamin, B1 (mg)	1.4	1.4	2.6	2.0	0.4	1.2	2.3	1.7	0.4	0.1049
19	Riboflavin, B2 (mg)	1.7	0.9	3.0	2.0	0.6	1.2	3.5	2.1	0.8	0.7216

Table 2. Continuation

No	**Nutrient**	Reference nutrient	Follow-up 1				Follow-up 2				*P*
20	Niacin, B3 (mg-equiv)	19	30.1	51.8	41.4	7.5	28.2	45.2	37.9	5.0	0.2337
21	Pyridoxine, B6 (mg)	1.6	1.7	3.8	2.4	0.6	1.8	3.1	2.3	0.4	0.3590
22	Cyanocobalamin, B12 (μg)	2.0	3.5	22.7	8.0	5.8	2.9	42.5	10.3	11.6	0.4819
23	Folic acid, B10 (μg)	350–500	136.2	389.7	275.0	69.3	229.7	455.4	285.6	65.3	0.7241
24	Pantothenic acid, B5 (mg)	5–10	3.7	10.5	7.6	1.8	5.1	10.8	6.9	1.7	0.4079
25	Biotin, H (μg)	100–200	13.6	50.8	30.0	10.6	17.6	38.4	27.7	7.1	0.5637
26	Vitamin C (mg)	75	10.4	128.0	72.4	34.6	39.0	128.6	84.6	27.6	0.2971
27	Sodium (mg)	2000–3000	1887.0	4241.8	2751.6	753.6	1488.0	3178.6	2299.9	602.1	0.1249
28	Potassium (mg)	3500	2525.7	4671.7	3921.9	676.0	3095.5	5384.9	3842.5	636.2	0.7676
29	Calcium (mg)	800	491.0	2706.1	1221.1	545.3	781.9	1348.2	1022.4	204.5	0.2570
30	Phosphorus (mg)	600	1091.9	2957.0	2046.4	455.7	1471.2	2377.9	1789.4	250.1	0.1333
31	Magnesium (mg)	350	284.5	530.2	454.7	73.3	332.1	553.1	397.7	63.1	0.0473*
32	Iron (mg)	9	14.6	32.7	22.0	6.3	14.6	30.2	19.8	4.9	0.3425
33	Selenium (μg)	50	73.6	154.5	111.0	25.1	64.8	109.5	94.4	14.0	0.0913

* Statistically significant difference ($P \leq 0.05$)

** by Estonian Nutrition Recommendations and Food Based Dietary Guidelines (Tallinn, 2006)

Minerals. The salt content in consumed food decreased, although statistically insignificantly, and remained within the norm. The salt content was calculated from the amount of sodium in the food. Potassium daily intake somewhat exceeded the norm (FU1, 3921.9±676.0; FU2, 3842.5±636.2mg). The mean calcium content in food exceeded the norm, but there was a tendency to decrease. Phosphate intake from the food exceeded the recommended norm (FU1, 2046.1±455.7mg; FU2 1789.4±250.1mg), but there was a tendency to decrease. Magnesium content decreased statistically significantly but remained within the norm (P=0.0473). Iron and selenium content in food was within the range of norm.

The analysis results of female patients' 3-day menus are given in Table 3.

The daily average energy intake (kcal) in the female group revealed statistically significant differences (FU1, 2028.0±465.5; FU2, 2352.9±487.0). Energy content (kcal) per kg of body weight (kg) increased statistically significantly (FU1, 29.2±12.7; FU2, 32.9±10.4).

The food protein intake (g) in menus had increased statistically significantly (FU1, 79.6±19.7; FU2, 89.2±19.5). The percentage of proteins received from daily food energy intake remained within the norm (FU1, 15.8±2.2; FU2, 15.2±1.7). Research data of kidney transplant patients' menus indicated that the mean consumption of proteins received from food (g/kg) did not differ statistically significantly (FU1, 1.2±0.4; FU2, 1.2±0.4).

The amount of food fats increased within the norm but not significantly (FU1, 76.0±23.0; 88.0±27.1). Percentage of fats in food energy did not change and remained within the norm (FU1, 33.2±5.6; FU2, 33.4±4.7).

The amount of cholesterol in food increased statistically significantly exceeding the upper limit of the norm (FU1, 271.0±106.2; FU2, 359.6±146.4).

The amount of carbohydrates in food (g) increased statistically significantly but remained within the norm (FU1, 252.8±58.3; 293.2±61.0). Percentage of carbohydrates in food energy increased significantly (FU1, 50.2±5.3; FU2, 50.0±5.3).

Table 3. Comparison of energy and main nutrients content in menus of female renal transplant patients (n=16)

No	Nutrient	Reference nutrient intake**	Follow-up 1				Follow-up 2				*P*
			Min	Max	Mean	SD	Min	Max	Mean	SD	Value*
1	Energy content (kcal)	2000±150	1128.3	2974.3	2028.0	465.5	1380.2	3266.7	2352.9	487.0	0.0018*
2	Proteins (kcal)	200–360	196.9	492.6	318.6	78.6	246.4	524.1	356.8	78.2	0.0384*
3	Fats (kcal)	450–810	198.5	1071.7	683.9	207.0	451.2	1462.3	792.0	244.0	0.0521
4	Carbohydrates (kcal)	1000–1400	715.7	1449.2	1011.1	233.4	664.2	1656.2	1172.8	243.9	0.0033*
5	Proteins (g)	50–90	49.2	123.1	79.6	19.7	61.6	131.0	89.2	19.5	0.0384*
6	Fats (g)	50–90	22.1	119.1	76.0	23.0	50.1	162.5	88.0	27.1	0.0521
7	Carbohydrates (g)	250–350	178.9	362.3	252.8	58.3	166.0	414.1	293.2	61.0	0.0033*
8	% of proteins in food energy	10–15%	11.7	20.3	15.8	2.2	12.1	18.1	15.2	1.7	0.3817
9	% of fats in food energy	25–30%	17.6	41.4	33.2	5.6	27.2	44.8	33.4	4.7	0.9175
10	% of carbohydrates in food energy	55–60%	42.5	63.4	50.2	5.3	39.3	59.6	50.0	5.3	0.0001*
11	Energy/body weight (kcal/kg)	25–35	13.2	45.5	29.2	9.2	15.5	51.1	32.9	10.4	0.0114*
12	Proteins/body weight (g/kg)	1.0	0.5	2.2	1.2	0.4	0.5	1.8	1.2	0.4	0.2828
13	Cholesterol (mg)	200–300	82.8	469.0	271.0	106.2	139.9	728.1	359.6	146.4	0.0130*
14	Dietary fibres (g)	25–35	13.0	55.6	25.9	11.0	17.4	38.1	27.2	5.7	0.6417
15	Retinol (μg-equiv)	700	283.4	4860.3	1420.2	1387.9	345.7	5641.0	1369.3	1285.6	0.9038
16	Vitamin D (μg)	7.5	0.6	5.7	2.1	1.7	1.0	8.3	4.0	2.2	0.0037*
17	Vitamin E (mg)	8	2.8	14.7	8.2	3.1	6.0	21.1	8.9	4.4	0.5434

Table 3. Continuation

No	Nutrient	Reference nutrient	Follow-up 1				Follow-up 2				*P*
18	Tiamin, B1 (mg)	1.1	1.2	2.9	1.6	0.4	1.1	3.0	1.8	0.5	0.0343*
19	Riboflavin, B2 (mg)	1.3	0.8	2.4	1.5	0.5	1.0	2.5	1.7	0.5	0.1789
20	Niacin, B3 (mg-equiv)	15	18.0	52.7	30.6	8.2	23.9	49.6	36.1	7.9	0.0178*
21	Pyridoxine, B6 (mg)	1.2	1.0	2.3	1.7	0.4	1.3	3.0	2.2	0.6	0.0057*
22	Cyanocobalamin, B12 (μg)	2.0	1.2	27.8	6.1	6.7	3.3	24.0	7.2	5.4	0.5161
23	Folic acid, B10 (μg)	300–500	120.1	272.4	217.6	46.3	157.7	403.0	272.2	69.9	0.0045*
24	Pantothenic acid, B5 (mg)	4–9	2.9	8.1	5.3	1.5	4.1	8.3	6.2	1.3	0.0080*
25	Biotin, H (μg)	100–200	8.8	30.9	21.2	6.5	18.1	40.4	27.0	6.1	0.0142*
26	Vitamin C (mg)	75	17.4	134.2	54.6	32.4	4.7	173.2	87.2	53.0	0.0827
27	Sodium (mg)	2000–3000	951.9	3595.8	2240.1	759.1	1642.2	4050.1	2494.2	628.7	0.2206
28	Potassium (mg)	3100	1898.0	5194.3	2988.6	814.1	1804.7	5095.9	3578.5	965.8	0.0593
29	Calcium (mg)	800	247.9	1480.8	731.9	325.6	375.0	1468.7	915.0	326.1	0.0267*
30	Phosphorus (mg)	600	839.5	2162.2	1433.3	408.6	1129.7	2320.5	1616.2	328.3	0.0373*
31	Magnesium (mg)	280	187.1	648.6	325.8	108.2	223.2	485.9	346.1	66.5	0.4975
32	Iron (mg)	15/9***	9.5	31.0	16.8	5.0	11.0	23.6	17.4	3.6	0.4978
33	Selenium (μg)	40	53.3	132.9	84.6	19.7	60.2	149.1	98.3	23.9	0.0130*

* Statistically significant difference ($P \leq 0.05$)

** by Estonian Nutrition Recommendations and Food Based Dietary Quidelines (Tallinn, 2006)

*** The need for iron depends on iron loss during menstruation. The recommended daily iron intake for postmenopausal women is 9 mg.

Fat-soluble vitamins. Retinol content in food (µg-equiv) exceeded the recommended norm. Vitamin D content in food (µg) was statistically significantly lower during the whole period, constituting 50% of the norm (P=0.0037). Vitamin E content (mg) was within the range of norm.

Water-soluble vitamins. Thiamine, niacin, pyridoxine and pantothenic acid content in food increased statistically significantly, remaining within the norm. Biotin values in food were low. Riboflavin and cyanocobalamin intake in kidney transplant patients had increased but was within the range of norm. Vitamin C content increased but not significantly (FU1, 54.6±32.4; FU2, 87.2±53.0).

Minerals. The sodium content (mg) in consumed food did not differ statistically insignificantly and remained within the norm. The salt content was calculated from the amount of sodium in the food. Potassium daily intake somewhat exceeded the norm (FU1, 2988.6±6814.1; FU2, 3578.5±965.8). The mean calcium content in food statistically significantly exceeded the norm (P=0.0267), and had a tendency to increase. Phosphate intake from the food (mg) statistically significantly exceeded the norm (FU1, 1433.3±408.6; FU2 1616.2±328.3) and had a tendency to increase. Magnesium content increased statistically insignificantly but remained within the norm. Iron content in food (mg) was within the range of norm for women. Selenium content in food was statistically significantly higher than the norm (P=0.0013).

DISCUSSION

We found in the current study that there was a tendency to increased consumption of proteins and carbohydrates in patients after kidney transplantation. Consumption of fats was within the normal range. Analysis of the menus' vitamins and minerals content showed low consumption vegetables, fruit and berries but foodstuffs containing animal proteins were consumed more often. The analysis of menus showed, that mean consumption of proteins by male patients exceeded the norm, but in female patients remained within the normal range compared with nutritional recommendations. Our study recommends that chronic renal patients should consume 0.8–1.0 grams of protein/kg/day and diet energy 25–35 kcal/kg/day. Low-protein diet is a general recommendation for patients after kidney transplantation [2, 6]. A long-term study of Bernardi A. et al. [2] suggests that restriction in protein intake and diet energy may be a useful strategy in slowing the progression of chronic transplant injury.

Conclusion. Optimal counselling by a dietician is important after the kidney transplantation in order to improve the patient's nutritional habits and to avoid unbalanced and excessive food consumption if the patient has a tendency to weight increase.

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IMMUNIHISTOCHEMICAL DETECTION OF THE LUTEINIZING HORMONE RECEPTORS IN PENILE TISSUE

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ABSTRACT

The proportion of men with serum Luteinizing Hormone (LH) > 6.0 U/l and serum testosterone > 9.8 nmol/l, i.e. of men with subclinical hypogonadism, increases significantly between 40 and 70 years. As the proportion of men with erection disturbances increases simultaneously, it is possible that the elevated LH concentrations are involved in the generation of erection disturbances. The precondition for this is the expression of LH receptor in the penile tissue. In the present study, the expression of the LH receptor in the male mouse penis was studied to see if LH effects are possible in the penile tissue. Balb/c mice were used as donors of normal penis tissue and testis tissue. Immunocytochemistry was used for the detection of the LH receptor. Positive immunoreaction for the LH receptor was found in the mouse penis in urethral epithelium and in the endothelial cells of the cavernous spaces in *corpus cavernosum* and *corpus spongiosum.* Our results suggest that the LH receptor is expressed in the mouse penis and thus the elevated LH levels of the aging men with subclinical hypogonadism may affect the functions of penile tissue.

Key words: *luteinizing hormone, penis, erectile disturbances, subclinical hypogonadism*

INTRODUCTION

The role of luteinizing hormone in the regulation of normal reproductive functions in males and females is quite well established. In male gonads LH is the primary stimulus for testosterone secretion by Leydig cells. In the ovary, LH receptor expression has been detected in the theca cells where they regulate androgen production as well as in luteal cells where the LH receptor regulates progesterone production. LH exerts its effects through binding to its specific receptor (luteinizing hormone/chorionic gonadotropin receptor) which belongs to the seven transmembrane domain G-protein associated receptors [2]. Besides the expression of LH receptors in the target cells in gonads, it has been found in several extragonadal organs. However, the physiological significance of such effects has remained unclear [9]. In the male reproductive system LH receptors have been detected in prostate [14], seminal vesicles [15] and human sperm [3]. LH receptors are also expressed in brain, blood vessels of the uterus, placenta [13], skin [8], urinary bladder [16], umbilical cord [10], spinal cord [11], mammary glands, kidneys and adrenal glands [1]. The novel functions of LH include its role in specific situations, such as being a promoter of formation and growth of gonadal and extragonadal tumours [5].

A significant proportion of aging men have sex hormonal changes. The proportion of men with serum LH > 6.0 U/l and serum testosterone > 9.8 nmol/l, i.e. of men with subclinical hypogonadism, increases significantly between 40 and 70 years of age. About 23% of men above 40 years of age have compensated subclinical hypogonadism [6]. The proportion of men with erection disturbances increases simultaneously. It is a significant male health problem affecting approximately 2% of men at 40 years of age and about 25% or more at 65 years of age [7]. Erectile dysfunction is an age-dependent problem, but it is not an inevitable result of aging. No consensus has been reached on the role of serum androgens in the maintenance of potency [17]. According to the earlier findings of P. Härkönen and P. Pöllänen's groups [6] from Turku Aging Male Centre, there was a statistically significant positive correlation between LH and the reported severity of decreased potency. According to these reports, and if the LH receptor is expressed in the penile tissue, it is possible that the elevated LH concentrations are involved in the generation of the erection disturbances.

MATERIALS AND METHODS

Animals

The mice used in this study were bred and cared at the Animal Care Centre of the University of Tampere, Finland. Permissions for the experiments and to use organs from the animals after sacrifice with CO_2 were granted by the local animal authorities.

Balb/c mice (n=10, age 7weeks) were used as donors of normal penis tissue and testis tissue (positive control). The animals had free access to food and water and they were maintained in a normal dark/light cycle. The mouse penises and testes were removed after sacrificing the mice with CO_2.

Immunocytochemistry

Tissues

The penis was collected up to the body wall, cut, so the visible part of penis was collected. Glans penis distal 2/3 of the body of the penis was used for each analysis. 10 penises and 2 testes (from 2 mice) were collected for immunocytochemistry, fixed in 4% formalin and embedded in paraffin.

Antibodies

Rabbit polyclonal anti-Human Luteinizing Hormone/Choriogonadotropin Receptor antibody (Acris Antibodies GmbH, Germany, Cat. No SP4594P) was used as the primary antibody. Affinity Purified Goat anti-Rabbit IgG-HRP (Acris Antibodies GmbH, Germany, Cat. No R1364HRP) was used as a secondary antibody.

The avidin-biotin immunoperoxidase method

Paraffin sections of 5 μm in thickness were cut and mounted on slides. After deparafinization, endogenous peroxidase blockade (0.5% H_2O_2 in methanol) was carried out for 30 min. Sections were washed in dH_2O for 2×5 min and in PBS 2×10 min. Slides were held in 0.01 M sodium citrate buffer (pH 6.0) in a microwave oven at 100°C for 20 min. Sections were removed from heat and kept at room temperature in buffer for 20 min. After washing in TBS for 5 min and in PBS for 5 min, nonspecific binding sites were blocked by incubating the sections in 10% normal goat serum (NGS) for 30 min. The sections were then incubated with the primary antibody or the control serum overnight at

+4°C. Rabbit polyclonal anti-LH Receptor antibody (Acris Antibodies GmbH, Germany) was used as the primary antibody diluted 1:750 in 1% NGS in PBS. The sections were washed for 3×10 min in PBS and incubated with Goat anti-Rabbit IgG (Acris Antibodies GmbH, Germany) for 30 min. The biotinylated secondary antibody was diluted 1: 500 in PBS containing 1% NGS. After 3×10 min washing in PBS, the sections were incubated with the ABC reagent for 30 min (reagent A 90 μl and 10ml PBS+ reagent B 90 μl, Vector Laboratories, Inc., Burlingame, CA). The sections were washed for 3×10 min in PBS followed by a demonstration of peroxidase activity, using 3.3′-diaminobenzidine (DAB; Sigma) as a substrate.

RESULTS

Strong positive immunoreaction for LH receptors was present in the urethral epithelium (Fig. 1A). Positive immunoreaction was also detected in the endothelial cells of cavernous spaces both in the corpus spongiosum and corpus cavernosum penis (Fig. 1A). All these kinds of positive cells were found in all investigated penises. No positive immunoreaction was found in the interstitial tissue. There was no positive staining in tunica albuginea. No positive cells were present in negative controls (Fig. 1B).

Testis tissue was used as positive control for the detection of LH receptors in their target cells. Positive immunoreaction to the LH receptor was found in the Leydig cells and in the central part of seminiferous tubules next to the lumen, in spermatozoas. No positive cells were present in negative controls.

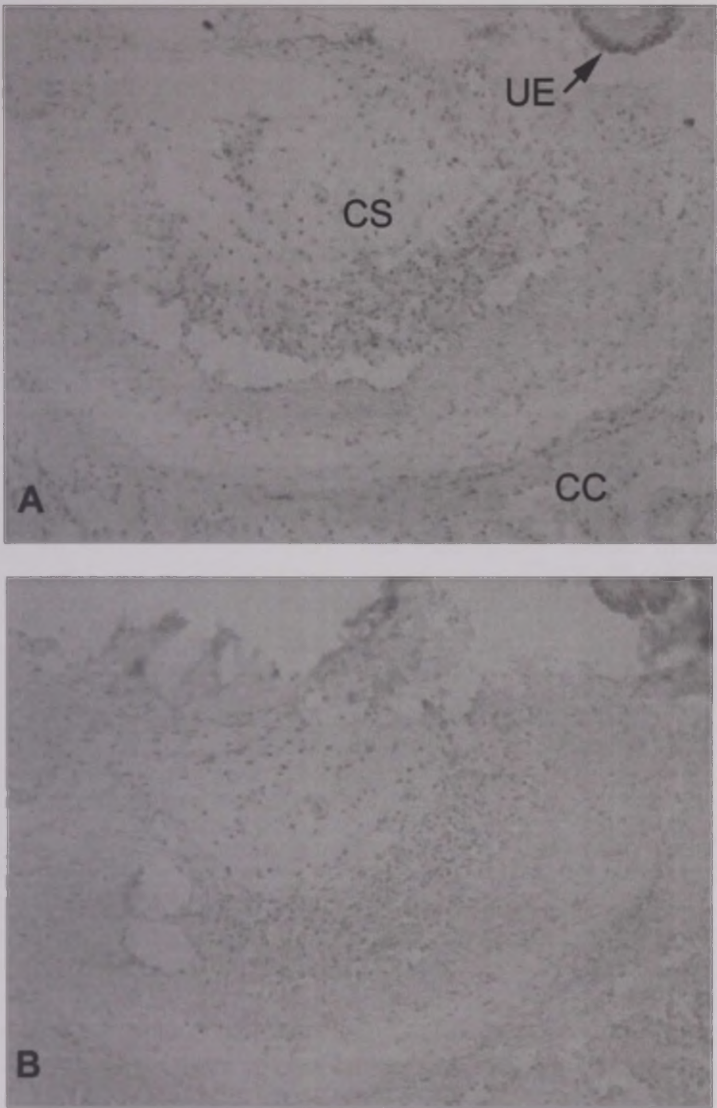

Fig. 1. Expression of LH genes at the protein level in the mouse penis (A) Control sections of penis (B). UE – urethral epithelium; CS – corpus spongiosum penis; CC – corpus cavernosum penis. Magnification × 2300, indirect immunocytochemistry (avidin-biotin-peroxidase) on a paraffin section.

DISCUSSION

In the present study, the expression of the LH receptor in the penile tissue was studied to see if LH effects might be possible and affect the tissue function in the penis. A precondition to it is the expression of LH receptor in the penile tissue.

A number of laboratories worldwide have demonstrated the presence and functions of LH/hCG receptors in various female and male nongonadal tissues in different species, thus suggesting additional non-classical actions for LH and hCG. No species specificity was noticed, but there was tissue specificity in the nongonadal LH/hCG receptor distribution. Nongonadal receptor levels were lower but they were regulated and processed and used signalling mechanisms similarly to gonadal receptors [11].

The present study demonstrated the presence of the LH receptors in the urethral epithelium and in the endothelial cells of the cavernous spaces in corpus spongiosum and corpus cavernosum of the mouse penis. As the nongonadal actions are physiologically important, it suggests that they are really able to affect the penile tissue function.

It has been suggested that hypoandrogenism in aging men may influence locally the erectile mechanisms and, in association with other conditions negatively influencing the erectile activity, may be an important co-factor in the induction of erectile dysfunction among the aging men [4]. However, in contradiction to this, the men with androgen receptor CAG members in the uppermost quartile ($\geq$ 23 repeats) reported decreased potency less often than the others [6]. As it has been suggested that the high CAG repeat members reduce androgen effect at the receptor level due to binding of the androgen receptor protein polyglutamine tail to certain cofactors of the androgen receptor, the less often occurring potency disturbances with high CAG repeat members would seem to be contributing, suggesting that testosterone is not critical in the potency disturbances. If the LH receptor is expressed in the penile tissue of the human, as the present results suggest in mice, it is possible that the elevated LH levels of the men with subclinical hypogonadism i.e. s LH > 6.0 U/l, s-testosterone > 9.8 nmol/l (23% of all the 40–70-year men) [6], are involved in the generation of erection disturbances. This could additionally explain the pathogenesis of erection disturbances and open new treatment possibilities.

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CHANGES IN ESTONIAN SCHOOL STUDENTS' HEIGHT AND WEIGHT IN THE LAST TEN YEARS

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ABSTRACT

The article presents, according to age groups, data on Estonian school students' (aged 7–18 years) height, weight and body mass index collected from schools in recent years. The data are compared with similar data collected ten years before – in 1998. For statistical comparison, the t-test is used.

In ten years, Estonian school students have grown significantly taller (girls, on average, by 3.94 cm and boys by 4.89 cm) and also significantly heavier (girls, on average, by 4.85 kg and boys by 6.72 kg). The mean BMI has increased in boys by 1.56 and in girls by 1.20.

Key words: *school students' height, weight, body mass index at the age of 7–18 years.*

INTRODUCTION

All cultured nations pay attention to school students' physical development and establish corresponding norms, which are periodically changed. In Estonia school students' height and weight norms were the school students' physical development assessment tables published by Juhan Aul in 1974 [1].

In newly independent Estonia one of the most significant undertakings was compilation of height, weight and body mass index norms for children aged 3–18 years by H. Grünberg, B. Adojaan and M. Thetloff in 1988 [2].

These have been until now used in schools and health care institutions. At all the doctor's offices at schools of general education, each student's medical card has a sheet with age-height and age-weight percentile graphs. These have been compiled according to Estonian national norms collected in 1998 [2]. Each year the student's height and weight are measured by the school nurse and recorded there. This way, the child's individual physical development is comparable to the national average.

The aim of the current article is to compare the new data on boys and girls aged 7–18 years with the data of 1998 [2].

MATERIAL AND METHODS

In the first sample under study age, body height and weight of boys and girls aged 6–19 years measured by the Centre for Physical Anthropology in 2006–2009. A total of 22,134 school students were measured – 11,674 girls and 10,640 boys. As their dates of birth and dates of measuring were known, the children's age was calculated from them. Age groups from 6 to 19 full years were formed (Tables 1–3).

The other sample included the same measurements of Estonian school students aged 7–18 years measured in 1996 [2]. The total number of school students measured then was 16,907 (Tables 4–6).

The comparison of samples was carried out according to a unitary scheme where body height, body weight and body mass index were compared. For comparison, t-test was used. The significance level was set at 0.95 (i.e. 95%), and the critical value of the t-statistic, considering the size of our samples, was 1.96. Computing the t-statistics for each age group, they can compared with the critical value. When the computed t-statistic is greater than the critical value of t, we have proved the existence of a statistically significant difference with the probability of 95% (Tables 7–12).

To determine the direction of differences, the tables also provide the difference of means (in the column "differences") and at the end, the arithmetic means of all age groups.

The statistical analysis of the data was carried out by Master of Mathematical Statistics Säde Koskel. The consultant was Professor Emeritus Ene-Margit Tiit.

RESULTS

The data collected about Estonian school students' body height, body weight and body mass index in 2006–2009 are presented in Tables 1, 2 and 3.

The comparative data about school students' body height, body weight and body mass index measured in 1996 are given in Tables 4, 5 and 6.

The results of comparison of both samples are provided in Tables 7–12.

Comparison of girls' body weights shows that the mean difference is +4.85 kg (Table 7, Fig. 3). The greatest differences were in age classes 11–13 years (puberty); the differences were the smallest in the age classes of 17 and 18 years. All the differences were positive and statistically significant.

The mean difference in boys' weight was +6.72 kg (Table 8, Fig. 4). The difference was the greatest in the age group of 13–15 years (puberty) and the smallest in the group of 7-year-olds.

Comparison of body height reveals that the mean difference in the sample of girls was +3.94 cm (Table 9). The difference in height was the greatest in 11-year-olds and the smallest in the age groups of 16–18 years. In the age group of 18 years the difference was statistically insignificant ($t = 1.76$, which is smaller than 1.96; see Table 9).

In boys the mean difference in height was +4.89, being the greatest at the age of 13 years. Similarly to girls, the difference was the smallest in the age groups of 16–18 years, and at the age of 18 years the difference was statistically insignificant ($t = 1.80$, Table 10, Fig. 2).

Most probably, the height of adult women and men (aged 18) has not changed significantly, although their weight has.

Body mass index (BMI), calculated from body weight and body height, shows that in girls aged 17 and 18 years, BMI has not changed statistically significantly (Table 11). In boys, BMI has changed statistically significantly in all age groups (Table 12, Fig. 5).

In conclusion, it can be said that the data under observation show that in ten years our school students have become taller (girls by 3.94 cm and boys by 4.89 cm on average) and heavier (girls by 4.85 kg and boys by 6.72 kg). A great contribution to these changes is given by the age group of 11–13 years.

Table 1. Body weight of Estonian school students measured in 2006–2009

	Girls					Boys				
Age	**Sample size**	**Min**	**Max**	**Mean**	**Std**	**Sample size**	**Min**	**Max**	**Mean**	**Std**
6	120	18.0	49.3	25.34	5.26	103	17.8	62.5	25.96	5.87
7	1057	15.8	53.0	27.33	5.37	948	13.3	64.0	28.61	5.83
8	682	18.0	55.9	30.20	6.39	719	19.5	74.7	30.96	6.89
9	1081	16.5	79.1	34.31	7.67	1062	19.0	77.0	34.95	7.73
10	455	20.4	86.1	38.29	9.69	463	24.9	83.2	39.36	9.85
11	1318	21.0	119.0	43.70	10.48	1126	26.0	104.0	43.66	10.68
12	546	26.0	95.0	48.32	10.77	575	25.1	102.0	47.31	11.07
13	1375	28.5	124.0	53.74	10.67	1248	28.0	120.3	55.69	13.00
14	645	33.2	108.3	55.92	11.08	695	29.7	125.3	59.44	13.13
15	1856	32.7	119.0	58.92	9.90	1622	28.6	128.0	66.47	12.16
16	1001	35.5	108.4	59.64	9.74	859	32.0	123.5	68.51	12.51
17	595	43.0	125.0	61.19	9.37	379	42.6	127.0	71.87	12.14
18	776	26.0	125.0	61.36	10.70	535	47.0	127.0	75.00	12.53
19	167	36.0	88.6	61.32	9.34	126	49.0	116.0	74.79	11.19
Total	**11674**	**15.8**	**125.0**	**48.34**	**15.36**	**10460**	**13.3**	**128.0**	**51.44**	**18.91**

Table 2. Body height of Estonian school students measured in 2006–2009

	Girls					Boys				
Age	Sample size	Min	Max	Mean	Std	Sample size	Min	Max	Mean	Std
6	120	111.0	143.0	124.61	6.45	103	104.9	150.0	125.53	6.02
7	1057	110.5	146.5	128.38	5.69	948	111.5	150.0	129.73	5.81
8	682	115.3	149.0	133.07	6.02	719	114.0	171.5	134.00	6.41
9	1081	121.0	168.0	139.64	6.65	1062	110.0	164.5	139.93	6.41
10	455	120.5	172.0	145.26	7.57	463	126.0	165.0	144.77	6.54
11	1318	128.5	180.0	152.28	7.42	1126	129.9	182.0	151.43	7.28
12	546	130.0	173.0	157.72	7.02	575	134.0	183.5	156.26	7.97
13	1375	139.5	188.5	163.48	6.56	1248	136.5	193.0	165.57	8.82
14	645	143.5	185.0	165.23	6.54	695	138.0	195.0	169.69	8.78
15	1856	131.5	188.0	167.12	6.08	1622	131.8	200.0	176.78	7.44
16	1001	149.5	189.0	167.64	6.25	859	147.0	200.0	178.37	7.41
17	595	140.0	193.0	168.65	6.08	379	156.0	202.0	180.75	6.43
18	776	128.0	190.0	168.31	6.17	535	159.5	200.1	181.23	6.58
19	167	125.0	181.5	167.86	6.98	126	156.0	198.0	182.52	6.91
Total	**11674**	**110.5**	**193**	**155.35**	**15.66**	**10460**	**104.9**	**202**	**158.82**	**19.47**

Table 3. Body mass index of Estonian school students measured in 2006–2009

Age	Girls Sample size	Min	Max	Mean	Std	Boys Sample size	Min	Max	Mean	Std
6	120	12.4	25.5	16.20	2.21	103	12.5	36.4	16.36	2.83
7	1057	10.3	28.4	16.49	2.40	948	8.8	30.4	16.88	2.48
8	682	11.4	29.8	16.94	2.71	719	9.2	31.6	17.12	2.79
9	1081	8.9	31.9	17.46	2.89	1062	10.7	33.8	17.72	2.89
10	455	12.6	35.6	17.96	3.34	463	13.1	34.5	18.62	3.59
11	1318	11.2	40.5	18.69	3.45	1126	13.0	38.2	18.89	3.53
12	546	13.0	34.4	19.28	3.38	575	12.7	43.9	19.23	3.53
13	1375	10.7	38.3	20.03	3.36	1248	12.4	39.4	20.15	3.62
14	645	14.2	39.7	20.42	3.55	695	14.2	41.4	20.51	3.60
15	1856	13.4	46.8	21.07	3.20	1622	14.3	37.2	21.20	3.22
16	1001	13.6	40.8	21.20	3.15	859	14.1	38.5	21.48	3.44
17	595	15.9	41.8	21.50	2.93	379	15.3	36.5	21.95	3.17
18	776	15.4	41.5	21.62	3.27	535	16.1	42.4	22.81	3.49
19	167	16.7	36.2	21.74	2.92	126	15.9	32.9	22.42	2.90
Total	**11674**	**8.9**	**46.8**	**19.48**	**3.61**	**10460**	**8.8**	**43.9**	**19.63**	**3.74**

Table 4. Body weight of Estonian school students measured in 1996

	Girls					Boys				
Age	**Sample size**	**Min**	**Max**	**Mean**	**Std**	**Sample size**	**Min**	**Max**	**Mean**	**Std**
7	624	15.5	39.0	23.92	3.56	545	17.3	39.5	24.35	3.31
8	1040	16.0	46.0	25.45	3.97	1077	16.5	45.0	26.36	3.84
9	950	18.8	58.0	28.62	4.92	967	18.3	54.0	29.52	4.73
10	883	21.1	77.0	32.09	6.08	959	21.5	64.0	32.60	5.45
11	863	20.3	77.0	35.51	7.19	839	24.0	65.0	36.04	6.31
12	902	20.9	83.0	40.35	8.88	874	18.8	98.0	40.34	8.24
13	762	21.7	87.5	46.12	9.43	795	28.0	96.0	45.19	9.75
14	657	25.0	94.0	51.62	9.61	653	27.5	93.5	50.84	9.91
15	658	29.0	99.0	55.07	9.34	609	30.5	99.3	56.84	9.63
16	553	30.0	89.5	57.24	8.32	425	31.5	98.0	62.72	10.27
17	353	40.5	95.0	59.12	8.46	220	41.0	98.0	65.82	9.59
18	296	40.5	94.7	59.56	8.23	189	49.5	99.0	70.57	8.69
Total	**8541**					**8152**				

Table 5. Body height of Estonian school students measured in 1996

	Girls					Boys				
Age	**Sample size**	**Min**	**Max**	**Mean**	**Std**	**Sample size**	**Min**	**Max**	**Mean**	**Std**
7	626	110.0	137	123.80	5.04	548	111.0	145	124.54	5.32
8	1078	110.0	148	128.20	5.71	1118	106.0	152	129.18	5.86
9	969	116.0	152	133.76	6.06	992	110.0	156	134.57	6.33
10	902	121.0	167	139.61	7.11	975	120.0	158	139.69	6.39
11	872	125.0	169	144.66	7.40	854	127.0	167	144.92	6.59
12	902	121.0	176	151.79	7.95	881	122.0	183	150.94	7.69
13	770	124.0	179	158.15	7.48	801	131.0	186	156.80	9.13
14	654	127.0	181	162.94	7.00	654	133.0	190	163.79	9.14
15	660	140.5	187	164.92	6.12	613	141.5	190	170.86	8.50
16	553	148.0	190	166.59	6.21	427	144.0	192	175.69	7.76
17	353	152.0	191	167.41	5.90	220	157.0	199	178.52	7.19
18	296	151.0	183	167.62	5.54	189	160.0	203	180.27	6.25
Total	**8635**					**8272**				

Table 6. Body mass index of Estonian school students measured in 1996

	Girls					Boys				
Age	**Sample size**	**Min**	**Max**	**Mean**	**Std**	**Sample size**	**Min**	**Max**	**Mean**	**Std**
7	621	11.7	23.4	15.55	1.68	544	11.7	24.5	15.72	1.44
8	1039	11.1	24.3	15.44	1.66	1072	10.9	22.9	15.77	1.56
9	948	12.0	25.9	15.92	1.90	966	10.2	27.4	16.24	1.77
10	883	12.5	28.0	16.37	2.08	959	12.1	27.1	16.63	1.91
11	860	12.0	29.0	16.83	2.27	836	11.8	27.0	17.06	2.06
12	887	10.9	32.8	17.36	2.70	870	9.8	32.3	17.56	2.36
13	761	13.0	34.3	18.32	2.85	792	13.3	30.6	18.20	2.55
14	654	13.8	31.8	19.38	3.00	635	13.0	31.4	18.81	2.51
15	656	14.4	33.1	20.21	2.97	609	13.9	33.9	19.37	2.33
16	553	13.5	32.8	20.60	2.63	425	13.8	33.9	20.20	2.65
17	353	16.1	32.1	21.10	2.63	220	16.0	29.0	20.59	2.28
18	296	15.6	30.0	21.18	2.60	189	16.4	33.7	21.72	2.51
Total	**8511**					**8117**				

Table 7. Difference in girls' body weight

Age	Years 2006–2009			Year 1996			t-statistic	Difference
	Sample size	Mean	Std	Sample size	Mean	Std		
7	1057	27.33	5.37	624	23.92	3.56	15.63	3.41
8	682	30.20	6.39	1040	25.45	3.97	17.33	4.75
9	1081	34.31	7.67	950	28.62	4.92	20.11	5.69
10	455	38.29	9.69	883	32.09	6.08	12.43	6.20
11	1318	43.70	10.48	863	35.51	7.19	21.64	8.19
12	546	48.32	10.77	902	40.35	8.88	14.55	7.97
13	1375	53.74	10.67	762	46.12	9.43	17.06	7.62
14	645	55.92	11.08	657	51.62	9.61	7.48	4.30
15	1856	58.92	9.90	658	55.07	9.34	8.93	3.85
16	1001	59.64	9.74	553	57.24	8.32	5.12	2.40
17	595	61.19	9.37	353	59.12	8.46	3.50	2.07
18	776	61.36	10.70	296	59.56	8.23	2.93	1.80
Mean		48.34			39.74			4.85

Table 8. Difference in boys' body weight

	Years 2006–2009			Year 1996				
Age	**Sample size**	**Mean**	**Std**	**Sample size**	**Mean**	**Std**	**t-statistic**	**Difference**
7	948	28.61	5.83	545	24.35	3.31	18.01	4.26
8	719	30.96	6.89	1077	26.36	3.84	16.30	4.60
9	1062	34.95	7.73	967	29.52	4.73	19.26	5.43
10	463	39.36	9.85	959	32.6	5.45	13.77	6.76
11	1126	43.66	10.68	839	36.04	6.31	19.77	7.62
12	575	47.31	11.07	874	40.34	8.24	12.92	6.97
13	1248	55.69	13.00	795	45.19	9.75	20.80	10.50
14	695	59.44	13.13	653	50.84	9.91	13.62	8.60
15	1622	66.47	12.16	609	56.84	9.63	19.52	9.63
16	859	68.51	12.51	425	62.72	10.27	8.82	5.79
17	379	71.87	12.14	220	65.82	9.59	6.73	6.05
18	535	75.00	12.53	189	70.57	8.69	5.32	4.43
Mean		51.44			39.89			6.72

Table 9. Difference in girls' body height

	Years 2006–2009			Year 1996				
Age	**Sample size**	**Mean**	**Std**	**Sample size**	**Mean**	**Std**	**t-statistic**	**Difference**
7	1057	128.38	5.69	626	123.80	5.04	17.16	4.58
8	682	133.07	6.02	1078	128.20	5.71	16.88	4.87
9	1081	139.64	6.65	969	133.76	6.06	20.95	5.88
10	455	145.26	7.57	902	139.61	7.11	13.23	5.65
11	1318	152.28	7.42	872	144.66	7.40	23.58	7.62
12	546	157.72	7.02	902	151.79	7.95	14.82	5.93
13	1375	163.48	6.56	770	158.15	7.48	16.53	5.33
14	645	165.23	6.54	654	162.94	7.00	6.10	2.29
15	1856	167.12	6.08	660	164.92	6.12	7.96	2.20
16	1001	167.64	6.25	553	166.59	6.21	3.18	1.05
17	595	168.65	6.08	353	167.41	5.90	3.09	1.24
18	776	168.31	6.17	296	167.62	5.54	**1.76**	0.69
Mean		155.35			147.34			3.94

Table 10. Difference in boys' body height

	Years 2006–2009			Year 1996				
Age	**Sample size**	**Mean**	**Std**	**Sample size**	**Mean**	**Std**	**t-statistic**	**Difference**
7	948	129.73	5.81	548	124.54	5.32	17.57	5.19
8	719	134.00	6.41	1118	129.18	5.86	16.27	4.82
9	1062	139.93	6.41	992	134.57	6.33	19.06	5.36
10	463	144.77	6.54	975	139.69	6.39	13.86	5.08
11	1126	151.43	7.28	854	144.92	6.59	20.82	6.51
12	575	156.26	7.97	881	150.94	7.69	12.61	5.32
13	1248	165.57	8.82	801	156.80	9.13	21.50	8.77
14	695	169.69	8.78	654	163.79	9.14	12.08	5.90
15	1622	176.78	7.44	613	170.86	8.50	15.18	5.92
16	859	178.37	7.41	427	175.69	7.76	5.92	2.68
17	379	180.75	6.43	220	178.52	7.19	3.80	2.23
18	535	181.23	6.58	189	180.27	6.25	**1.80**	0.96
Mean		158.82			148.08			4.89

Table 11. Difference in girls' body mass index

Age	Years 2006–2009 Sample size	Mean	Std	Year 1996 Sample size	Mean	Std	t-statistic	Difference
7	948	16.49	2.40	548	15.55	1.68	8.82	0.93
8	719	16.94	2.71	1118	15.44	1.66	13.33	1.50
9	1062	17.46	2.89	992	15.92	1.90	14.36	1.54
10	463	17.96	3.34	975	16.37	2.08	9.41	1.59
11	1126	18.69	3.45	854	16.83	2.27	14.42	1.86
12	575	19.28	3.38	881	17.36	2.70	11.46	1.92
13	1248	20.03	3.36	801	18.32	2.85	12.36	1.71
14	695	20.42	3.55	654	19.38	3.00	5.82	1.04
15	1622	21.07	3.20	613	20.21	2.97	5.97	0.86
16	859	21.20	3.15	427	20.60	2.63	3.62	0.60
17	379	21.50	2.93	220	21.10	2.63	**1.70**	0.40
18	535	21.62	3.27	189	21.18	2.60	**1.84**	0.43
Mean		19.36			17.45			1.20

Table 12. Difference in boys' body mass index

	Years 2006–2009			Year 1996				
Age	**Sample size**	**Mean**	**Std**	**Sample size**	**Mean**	**Std**	**t-statistic**	**Difference**
7	948	16.88	2.48	548	15.72	1.44	11.50	1.16
8	719	17.12	2.79	1118	15.77	1.56	11.89	1.35
9	1062	17.72	2.89	992	16.24	1.77	14.04	1.48
10	463	18.62	3.59	975	16.63	1.91	11.19	1.99
11	1126	18.89	3.53	854	17.06	2.06	14.43	1.83
12	575	19.23	3.53	881	17.56	2.36	9.95	1.67
13	1248	20.15	3.62	801	18.20	2.55	14.32	1.95
14	695	20.51	3.60	654	18.81	2.51	10.10	1.70
15	1622	21.20	3.22	613	19.37	2.33	14.78	1.83
16	859	21.48	3.44	427	20.20	2.65	7.35	1.28
17	379	21.95	3.17	220	20.59	2.28	6.05	1.36
18	535	22.81	3.49	189	21.72	2.51	4.60	1.09
Mean		19.63			17.48			1.56

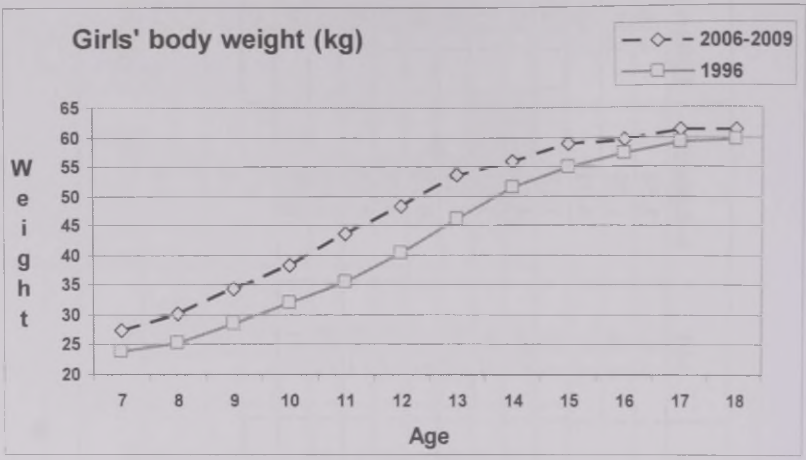
Girls' body weight (kg)
2006-2009
1996
Weight
65
60
55
50
45
40
35
30
25
20
7 8 9 10 11 12 13 14 15 16 17 18
Age

Fig. 1

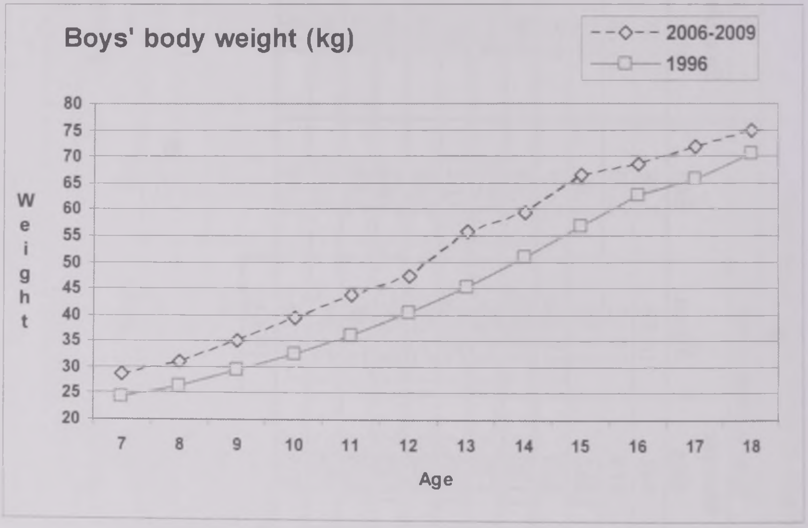
Boys' body weight (kg)
2006-2009
1996
Weight
80
75
70
65
60
55
50
45
40
35
30
25
20
7 8 9 10 11 12 13 14 15 16 17 18
Age

Fig. 2

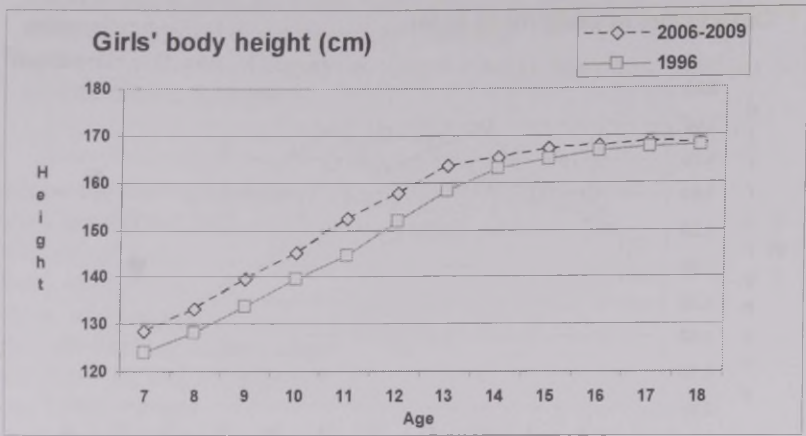
Girls' body height (cm)
2006-2009
1996
180
170
160
150
140
130
120
Height
7
8
9
10
11
12
13
14
15
16
17
18
Age

Fig. 3


Boys' body height (cm)
2006-2009
1996
190
180
170
160
150
140
130
120
Height
7
8
9
10
11
12
13
14
15
16
17
18
Age

Fig. 4

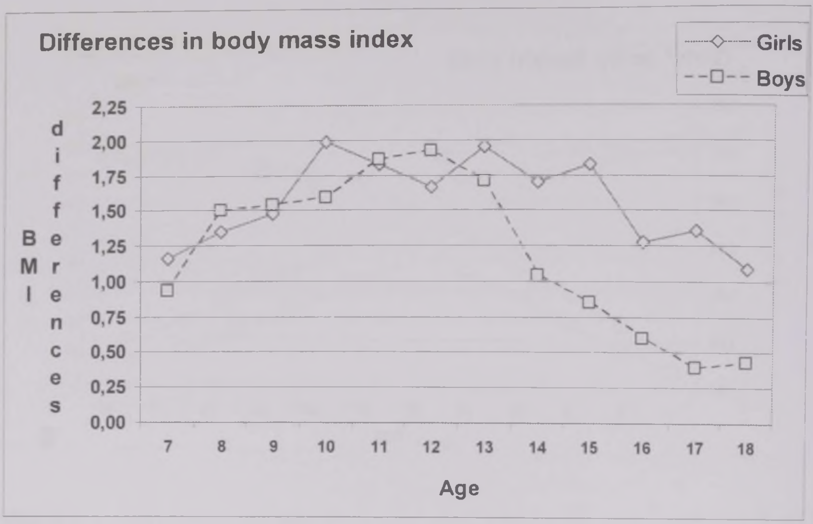

Fig. 5

CONCLUSIONS

1. As the changes during the last 10 years are significant, it is necessary to continue the tradition and check the physical development of school students after each ten years.
2. The changes should be introduced in schools and health care institutions. The new average national norms of school students' height, weight and BMI will be sent to all schools, the Ministry of Social Affairs and health care institutions.

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HISTOCHEMISTRY OF PLACENTA: DEEPER UNDERSTANDING OF MOLECULAR PROCESSES, HAVING POSSIBLE IMPACT ON THE PHYSICAL DEVELOPMENT OF FETUS

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ABSTRACT

There still remains a significant portion of clinical cases, unexplained after clinical investigation and routine pathological examination of placenta; therefore clinical specialists are looking for additional ways of disclosure of hidden processes in pregnancy. One of such possible ways is immunohistochemistry, detecting molecular markers of placental changes. In the present study the correlation between growth factors, their receptors, as well as apoptosis in the placental tissues and the anthropometrical parameters of the child was researched. The expression between fibroblast growth factor receptor 1 (FGFR1) and basic fibroblast growth factor (FGF-b) showed statistically significant positive correlation. The expression of FGF-b had a weak non-significant correlation with gestational age; the expression of FGFR1 had a similar negative correlation with the body mass index (BMI). The results showed statistically significant negative correlation between apoptotic cells and some anthropometric values of the newborn – the length, the head and chest circumference. There was a weak and non-significant correlation between the body weight and the BMI. We concluded that immunohistochemistry can reveal the factors, e.g. vascular endothelial growth factor (VEGF) having common impact on the anthropological parameters of fetus as well as local factors (apoptosis, FGF-b, FGFR), influencing mainly the growth and the development of placenta itself.

Key words: *placenta, histochemistry, fetus, anthropometry*

INTRODUCTION

Pregnancy sampling and the post delivery examination of placenta has become a routine part of obstetrical and neonatal care with the main goal to find out or confirm possible pathways of pathological processes that could have led to unwanted and unexpected outcome. Although no-one, involved in the maternity care, denies the importance of placental examination, there are different approaches to the practical application of this persuasion. The only way to exploit at the maximum extent all the information from the placental tissues is to merge clinical knowledge of the perinatal team and the pathologist. It has been acknowledged that "the examination of the placenta by pathologists requires a good working knowledge of the implications of various factors in the clinical obstetric history" [5]; on the other side the clinical evaluation of perinatal processes requires the understanding of normal and pathological processes in the placenta that could potentially have a significant impact on the duration and outcome of pregnancy.

The routine physical examination of post delivery placenta is beneficial for clinical praxis, but does not answer many questions. The assessment of haematoxylin and eosin staining of placenta, a significant tool of evaluation of placental tissues, is provided in the cases of identified pathologies, but it has "visual" limitations due to the physical properties of cells and tissues.

For the last few decades methodologies have been developed for a more detailed understanding of the processes of placentation, the progression of pregnancy and its termination. Immunohistochemistry as a research method has proven itself to be much more sensitive for the establishment of pathological pathways and therefore clinical diagnosis [15]. It has been stated that histochemistry can provide information that cannot be readily gained with biochemical and morphological methods alone [21]. The special clinical significance of immunohistochemical investigations is determined by their capability to assess the expression and the distribution of biomolecules *in situ.* Thereby from a clinical standpoint the results of immunocytochemical studies could be used to find out the direction of studiesthat could possibly provide the results important for medical praxis.

Significant roles in the establishment and functionality of placenta are played by vasculogenesis, angiogenesis and cellular proliferation, influenced by growth factors, including the vascular endothelial growth factor (VEGF) and the fibroblast growth factor (FGF) with its binding site fibroblast growth factor receptor (FGFR). The main body of immunohistochemical and immunocytochemical studies relate to the first trimester of pregnancy, as the implantation and the formation of the placenta are the heaviest cornerstones of the establishment of pregnancy. Anteby et al [1] have investigated the effect of VEGF on the trophoblast plasminogen activator (PA) and matrix metalloproteinase 9 (MMP-9) as well as the expression of epidermal growth factor (EGF) and FGF at the maternal-fetal interface. They concluded that VEGF, EGF and FGF4 and 10 are playing an important role in the regulation of trophoblast invasion and the altered expression of these cytokines at the maternal-fetal interface may contribute to the abnormal placental development in the diseases such as pre-eclampsia and intrauterine growth restriction (IUGR). Reynolds et al [18] suggest vasculogenesis to be a major component in the increase in placental blood flow throughout gestation. Natanson-Yaron et al [14] investigated the role of FGFR10 on the establishment of pregnancy and concluded that FGF10 plays a major role in the branching morphogenesis BM of placental villi. considerably fewer studies evaluate the expression of VEGF or FGF in the third trimester of pregnancy. Oussama Grissa et al [6] investigated the patients with gestational diabetes and found that FGF 2 plays an up-regulating role in the development of fetal macrosomia.

A negative impacts on the functionality of placenta besides decreased growth factors can cause the increased apoptosis of placental cells, therefore there are a number of studies investigating how this process could be activated. Athapathu et al [2] found a higher incidence of apoptotic cells in placental tissues in pregnancies complicated by intrauterine growth retardation (IUGR) than in placentas in normal pregnancies. In the study of Leach et al [11] the mechanism of protection against apoptosis was investigated and the results showed that a re-oxygenation event is significantly reducing this protection, appearing at the presence of hypoxia.

Vogt Isaksen et al [8] found that apoptosis was increased in the placentas of smoking mothers with growth-restricted infants.

On the basis of the aforementioned investigations the aim of our work was to look for immunohistochemical markers in clinically non-significant pregnancies, thereby disclosing the presence or consequences of molecular processes with a possible impact on the child maturity.

MATERIALS AND METHODS

Materials and methods were based on the 14 post-delivery placentas of different gestational ages and obstetrical histories, acquired at the Riga Maternity Hospital. On the 12 March 2009 the study was approved by the Ethics Committee of the Riga Stradins University. Patients with clinically significant general or gestational pathologies were excluded from the study, including severe pre-eclampsia or intra-uterine growth restriction (IUGR) in the actual pregnancy, positive status for hepatitis B, C viruses (HBV, HCV) or human immunodeficiency virus (HIV) as well as diabetes. Patients signed an informed consent and completed a survey. After the delivery of placenta it was evaluated for visual abnormalities. Significant macroscopic anomalies of placenta, including the meconium stain, were considered to be the exclusion criteria. The clinical outcome was evaluated as "good" in the cases of complete recovery, "bad" – in the cases of death, persistent health problems or severe developmental delays.

The data regarding the social status and lifestyle were gained from the study survey; anthropological parameters included routinely assessed measurements of newborns. Placental samples were taken by a single use surgical knife from the part of placenta shown in Figure 1 and placed into Picric Acid-Formaldehyde Fixation, described by Stefanini et al [20]. From each placenta 2 samples were taken from symmetrically located places. The samples were processed at the Institute of Anatomy and Anthropology of the Riga Stradins University. The preparation of samples was performed by these consecutive steps: deparaffinization with xylol, dehydratation with alcohol, simmering, washing in a buffer solution, blocking in peroxidase and rinsing. In the process of dyeing the Dako EnVision kit (USA) was used, the samples were processed by the antibodies of growth factors and growth factor receptors: the vascular endothelial growth factor (VEGF, mouse monoclonal, Dako Cytomation, 1: 50, M-7273), the basic fibroblast growth factor basic (FGF-b, basic rabbit polyclonal, abcam, 1: 200, ab16828), the fibroblast growth factor receptor 1 (FGFR1, rabbit polyclonal, abcam, 1: 100, ab10646). Apoptotic cells were identified by the detection of DNA fragmentation by labeling the terminal end of nucleic acids (TUNEL) by In Situ Cell Death Detection kit (ROCHE Diagnostics, 1: 10, Cat. No 1684817).

The data were evaluated semi-quantitatively regarding the number of positive structures in a visual field: 0 – none, 0/+ – occasional, + few,

++ – moderate, +++ – numerous, ++++ – abundant [17]. The number of apoptotic cells was assessed in 10 visual fields; the average was counted. The data were evaluated qualitatively; numeric values were counted by means of Microsoft Office Excel 2007. The statistical significance was determined at $p < 0.05$, non-significant weak correlation was established at $0.05 < p < 0.1$. Correlation was evaluated by the Pearson correlation Sig. (2 – tailed) test [7].

RESULTS

At the time of delivery mothers were 19–41 years old, 11 were employed during a full working day, 2 partly and 1 not working (a student); 5 patients had graduated from the university, 4 had finished secondary school, 2 were students and 1 patient had completed primary school; 8 women had the first delivery, 3 – the second and 3 – the third one. None of the patients recorded tobacco smoking during pregnancy or other hazardous habits. Seven were normal deliveries at more than 34 weeks of gestation, 2 of them by Cesarean section; four term deliveries were accompanied by significant fetal distress, 3 of them ended with the emergency Cesarean section, including one case of stillbirth and one case of neonatal death. Three deliveries were vaginal preterm at 28, 29 and 33 weeks of gestation. Seven of the newborns were girls and seven were boys.

The average weight of the newborns was 3,359.43 g ± 1,187.39; body length 51.14 cm ± 6.83; head circumference 34.43 cm ± 3.78; chest circumference 33.00 cm ± 4.66, calculated body mass index (BMI) 12.24 ± 2.04. Seven of the term newborns were macrosomic with the body mass ≥ 4,000g; three of them were diagnosed as large for the gestational age (LGA) with the body mass ≥ 4,400g.

In seven placentas pathological changes were found by the evaluation of haematoxylin and eosin staining preparations: hemorrhages in the intra-villous space, chorionamnionitis, vasculitis, the zones of infarctions, and the presence of fibrin. Despite the strict exclusion criteria in four cases there were significant signs of infections: two cases of unidentified early neonatal sepsis in 28 and 40 weeks of gestation, pathologically detected vasculitis in the stillbirth case and a positive HCV status of a patient delivered at 35 gestational weeks.

The positive structures of VEGF were not found in any of the preparations. The variable expressions of FGF-b and FGFR1 were present in all the samples from few structures of the factor and receptor in a case of spontaneous delivery in 35 gestational weeks with 3,020 g healthy child till the abundance of both structures in a placenta after the emergency Cesarean Section in 41 gestational weeks with 4,630 g stillborn child.

In the three placentas from the delivery prior to 34 complete weeks numerous or an abundant number of FGFR1 positive structures were found (Fig. 1) whilst the expression of FGF-b was more variable – from few positive structures in a 28 gestational weeks placenta from a delivery with a 1,190 g child with sepsis, having developed severe complications, to numerous positive structures in 29 (Fig. 2) and 33 gestational weeks placentas where 1,290 g and 1,992 g children did not develop any significant prematurity complications.

From the four term placentas with significant fetal distress during labor the number of positive structures of FGFR1 varied from moderate in two of the placentas – 40 gestational week placenta after vaginal delivery where 4,330 g neonate developed sepsis and 38 gestational week placenta after the emergency Cesarean section and a 4,510 g child of neonatal mortality due to brain death, to an abundance of structures in the stillbirth case.

Placentas from normal deliveries with good outcomes in more than 34 gestational weeks revealed the expression of FGFR1 from a few positive structures in a visual field in a 35 week vaginal delivery placenta to numerous structures in 4 placentas: elective CS in 36 gestational week with a 3,200 g child, 38 weeks CS with a 4,290 g child, 39 week vaginal delivery with a 2,740 g child and 40 week vaginal delivery with a 4,180 g child. In two 39 week placentas from normal vaginal deliveries with children of 4,000 g and 4,410 g there were moderate numbers of FGFR1 positive structures. The numbers of FGF-b positive structures in this group of patients varied from a few in 35 and 39 week placentas and neonatal birth weight of 3,020 g and 4,410 g to numerous in the 36 week CS placenta with a child of 3,200 g. In the remaining 4 placentas there were moderate numbers of FGF-b positive structures (Fig. 3).

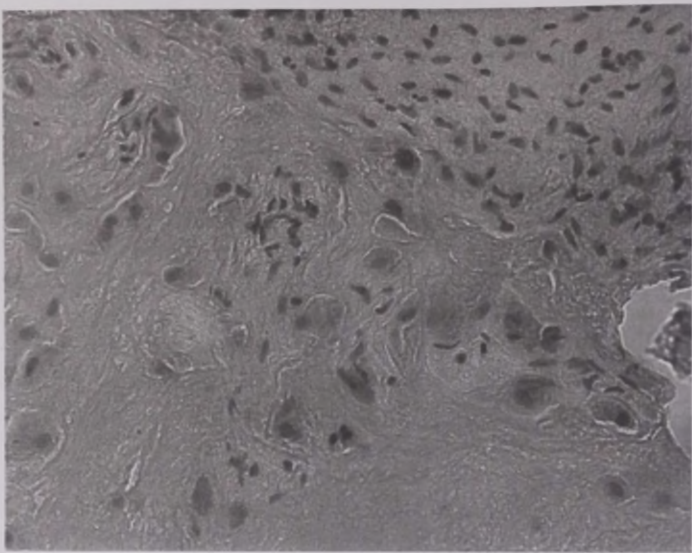

Fig. 1. Micrograph of a pre-term 29 weeks placenta after vaginal delivery with good perinatal outcome demonstrating numerous FGFR1 positive structures in syncytiotrophoblast. FGFR1 IMH, X 400.

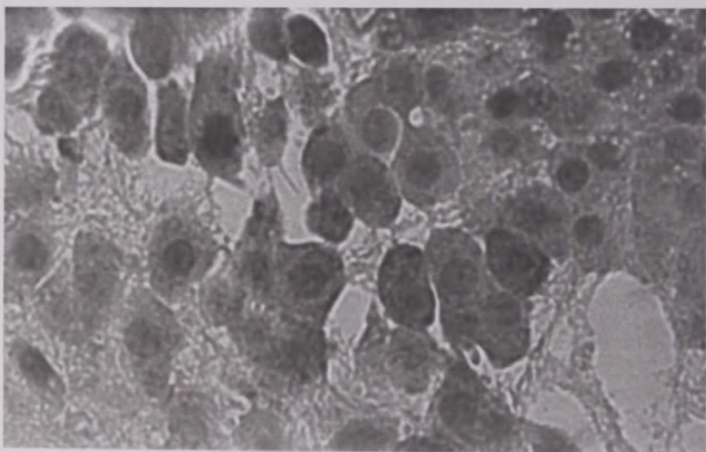

Fig. 2. Micrograph of a 29 week pre – term placenta after spontaneous vaginal delivery, presenting numerous positive structures of FGF-b. FGF-b IMH, X 400.

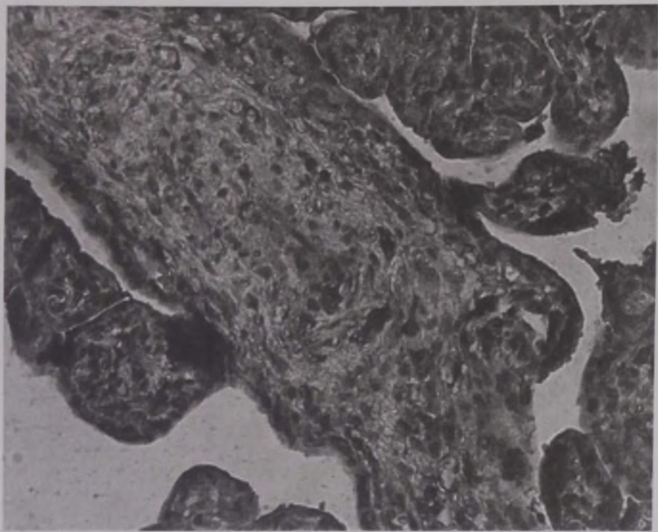

Fig. 3. Micrograph of a term 40 weeks old placenta after normal spontaneous delivery containing moderate number of FGF-b positive cells in the placental macrophages. FGF-b IMH, X 400.

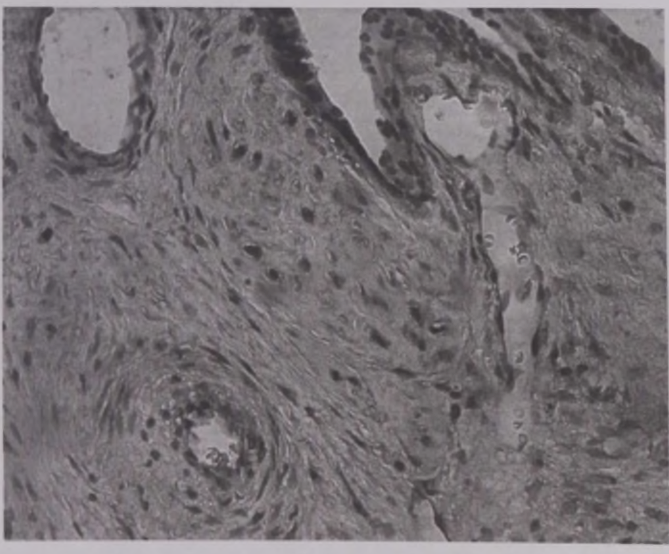

Fig. 4. Moderate number of apoptotic cells in a term 40 weeks placenta after spontaneous vaginal delivery with a healthy child. TUNEL, X 400.

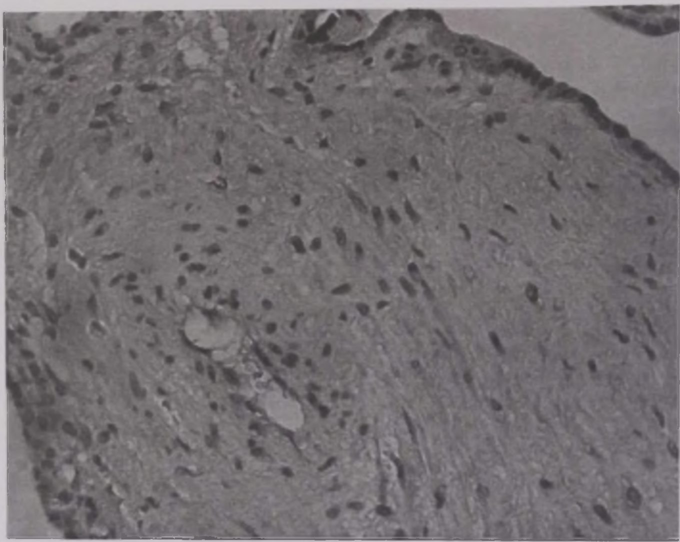

Fig. 5. Marked apoptosis in a 28 weeks placenta after spontaneous vaginal delivery with a pre-mature child with an early neonatal sepsis. TUNEL, X 400.

Statistically significant positive correlation was found between the structures of FGF-b and FGFR1; statistically non-significant week negative correlation was detected between FGF-b structures and the gestational age; statistically non-significant weak negative correlation of FGFR1 positive structures with BMI and positive with the blood pH after delivery were observed.

A significant variation in the average numbers of apoptotic cells from 0.6 ± 0.84 till 44.3 ± 11.70 (Fig. 4) was found. A large standard deviation showed a large variety of the number of apoptotic cells in different visual fields of one sample indicating the patchy mode of distribution throughout the placenta. In four cases with clinically significant infection the number of apoptotic cells was significantly higher than in the others – they were both cases of early neonatal sepsis in 28 weeks (26 ± 12.68) (Fig. 5) and 40 weeks (44.30 ± 11.70), a 41 weeks stillbirth case with a pathologically detected umbilical vasculitis (13.70 ± 7.39) and 35 weeks placenta of a mother with positive VHC (13.80 ± 8.88).

Statistically significant ($p < 0.05$) negative correlations between the average numbers of apoptotic cells in 10 placentas without clinically significant signs of infection and some anthropometric parameters: length, head and chest circumference were found. There were also no statistically significant correlations between the average numbers of apoptotic cells and body weights or the BMI. Finally there was a statistically significant negative correlation of head circumferences and bodyweights with blood pH, whereas correlations between the average numbers of apoptotic cells with blood pH were not statistically significant.

We did not find any correlations between the average number of apoptotic cells and the amount of FGF-b and FGFR1 positive structures.

DISCUSSION

Placenta is growing and developing throughout the pregnancy and its functionality greatly depends on vascularization, therefore vasculogenesis should continue till the termination of pregnancy. VEGF is one of the key factors responsible for angiogenesis and vasculogenesis. There are some contra-versions among the investigators regarding the expression of VEGF in the cases of clinically decreased placental blood blow, associated with the development of pre-eclampsia and intrauterine growth restriction (IUGR). Several studies [10, 12] suggest that the decreased expression of VEGF is associated with the increase of soluble fms-like tyrosine kinase-1 (sFlt-1), indicating the development of pre-eclampsia, quite often leading to IUGR of the fetus. On the other hand, Barut et al [3] found out strong staining of VEGF and FGF in placentas with IUGR fetuses referring to K Benirschke [4] that hypoxic stimuli are inducing vascular growth factors. We did not find VEGF positive structures in any of the samples although the study group included pre-term placentas, placentas after acute fetal distress, and placentas after normal term deliveries or elective CS. Such a finding agreed with the disclosure of Jia et al [9] suggesting that in the course of pregnancy there was a significant decrease in the level of VEGF expression indicating that VEGF probably is not the only regulatory factor of angiogenesis in the chorionic villi and placenta in general differs from other tissues which react on ischemia by the increase of VEGF.

Marzioni et al [13] suggested that FGF and FGFR strongly contribute to the growth and development of placenta and fetus. There are several studies looking for the correlation of FGF and FGFR with the pathologies of pregnancy and anthropometric parameters of the child. Ozkan et al [16] reported the increased expression of FGF in the placentas of patients with pre-eclampsia, a common clinical cause of restricted fetal growth. This finding corresponds with the disclosure of Barut et al [3] reporting a higher expression of FGF-b in the placentas of IUGR fetuses. The study of Oussama Grissa et al [6] concerned patients with diabetes; therefore their findings of the correlation between FGFR2 and fetal macrosomia can be influenced by other factors possibly related to the level of glucose throughout the pregnancy. We found a weak negative correlation between the amount of positive structures of FGF-b and the gestational age and the positive structures of FGFR1 and BMI. This probably indicates local changes of placental ageing rather than the impact of external factors on the weight of the developing fetus.

Apoptosis is a process that is present in placenta throughout the pregnancy like all the other live tissues, providing its development. Smith et al found that apoptosis is increasing with the course of pregnancy with correspondingly significantly higher number of apoptotic cells in the third trimester than in the first trimester [19]. Our study did not include the placentas from the first trimester of pregnancy, but there were two very low birth weight babies with 28 and 29 weeks of gestation and one 33 week premature baby, so the range of gestation and anthropometrical parameters was quite wide. We found statistically significant negative correlation between the average number of apoptotic cells in a visual field and length parameters – body length, head and chest circumferences. Negative correlation with body weight and BMI was weak and non-significant, acting like the growth restriction of the first trimester (body length), the second trimester (head circumference) and the third one (chest circumference). We did not find any significant correlations between the average numbers of apoptotic cells and the gestational age, maybe because all of our samples were from post-delivery placentas in the third trimester of pregnancy.

We concluded that normal courses of pregnancy do not warranty equal conditions of development for all fetuses, as it is influenced by different processes on the maternal-fetal interface. Immunohisto-chemistry can reveal the factors (VEGF) having a common impact on the anthropological parameters of fetus as well as local factors (apoptosis, FGF-b, FGFR) influencing mainly the growth and development of placenta itself. We did not find any correlations between social factors and the fetal size or placental findings.

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HUMAN CONSTITUTION AND ITS VARIANTS AND SYNONYMES

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ABSTRACT

Very little attention has been paid to the human constitutional terminology and to its historical evolution in published papers in Estonia. In the present article we are making an attempt to give a short overview of the development of the terminology, and synonyms used by French, Italian, Anglo-American and German investigators. We also added the terms we recommended for using in the Estonian language for readers.

***Key words:** human constitution, three types, synonyms*

REVIEW

What is the human constitution? Taber's cyclopedic medical dictionary [1] defines it as follows: the physical makeup and functional habits of the body (in Latin *constituere* – to establish).

What is "constitutional"? – it is pertaining to the body as a whole.

What is the somatotype? Taber's cyclopedic medical dictionary explains it as follows: a particular build or type of body.

And also the body type: the classification of the human body according to certain physical characteristics.

The beginning of the human constitution typology in science is known from antiquity: Hippocrates used the description Habitus phthisicus (thin, lean, and skinny) and Habitus apoplecticus (thick and short).

It was not until the 19th century when many researchers devoted attention to the human constitution nomenclature and its variants. National schools of the constitution were developing in France, Italy, Germany and in Anglo-American countries.

Tucker and Lessa (1940) [2], Conrad (1940,1963) [3,4] and Albonico (1969) gave interesting reviews which gave overviews about the national schools and synonyms created for three(four) types of classes.

Recently Christoph Raschka's book "Sportanthropologie" (2006) [5] was published. In book the author had also added an overview of the historical development human constitution schools and a variety of the synonyms used by different authors.

We made an attempt to introduce for Estonian readers the history of the human constitution terminology development and a variety of the synonymes used.

We also try to offer terms of the human constitution in the Estonian language.

For our review the tables of Raschka (2006) [5] were used as a basis.

Synonyms used in Tables 1–4 are interesting.

Even Old Romans mythological names for Gods (Walker, 1823) [5] are used.

Thus the narrow type was named Minerva – the ancient Romans' God for wisdom and the supporter of the clever and courageous men (in ancient Greece mythology she was named as Pallas Athena – the daughter of the Head of the Greek Gods Zeus.

The middle type was named as the Romans' god Diana – the huntings god (in ancient Greece she was named Artemis).

For the broad type the name Venus – the ancient Romans' God of the beauty and love (in ancient Greece the God's name was Aphrodite) was used.

Which was the body type of the mythological Gods? This information shows is shown in the old sculptures and the figures on old vases [6].

Some classifications have used for the names of types the leading elements of the body – they were cephalic, muscular and abdominal (Halle 1797, Rostan 1826, Sigaud 1914) [5].

There are classifications using the pecularities of the skeleton – macro-, meso- and brachyskeleton (Manouvrier 1902, Viola 1909) or the body geometrical form – flat or round (Mac Auliffe 1925), vertical or horizontal (Stern 1912, Stockard 1923, Aschner 1924, Pfuhl 1924, Schneider 1937) [5].

Metabolic states as a criterion for classification – the catabolic versus the anabolic type (Pende, 1922) are also used.

Also, the peculiarities of the chest are used – the narrow, normal and wide-chested (Brugsch, 1918).

As the differences in the body build are also symptomatic for the health status, the names of the constitutional types are used – astenic versus apoplectic (v. Rokitansky. 1826), scrophulos-phthisisch – rachitic versus carcinomatous (Benecke, 1878), asthenic versus apoplectic-arthritic-hypertonic (Stiller, 1907), hypotonic versus hypertonic (Tandler, 1913).

The classification by Friedenthal (1925) is interesting It recommends the names of the profession of the different body builds persons – Herdsman, Huntsman and the Farmer type.

Schlegel (1957) recommends for the narrow type term – the andromorphic and for the broad type term the gynaecomorphic, thus gender typical differences are also used of the classification of constitutional types

By Hellpach (1922) the terminology for the narrow type is – the Frankish face and for the wide type – the Swabian face.

Bryant (1913) recommends the name for the narrow type carnivorous and for the broad type herbivorous, the names which characterized nutritional habits.

The same names are recommended Sheldon (1940) [7], Parnell (1954) [8] and Heath-Carter (1967) [9] – ectomorph, mesomorph and endomorph, but the determination of type developed from photos to anthropometry.

Very similar trilogies are used by Kretschmer (1921) – leptosome, athletic and pycnic and Conrad (1940) leptomorphic, metromorphic and pycnomorphic.

Raschka (1993) [10] in his work with the statistical methods shows that the human constitution is connected with the endocrinological status – namely the narrow type is more connected with triiodinethyronin, the middle type more with testosterone and the wide type more with oestrogenic hormones and he recommends accordingly tree types as triiodine-thyronin-effect, testosterone-effect and oestrogenic effect types. This work is most recent in the German constitutional typology terminology.

Historically it is interesting to say that for the first time the Estonian males' constitution was described by K. E. V. Baer in his doctoral dissertation in 1814 [11].

In 1964 Tiik in his candidate dissertation made an attempt to use a computer generated classification for the characterizing Estonian males' and females' constitution. This candidate dissertation was defended in 1965 at the University of Tartu [12].

In 1974 Aul classified the constitution of Estonian schoolchildren aged 7–18-years using seven anthropometric variables – height, weight, chest circumference, sitting height, bi-acromial breadth, bicristal breadth, upper limb length and by lungs vital capacity. All the parameters were divided into five classes – very small, small, medium, large and very large [13].

In 1981, 1995, 2001 Kaarma introduced a new way of classification – the five-class height-weight system – three proportional classes – small (small height-small weight), medium (medium height – medium weight), large – (large height – large weight) and the fourth class – pycknomorphs (short and large weight) and the fifth class – leptomorphs (large height and small weight). In all the studied students there were 36 anthropometric variables and 12 skinfolds measured and 64 indices calculated. It was statistically proven that the mean values of the variables in classes small – medium- large were also significantly statistically different. The same rule was proven as the classes 4 and 5 were compared – the mean values, all measured and calculated variables, were statistically significantly different.

At first the system was introduced in Estonia (1981) [14] and later on in Germany (1995) [15], in USA (2001) [16] and in Russia (2001) [17].

That classification is also accepted as an original way for the classification of the humans body build by the Editor-in-Chief of the American Journal of Physical Anthropology in her letter to Kaarma (Kees, 2009) [18].

Raschka (2006) in his book "Sportanthropologie" also named the system of Kaarma deserving high recognition and named it as a new innovative approach from Tartu: "the Estonian system for the sports and general constitutional typology".

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Tabel 1. French school according to Raschka (2006), modified by us – synonymes in [1]English and in [3]Estonian used

Author	Year	Narrow	Intermediate	Broad
Hallé	1797	[1]Cephalic type	Muscular type	Abdominal
		[2]Kephaler Typ	Muskulärer Tup	Abdominaler Typ
		[3]Kefaalne tüüp	Lihaseline tüüp	Kõhtmine tüüp
Rostan	1826	[1]Cerebral	Muscular	Digestive
		[2]Type cerebral	Type musculaire	Type digestiv
		[3]Tserebraalne tüüp	Lihaseline tüüp	Kõhtmine tüüp
Manouvrier	1902	[1]Macroskeleton type	Mesoskeleton type	Brachyskeleton type
		[2]Makroskeler Typ	Mesoskeler Typ	Brachyskeler Typ
		[3]Pika skeletiga tüüp	Keskmise skeletiga tüüp	Lühikese skeletiga tüüp
Sigaud	1914	[1]Cerebral type	Muscular type,	Kõhtmine tüüp
		[2]Type cerebral	Type musculaire, type respiratoire	Type digestiv
		[3]Tserebraalne tüüp	Lihaseline tüüp	Kõhtmine tüüp
Mac Auliffe	1925	[1]Flat type		Round type
		[2] Type plat		Type rond
		[3] Lame tüüp		Ümar tüüp
Schreider	1937	[1]Vertical type		Horizontal type
		[2] Vertikaler Typ		Horizontaler Typ
		[3]Vertikaalne tüüp		Horizontaalne tüüp
Martiny	1948	[1]Ectoblastic type		Entoblastic type
		[2]Type ectoblastique		Type entoblastique
		[3]Ektoblastne tüüp		Entoblastne tüüp

Tabel 2. Anglo-American school according to Raschka (2006), modified by us – synonymes in [1]English and in [3]Estonian used

Author	Year	Narrow	Intermediate	Broad
Walker	1823	[1]Mental type (Minerva)	Locomotion type (Diana)	Digestive type (Venus)
		[2]Mentaler Typ	Bewegungs Typ	Ernährungs Typ
		[3]Vaimne tüüp	Liikuv tüüp	Kõhtmine tüüp
Bryant	1913	[1]Carnivorous type	Normal type	Herbivorous
		[2]Carnivorer	Normaler Typ	Herbivorer Typ
		[3]Lihasööja tüüp	Normaalne tüüp	Taimetoiduline tüüp
Mills	1917	[1]Hyposthenic type	Sthenic type	Hypersthenic
		[2]Hyposthenisch	Sthenisch	Hypersthenisch
		[3]Hüposteeniline	Steeniline	Hüpersteeniline
Davenport	1923	[1]Slender type	Medium type	Fleshy
		[2]Slender Biotype	Medium Biotype	Fleshy biotype
		[3]Sale tüüp	Keskmine tüüp	Lihav tüüp
Stockard	1923	[1]Length-linear type		Lateral type
		[2]Längs-linearer Typ		Quer-lateraler Typ
		[3]Piklik-lineaarne tüüp		Laiamõõtmeline tüüp
Bean	1923	[1]Hyper-ontomorphic type (epitheliopathic)		Meso-ontomorphic type (Mesodermopathic)
		[2]Hyper-ontomorpher Typ (Epitheliopathen)		Meso-ontomorpher Typ (Mesodermopathen)
Sheldon	1940	[1]Ectomorph	Mesomorph	Endomorph
		[2]Ektomorpher Typ	Mesomorpher Typ	Endomorpher Typ
		[3]Ektomorfne tüüp	Mesomorfne tüüp	Endomorfne tüüp

Table 2. Continuation

Author	Year	Narrow	Intermediate	Broad
Rees/Eysenck	1945	[1]Leptomorphic type		Eurymorphic type
		[2]Leptomorph		Eurymorph
		[3]Leptomorfne tüüp		Eurimorfne tüüp
Burt	1947	[1]Leptosomatic		Pachysomatic
		[2]Leptosomisch		Pachysomisch
		[3]Leptosoomne		Pahhüsoomne

Tabel 3. Italian school according to Raschka (2006), modified by us – synonymes in [1]English and in [3]Estonian used

Author	Year	Narrow	Intermediate	Broad
de Giovanni	1877	[1]Phthisical –longitudinal	Thoracic	Polychaemic
		[2]Phthisischer (langliniger Habitus)	Athletischer (thorakaler) Habitus	Plethorischer Habitus (abdominaler)
		[3]Tuberkuloosne, kõhn	Atleetiline, rinnakas	Täisvereline, kõhtmine
Viola	1909	[1]Long type	Normal type	Brachy type
		[2]Longitypus, mikrosplanchisch	Normotypus, normosplanchisch	Brachytypus, Macrosplanchisch
		[3]Pikakasvuline, väikeseorganiline	Keskmisekasvuline, keskmiseorganiline	Lühike, suureorganiline
Pende	1922	[1]Catabolic, hypovegetative		Anabolic, hypervegetative
		[2]Katabolischer Typ, hypovegetativer		Anabolisher Typ, hypervegetativer
		[3]Kataboolne, hüpovegetatiivne tüüp		Anaboolne, hüpervegetatiivne tüüp
Castaldi	1928	[1]Platy		
		[2]Plati Typus		Sthenotypus
		[3]Lame tüüp		
De Toni	1953	[1]Leptosomatic		Pachysomatic
		[2]Leptosom		Pachisom
		[3]Leptosoom		Pahhüsoom
Correnti	1960	[1]Leptomorphic		Eurimorphic
		[2]Leptomorfo		Eurimorfo
		[3]Leptomorfne		Eurimorfne

Table 4. German school according to Raschka (2006), modified by us – synonymes in [1]English and in [3]Estonian used

Author	Year	Narrow	Intermediate	Broad
v. Rokitansky	1826	[1]Asthenic		Apoplectic
		[2]Asthenisch		Apoplektisch
		[3]Asteeniline		Apoplektiline
Carus	1853	[1]Cerebral, sensible, asthenic	Athletic	Polychaemic
		[2]Cerebrale, sensible, asthenische	Athletische	Plethorische
		[3]Tserebraalne, sensitiivne, asteeniline	Atleetiline	Pletooriline
Beneke	1878	[1]Scrofulos-phthisical	Rachitic	Carcinomatous
		[2]Scrophulös-phthisisch	Rachitisch	Carcinomatös
		[3]Tuberkuloosne-skrofuloosne	Rahhiitiline	Kartsinomatoosne
Huter	1907	[1]Sensible, sensitive	Movement type	Digestive
		[2]Empfindungsnaturell	Bewegungsnaturell	Ernährungsnaturell
		[3]Tundlik tüüp	Liikuv tüüp	Toitumist armastav tüüp
Stiller	1907	[1]Asthenic		Apoplectic-arthritic-hypertonic
		[2]Asthenisch, atonisch		Apoplectisch-arthritisch-hypertonisch

Table 4. Continuation

Author	Year	Narrow	Intermediate	Broad
		[3]Asteeniline, atooniline, lõtv		Apoplektiline-artriitiline-hüpertooniline
Stern	1912	[1]Long-growth stature		Width-growth stature
		[2]Hochwuchs		Breitwuchs
		[3]Pikakasvulised		Laiamõõtmelised
Tandler	1913	[1]Hypotonic	Normaltonic	Hypertonic
		[2]Hypotonisch	Normaltonisch	Hypertonisch
		[3]Hüpotooniline	Normaaltooniline	Hüpertooniline
Brugsch	1918	[1]Narrow-chested	Normal-chested	Wide-chested
		[2]Engbrüstig	Normalbrüstig	Weitbrüstig
		[3]Kitsarinnaline	Keskmiserinnaline	Laiarinnaline
Bauer	1919	[1]Asthenic habit		Arthritic habit
		[2]Asthenischer Habitus		Arthritische Habitus
		[3]Asteeniline kuju		Artriitiline kuju
Borchardt	1921	[1]Asthenic status		Irritable status
		[2]Status asthenicus		Status irritabilis
		Asteeniline		Erutatav
Kretschmer	1921	[1]Leptosome	Athletic	Pycnic
		[2]Leptosom	Athletiker	Pykniker
		[3]Leptosoom	Atleetiline	Püknik

Table 4. Continuation

Author	Year	Narrow	Intermediate	Broad
Hellpach	1922	[1]Frankish face		Swabian face
		[2]Fränkischer Gesicht		Schwäbischer Gesicht
		[3]Frankinägu		Švaabinägu
Aschner	1924	[1]Narrow individual	Middle individual	Broad individual
		[2]Schmale Individuen	Mittlere Individuen	Breite Individuen
		Kitsad isikud	Keskmised isikud	Laiad isikud
Mathes	1924	[1]Future-form		Juvenile-form
		[2]Zukunftsform		Jugendform
		[3]Tuleviku tüüp		Nooruslik tüüp
Pfuhl	1924	[1]Tall		Short
		[2]Longitypus		Brachytypus
		[3]Pikkusmõõtmeline tüüp		Laiusmõõtmeline tüüp
Jaensch	1926	[1]T-type (Basedow's)		B-type (tetanic)
		[2]T-typ (basedowoid)		B-Typ (tetanoid)
		[3]T-tüüp		B-tüüp
Friedenthal	1925	[1]Herdsman type	Huntsman type	Peasant type
		[2]Hirtentypus	Jägertypus	Bauerntypus
		[3]Karjasetüüp	Jahimehetüüp	Talumehetüüp
Weidenreich	1927	[1]Leptosome		Eurysome
		[2]Leptosom		Eurysom
		[3]Leptosoom		Eurüsoom

Table 4. Continuation

Author	Year	Narrow	Intermediate	Broad
Rautman	1928	[1]Leptosome, Hyposthenic	Mesosthenic	Hypersthenisch
		[2]Leptosom, Hyposthenisch	Mesosthenisch, mesosom	Hypersthenisch, pyknosom
		[3]Hüposteeniline-leptosoomne	Mesosteeniline-mesosoomne	Hüpersteeniline-püknosoomne
Buinewitsch	1940	[1]Hypoplastic		Hyperplastic
		[2]Hypoplastisch		Hyperplastisch
		[3]Hüpoplastiline		Hüperplastiline
Conrad	1940	[1]Leptomorphic	Metromorphic	Pycnomorphic
		[2]Leptomorph	Metromorph	Pyknomorph
		[3]Leptomorfne	Metromorfne	Püknomorfne
Hüttig	1942	[1]Neurogenic		Lymphatic
		[2]Neurogene Konstitution		Lymphogene Konstitution
		[3]Neurogeenne tüüp		Lümfogeenne tüüp
Curry	1946	[1]C-type(cold-front-type)		W-type(Warme-front-type)
		[2]K-Typ (Kalt front)		W-Typ (Warm front)
		[3]Külm tüüp		Soe tüüp
Schlegel	1957	[1]Andromorphic type		Gynaecomorphic type
		[2]Andromorpher Typ		Gynäkomorpher Typ
		[3]Mehelik tüüp		Naiselik tüüp

Table 4. Continuation

Author	Year	Narrow	Intermediate	Broad
Katsch	1959	[1]Ectodermal-vertebral		Entodermal-nutritional
		[2]Ektodermal-vertebral		Entodermal-nutritiv
		[3]Ektodermaalne-vertebraalne		Endoteliaalne-toiteline
Klaus/Noack	1961	[1]Leptosome	Athletosome	Pycnosome
		[2]Leptosom	Athletosom	Pyknosom
		[3]Leptosoomne	Atleetiline	Püknosoomne
Lampert	1962	[1]A-type, microkinetic		B-type, macrokinetic
		[2]A-Typ, mikrokinetischer		B-Typ, makrokinetischer
		[3]A-tüüp, mikrokineetiline		B-tüüp, makrokineetiline
Knußmann	1965	[1]Leptomorphic	Metromorphic	Pycnomorphic
		[2]Leptomorph	Metromorph	Pyknomorph
		[3]Leptomorfne	Metromorfne	Püknomorfne
Raschka	1993	[1]Tri-iodinethyronin-effect	Testosteron-effect	Oestrogenic-effect
		[2]Trijodthyronin-Effekt	Testosteron-Effekt	Östradiol-Effekt
		[3]Trijoodtüroniini mõju	Testosterooni mõju	Östradiooli mõju

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ANTHROPOMETRICAL AND SPORT CONSTITUTIONAL COMPARISON OF MALE AND FEMALE BALLROOM- AND LATIN-DANCERS WITH REGARD TO DIFFERENT PERFORMANCE LEVELS

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ABSTRACT

The aim of the present study was to examine the anthropometrical and sport-constitutional differences of male as well female Ballroom- and Latin-Dancers depending on their performance levels. For this purpose 29 male and 32 female dancers were anthropometrically analysed. The measurements were taken under standardised conditions and the results were evaluated statistically (ANOVA) after the subjects have been separated in 4 groups depending on their performance levels and gender, but without attending to the dancing style. To find differences between the body compositions skinfold measures, the Bioelectric-Impedance-Analysis (BIA), the Broca- and Body-Mass-Index (BMI) and AKS-Index were used. The exact defined landmarks after Conrad, Knussmann, Parnell and Heath/Carter were conducted as foundation of the examined and calculated measures of the body constitution.

Without responding to the well known sex differences only a view significant performance level specific characteristics were found. Overall the collected data shows that most of the anthropometrical values of male dancers at higher performance levels are by trend lesser than at lower performance levels: at the same average body height of about 179 cm the men at higher performance levels have greater weight (70.7 kg versus 75.6 kg), about 1.5 cm higher Sphyrion, about 1.4 cm smaller chest width, about 1.1 cm shorter shank and by trend a lower total body fat percentage (11.0% versus 14.0% [BIA]) in comparison to the men at lower performance levels. The research of the female dancers did not yield any meaningful performance level addicted findings. But all in all, most of the values of female sportsmen reveal an increasing trend in contrast to the female dancers of lower performance levels.

The average competition dancers, independent of gender and performance levels, seem to be moderately slender with a balanced **body's physical structure.** After the categorization of the body typification patterns the competition dancing take's its place – based on the relation of weight, strength and a stable tape apparatus – in the leptomorph area.

Key words: *Sports Anthropology, Ballroom and Latin Dancing, Body Composition, Body Fat, Somatotype*

INTRODUCTION

The origin of the Ballroom and Latin dancing dates back in time, due to the fact that dancing is one of oldest forms of approach and attitude to life. During World War 1 the public dancing was forbidden in Germany and France, therefore the English dancing instructors stood in the forefront of ballroom dance development, revolutionized it and finally established the state of the art [1]. Furthermore the evaluation directives were assessed in five categories: 1) feeling of the music tact and the basic elements, 2) rhythm, 3) balances, 4) motion sequence, 5) expression. Usually the national and international dancing tournaments are separated in two sections: the Ballroom dancing consisting of Slow Waltz, Tango, Viennese Waltz, Slow Foxtrot and Quickstep; and the Latin dancing (Samba, Cha-Cha-Cha, Rumba, Paso Doble and Jive).

The competition dancing is a serious sport. Beside physical conditions, it demands the musical-rhythmical sense and the competency to form a unity with the dancing partner, that also reveals the main focus of this sport. These parameters are difficult to research, whereas the anthropometrical characteristics could be measured and standardized.

The applied anthropology of sports is engaged in detecting the best of all suitable constitutional types to the respective sport. In this context, on the one hand, it is necessary to examine, to what extent the certain sports create a special body image drawing and, on the other hand, how a certain constitution influences the general and the special sports suitability. The supposition influences according to which direct coherence between the definite the body constitution, the equal physiological and psychological condition and the benefits in the decisive competition becomes controversially debatable [2]. Currently available data from sport anthropological investigations, concerning diverse sports, approve of this assumption [3]. Admittedly the assemblage of volumes and articles on the sport anthropology is rare, not to mention a discipline of dance. The aim of this investigation is to find important anthropometric data around the typical Ballroom and Latin performers depending on their performance levels from the point of the sports anthropology.

The German competition dancing association (DTV) was founded in 1921. Currently, according to the official homepage of the DTV, there are 220,000 registered members in 2,200 clubs, whereas 8,600 of them are active competition dancers in the Ballroom and Latin sections [4]. The trend of dance sport practicing is increasing [5]. DTV plays a meaningful role in the events of the International Dance Sport Federation, as well as a top-representative in the world competition ranking lists but also as an important organizer of IDSF-tournaments of a high level.

It is not only the body composition of dance performers which is of interest, but also the body compositional differences between the genders and the performance levels. This data could be useful by optimizing talent scouting of children and youth and for talent promotion.

In the present research the relative body fat was measured as well as the constitution typologies according to Parnell, Heath and Carter, Conrad and Knussmann were determined.

PARTICIPANTS AND METHODS

To evaluate the described hypothesis, the data of 29 male and 32 female Ballroom and Latin performers from two sport dancing clubs in Central Germany were collected and divided into four groups. Finally 13 male and 16 female performers from the lower performance levels (D/C/B) and further 16 male and 16 female performers from the higher performance levels (A/S) were anthropometrically measured. Their ages ranged from 16 years for the youngest to 49 years for the oldest participant. The countries of origin of performers and their distribution were: Germany (32f, 24m), Russia (1f, 2m), Greece (1f, 0m), Turkey

(0f, 3m). All the performers met the following inclusion criteria: the constant competition participation and the informed consent with this study.

During the anthropometrical examination the heights and lengths were measured with an anthropometer of the brand GPM Anthropological Instruments, the breadths and widths with a pelvimeter, the circumferences with a measuring tape, the skinfolds with the caliper of the brand Ti Xing and the body weight and the body fat percentage with the BIA-scale of the brand Korona. The measurements were realized by the author of this study under standardized conditions. The statistical analysis was performed using ANOVA. For each case included, the following data were reported besides anthropometrical facts: the age, the dexterity and the parameters of training configuration, like frequency and the duration of training and the continuity of the activity in the dancing sport.

The exact defined landmarks after Conrad, Knussmann, Parnell and Heath/Carter were conducted as rhe foundation of the examined and calculated measures of the body constitution. Beside the mentioned parameters additionally the BMI (Body-Mass-Index), the Broca-Index and the AKS-Index (Active-Body-Substance-Index) were used to differentiate the groups.

RESULTS

The observations summarized in Table 1 (selected parameters) show clear differences between the male and the female dance performers. Most of the additional parameters, such as widths, circumferences, thickness of subcutaneous fat layer, body fat percentages and the results of the single determinations of the constitution typologies also support this gender-specific differences.

With respect to the different performer levels the variations are decent. In relation to male performers there are only a few significant performance-level specific differences: the men of higher performance levels have greater weight (not significant), higher Sphyrion, smaller chest width, shorter shank (by the same average body height of about 179 cm) and lower total body fat percentage (not significant) in comparison to the men of low performance levels. Whereas the female performers mostly show the exact opposite to the conditions of the male performers at different levels: the female dancers at higher performance levels exhibit greater weight (not significant), shorter shank (by the same average body height of about 166 cm) and greater total body fat (not significant). At least the most of circumferences reveal an increasing trend in contrast to the female dancers of lower performance levels.

The Body-Mass-Index (BMI) defines a normal weight between 18.5–24.9 kg/m² [6]. All the performers of the present study offer a normal weight. Also, the Broca-Index attests a normal weight for both genders and performance levels (reference: –18% und +11% [6]). The AKS-Index-Diagram is demonstrated in Figure 1 and represents a weak to moderately developed active body substance/musculature in relationship with the body height.

The results of German determinants of the constitution types reveal for all the performers a picture of the leptomorph type. In particular, the chessboard pattern graphic after Conrad discloses the average dancers, independent of gender and the performance level, as moderately slim with the balanced body's physical structure. Furthermore, the plastic index after Conrad orders the male dancers, independent of performance levels to the metroplastic class and the female dancers more to the hypoplastic class (Fig. 2). The classification of pyknomorphy and makrosomia after Knussmann orders both genders to leptomorph-metrosom type (Fig. 3).

The male dancers of higher performance levels point a lower spreading in somatocharts of Parnell and Heath/Carter in contrast to the dancers of lower performance levels and all the female performers and reside in the mesomorphic area as well balanced subjects without any extreme. Compared with the male competition dancers, the average somatocharts of female subjects are located in the meso-endomorphic area. Figure 4 shows the averages in the somatochart after Heath/Carter.

Table 1. Averages, the standard deviation and the significance levels of the selected parameters for both genders and performance levels

Parameter	♂	♀	p	A/S		D/C/B		p
				♂	♀	♂	♀	
Age (in years)	26.4 ± 7.2	24.8 ± 7.1	n. s.	27.4 ± 9.6	26.8 ± 9.1	25.6 ± 4.5	22.9 ± 3.8	n. s.
Duration of training (in years)	8.0 ± 4.9	7.5 ± 5.9	n. s.	8.9 ± 5.9	8.8 ± 6.0	7.3 ± 3.9	6.2 ± 5.6	n. s.
Amount of training (in hours/week)	8.4 ± 2.9	8.1 ± 3.3	n. s.	8.1 ± 2.5	8.2 ± 3.4	8.7 ± 3.2	8.1 ± 3.2	n. s.
Body height (in cm)	179.3 ± 6.1	166.0 ± 5.5	≤ 0.001	179.5 ± 6.0	166.0 ± 5.1	179.2 ± 6.4	165.9 ± 6.1	n. s.
Body weight (in kg)	73.4 ± 9.6	60.5 ± 7.2	≤ 0.001	70.7 ± 9.6	61.7 ± 7.8	75.6 ± 9.3	59.3 ± 6.7	n. s.
Body fat (in %) after skinfold method	14.4 ± 6.9	22.5 ± 3.2	≤ 0.001	12.6 ± 3.5	22.8 ± 3.6	15.9 ± 8.6	22.1 ± 2.8	n. s.
Body fat (in %) after BIA	12.6 ± 4.9	24.7 ± 4.7	≤ 0.001	11.0 ± 3.3	25.6 ± 5.8	14.0 ± 5.7	23.7 ± 3.2	n. s.
Sphyrion (in cm)	8.1 ± 1.1	7.8 ± 0.7	n. s.	9.0 ± 0.9	7.8 ± 0.8	7.5 ± 0.8	7.8 ± 0.8	≤ 0.01
Chest width (in cm)	28.3 ± 1.9	25.3 ± 1.5	≤ 0.001	27.5 ± 1.5	25.3 ± 1.5	28.9 ± 2.0	25.3 ± 1.5	0.05
Shank length (in cm)	40.8 ± 2.8	37.0 ± 3.0	≤ 0.001	39.7 ± 2.7	36.4 ± 2.8	41.8 ± 2.6	37.6 ± 3.2	0.02
BMI (in kg/m²)	22.8 ± 2.7	22.0 ± 2.3	n. s.	21.9 ± 2.0	22.4 ± 2.9	23.6 ± 3.0	21.6 ± 1.5	n. s.
Broca-Index (in %)	92.6 ± 10.6	108.6 ± 12.0	≤ 0.001	88.9 ± 7.8	110.8 ± 15.3	95.7 ± 11.8	106.3 ± 7.2	n. s.
AKS-Index	1.1 ± 0.1	1.05 ± 0.1	0.03	1.1 ± 0.1	1.05 ± 0.1	1.1 ± 0.1	1.0 ± 0.1	n. s.

Table 2. Averages, the standard deviation and the significance levels of the parameters of the determination of the constitution typologies for both genders and performance levels

Parameter	♂	♀	p	A/S		D/C/B		p
				♂	♀	♂	♀	
Metrik-Index (after Conrad)	–1.0 ± 0.4	–1.2 ± 0.3	≤ 0.01	–1.1 ± 0.4	–1.2 ± 0.3	–0.9 ± 0.5	–1.3 ± 0.3	n. s.
Plastik-Index (after Conrad)	4.7 ± 1.3	3.6 ± 1.2	≤ 0.001	4.5 ± 1.3	3.6 ± 1.3	4.9 ± 1.3	3.6 ± 1.2	n. s.
Pyknomorphy (after Knussmann)	–2.6 ± 1.9	–1.4 ± 1.2	≤ 0.01	–3.3 ± 1.4	–1.5 ± 1.5	–2.0 ± 2.1	–1.4 ± 1.0	n. s.
Macrosomia (after Knussmann)	3.0 ± 1.4	3.0 ± 1.5	n. s.	3.1 ± 1.4	3.0 ± 1.5	3.0 ± 1.4	3.0 ± 1.4	n. s.
Endomorphy (after Parnell)	4.0 ± 0.8	4.7 ± 0.7	≤ 0.001	3.7 ± 0.5	4.6 ± 0.7	4.3 ± 1.0	4.8 ± 0.8	n. s.
Mesomorphy (after Parnell)	3.7 ± 1.1	3.3 ± 1.0	n. s.	3.5 ± 0.6	3.4 ± 0.9	3.8 ± 1.3	3.3 ± 1.1	n. s.
Ectomorphy (after Parnell)	3.8 ± 1.1	3.3 ± 1.0	0.04	4.3 ± 0.9	3.3 ± 1.3	3.4 ± 1.1	3.3 ± 0.7	n. s.
Endomorphy (after Heath & Carter)	3.6 ± 1.6	4.8 ± 1.1	≤ 0.001	3.1 ± 0.9	4.9 ± 1.2	4.0 ± 1.9	4.6 ± 1.0	n. s.
Mesomorphy (after Heath & Carter)	4.2 ± 1.2	3.8 ± 1.1	n. s.	3.8 ± 0.7	3.9 ± 1.1	4.5 ± 1.4	3.8 ± 1.2	n. s.
Ectomorphy (after Heath & Carter)	3.0 ± 1.1	2.5 ± 1.1	n. s.	3.3 ± 1.0	2.4 ± 1.3	2.8 ± 1.1	2.6 ± 0.8	n.s.

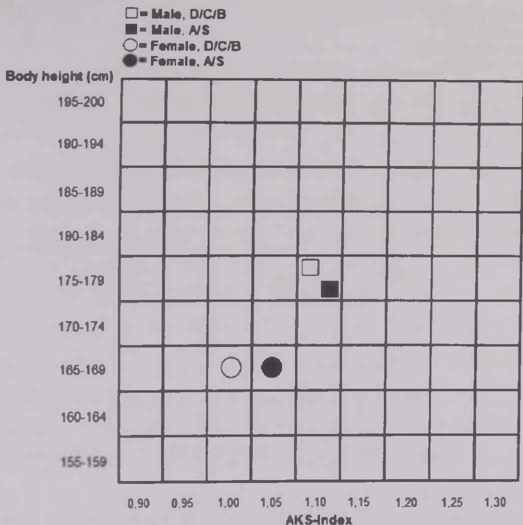

Fig. 1. AKS-Index-Diagram with the averages of both genders and performance levels

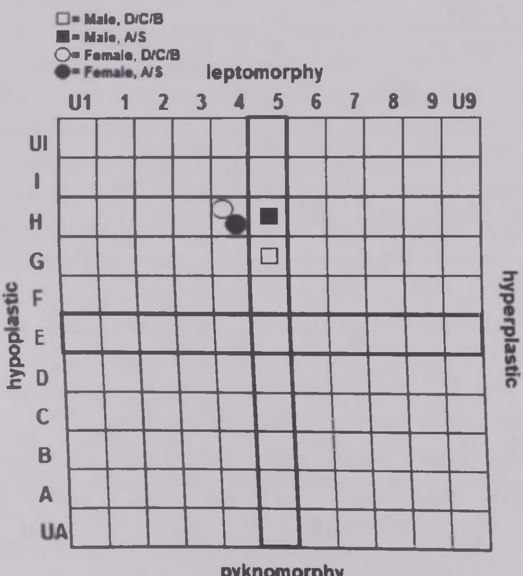

Fig. 2. Chessboard pattern graphic after Conrad with the averages of both genders and performance levels

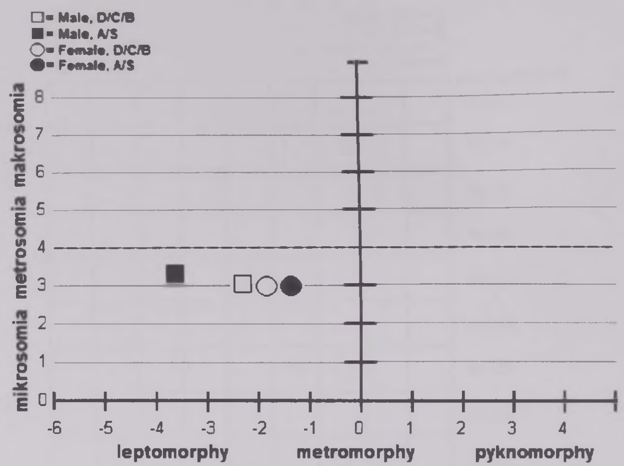

Fig. 3. System of the constitution types after Knussmann with the averages of both genders and performance levels

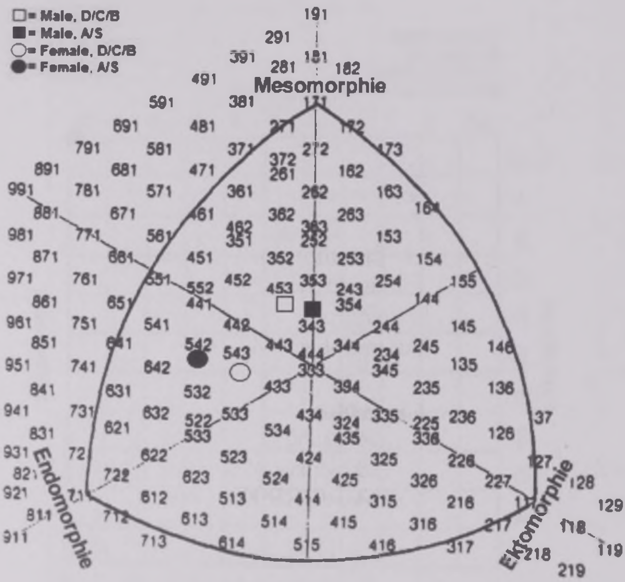

Fig. 4. Somatochart after Heath and Carter with the averages of both genders and performance levels

DISCUSSION

The present study demonstrates of the clear gender specific and certain performance level the specific differences according to the collected data.

The male and the female dancers of both performance levels do not differ in their height (male subjects: about 179 cm; female subjects: about 166 cm) and are almost at the national average. According to the Federal Office of Statistics the average height for 18 to 40 year old women in the Federal Republic of Germany is about 167 cm and for men int the same age about 180cm [7]. This could be an indication that the people with an average height are prone to the dance sport preferentially. The findings of the average body weight at different performance levels for men reflect a clear trend. The male dancers of the higher performance levels with an average body weight of 70.7 kg are approximately 5 kg below the dancers of lower performance levels and 10 kg below the national wide average [7]. In contrast to the male dancers, the female dancers of higher performance levels reveal a difference of 2 kg above the female dancers of lower performance levels. The detection of an ideal or optimal weight is especially important for the esthetic picture of a competition dancer, beside the technical skills and musical sense. In relation to the body fat percentage there is a similar trend between male and female performers. This gives rise to the hypothesis that the male dancers of higher performance levels deliver a better esthetical picture with less weight toward the subjects of lower levels. On the other hand, the importance of fat layer as a tissue by competitive athletes is provided rather in its lack as in its wealth [8]. The dance performers have to generate a high persevering achievement in certain intervals. The extensive fat depots do not bring any advantages according to the demanded effort. The observation of hypodermic fat tissue detects not only the gender-specific differences in the context of sexual dimorphism, but also the differences in the kind of the distribution of the hypodermic fat tissue: special accumulation areas as triceps, calves and thigh. The similar distribution pattern of the fat layer was also detected by Beyer [9] in the observation of Formation-dancers and Moer [10] as well.

Further, one of the few significant performance-level specific differences is about 1.5 cm higher Sphyrion of male dancers of the higher performance levels. A possible explanation of this difference could be searched, on the one hand, in the footwear and, on the other hand, in a certain typical dance technique. The shoes of the male Ballroom dancers feature a more plane heel (approx. 2.5 cm of height) in contrast to the Latin dancers (4–5 cm) or the female dancers (>5 cm). Almost all the ballroom disciplines (up to Tango) are characterized by constant lifting and sagging movement using a deliberate footwork. Mechanical strain results in an increased muscle cross section, muscle strain and a strengthening effect on ligaments, tendons and bones. De Marées describes this phenomenon as the adaptive hypertrophy [11].

The slender chest of the male performers of the higher levels is perhaps connected with the lower weight of the sportsmen of this league and is a mark of more gracile body construction. The pattern of the shorter shank of the higher level performers is comparable with the values of Beyer [9] and cannot be explained by differences in the body height or adaptive hypertrophy.

The male dance sport performers, irrespective of the performance levels, could be arranged by the consideration of the AKS-Index-Diagram to the same step with top athletes from the Cross-Country-Skiing disciplines or Long Jump [12]. The female performers do not allow any common classification with other sport disciplines. The relation to other sports merely serves to the better descriptiveness and does not offer obligations. Otherwise it could be a helpful observance that the certain body constitution facilitates the achievement of a higher performance level.

The average competition dancers, independent of gender and performance levels, seem to be moderately slender with a balanced body's physical structure (in that form also considered by Beyer [9]). In the atlas of Flügel et al. [13] the suggested averages of the shoulder widths are always bigger than the age-related values of the performers of the present study. This is another proof of the especially distinctive gracility of the dance sportsmen.

After the categorization of the body typification patterns the competition dancing takes its place – based on the relation of weight, strength and a stable tape apparatus – in the leptomorph area, also supported by Beyer [9]. According to Knussmann [14] the leptomorph body type is for a jumper and a runner particularly suitable, probably because of a low relative body weight which is an advantage on the locomotion.

The better comparability of the sportsmen in further studies is achievable by classification according to the connection of engagement duration to the sport and the whole training time per week. The membership in achievement classes like A/S does not afford a sure comparison for female performers, because their achievement class is directing to them their male partners.

In this investigation the sport anthropometry is proved as a relatively quick and cheap method, without any invasiveness. Some experts distinguish a big potential of this method in the talent sighting. The actual level of knowledge rests on the recent cross section studies which allow only a limited exploration. Furthermore, the special circumstances concerning the dance position, choreographical creation, footwear and training creation offer an extensive research spectrum to the other differentiation of this sport.

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IMPACT OF THE CORRELATION BETWEEN NORMALLY DISTRIBUTED SAMPLES OF STATURE AND BODY WEIGHT UPON BODY MASS INDEX STATISTICS

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ABSTRACT

The body mass index (BMI) is not only determined by the absolute values of its parent variables body weight (W) and height (H) but also by the correlation between them. Other influencing factors are the distributions of these variables. While the stature is normally distributed as a rule, the body weight is usually skewed to the right. To avoid such a bias upon BMI, only computer-generated normally distributed variables were used in this study. A stepwise change ranging from 0.1 to 0.9 in the correlation between W and H was applied to generate different samples, and to study the resulting changes in BMI statistics. W and H were chosen to imitate representative male and female samples. It was shown that for any sample, there was one single correlation that created the best results with respect to the skewness of BMI. This specific correlation also led to those characteristics of BMI that are prerequisites of its proper usage: an absent correlation between BMI and H, a high correlation between H and W, and a slope of 2 in the regression between the logarithms of W and H. However, the male samples performed better than the female ones. Therefore, these should always be used whenever the samples comprising all the essential attributes of BMI are needed for model studies. They can be generated by a special computer program, which was assembled to serve this purpose.

Key words: *Body mass index, correlation, statistics, normal distribution, computer-generated samples*

INTRODUCTION

The body mass index (BMI), which is the quotient between the body weight (W) and the height (H) squared, is widely used to characterise the body shape, and to define grades of obesity. H, one of the leading characteristics of human build, is known to be normally or almost normally distributed, whereas the distribution of W is regularly shifted to the right. Such a deviation from normality might influence BMI results. Furthermore, it is claimed that BMI should be ideally correlated highly with W but not correlated with H. This, however, is not always true in real population samples.

One of the main determinants of BMI statistics is the correlation r_{HW} between H and W. However, its effect has never been studied in detail, because many parameters like gender, age, and ethnicity create an uncontrollable bias. Therefore, it seemed intriguing to study BMI formation by processing calculations with normally distributed model populations only.

The study is designed to examine systematically the influence of a stepwise change in the correlation between two computer-generated normally distributed variables H and W with preset linear correlations between them upon changes in several BMI statistics, especially skewness, correlations between BMI, W and H, and linear regression between the logarithms of W and H.

METHODS

The modelled samples of this study were based on the published data of the means and standard deviations (SD) of H and W. It is well accepted that the dispersion of H is small, and the coefficient of variation (VC_H) is as low as 3 to 4% for both men and women. The variability for W, however, is about 4 times larger than VC_H in men ($VC_W \approx 16\%$) and about 5 times as high in women ($VC_W \approx 20\%$). This latter fact is due to the higher proportion of overweight in women.

The study used 4 different samples based on two different figures for H and two different Ws each. These compare well with the data from the literature (Table 1).

Table 1. Statistics of Normally Distributed Samples A to D

grp	H	SD_H	VC_H	W	SD_W	VC_W	Q
A	160	6.4	4.0	66.0	10.7	16.0	4.0
B	160	6.4	4.0	66.0	13.2	20.0	5.0
C	170	6.8	4.0	77.0	12.3	16.0	4.0
D	170	6.8	4.0	77.0	15.4	20.0	5.0
female	160	6.3	4.0	67.1	13.6	20.1	5.1
male	172	6.8	3.9	76.6	12.5	16.3	4.1

Q is the quotient between VC_W and VC_H, which is lower for men and higher for women. Data for female and male represent means of studies published in [3]. They are based on data of 210,531 men and 174,611 women.

Groups A and C characterise males, whereas B and D are examples of female populations with different H and W. The effects between male and female populations are likely to be seen from comparing A with B and C with D, respectively.

An SPSS syntax program (full listing is given in the Appendix) was designed to produce normally distributed samples of H and W with preset parameters (mean, SD) and a variable linear correlation between H and W (r_{HW}), variable within the margins of 0.10 and 0.90. The maximum absolute difference between preset r_{HW} and the results produced by the program were less than 0.015. The slope of the regression line was 1.000 ± 0.003 ($n = 70$), which deemed sufficient for the envisaged task.

Each run of the syntax program produced a sample of 50,000 data sets. Six different values for the correlation coefficient r_{HW} were used in each of the groups A to D to study their effects on BMI statistics.

RESULTS

Table 2 lists the BMI statistics for increasing correlations r_{HW} in groups A to D. Though H and W were held constant for each run, the BMI means decreased with the increasing coefficient r_{HW}. This is because the dispersion of BMI as seen from changes in SD and VC is large and hence its distribution is skewed to the right for an r_{HW} of between 0.3 and 0.4, but is shifted to the left, as soon as r_{HW} became larger than approximately 0.4 to 0.5.

This change in skewness is noticeable in those statistics, which usually indicate deviations from the normal distribution: the difference between median and mean (diff), the results for skewness (skew) and the Kolgomorov-Smirnov test (K-S). However, in each of the groups A to D, all these statistics indicate normal distribution for a single one r_{HW}. The value of r_{HW} producing a normal or almost normal distribution of BMI was lower for groups B and D (between 0.3 and 0.4), but larger for A and C (between 0.4 and 0.5). The exact values for r_{HW}, which would result in a normal distribution of BMI, were not searched because this study aimed to demonstrate the typical effects of correlation changes only.

The excess (kurt) of the BMI distributions did not follow skewness consistently. Its lowest figures did not always appear at the same r_{HW} level as skewness. The reason for this result was not studied further.

In all the samples there was a positive correlation r_{WBMI} between W and BMI obtained. This is one of the qualifications in using BMI. It passed through a shallow minimum of r_{HW} between 0.3 and 0.4 in groups B and D, and 0.4 to 0.5 in groups A and C, respectively. A much stronger influence of r_{HW} was observed on the correlation between H and BMI (r_{HBMI}). It started with negative figures and passed through zero to positive ones. This correlation should be zero ideally. Then again, the lowest figures were found following the same pattern as stated before.

The slope b of the regression $\log(W) = a + b \cdot \log(H)$ is expected to be 2, if BMI is to correctly describe the relationship between H and W. The results showed that $b = 2$ would again be obtained at the same r_{HW} levels as already described for the other statistics of groups A to D.

The statistics discussed previously showed that reasonable results could be obtained under suitable conditions for every single group. However, this statement is restricted, for in those groups with a large variability in W, as in the "female" groups B and D, the minimum for BMI is well below 10 or 12 that is considered the margin to be compatible with life [1].

Table 2. BMI Statistics for Groups A to D at different r_{HW}

grp	mean	SD	VC	min	max	median	diff	skew	kurtosis	K-S	signif	r_{hw}	r_{WBMI}	r_{HBMI}	a	b
A01	25,87	4,45	17,21	8,9	47,9	25,78	0,09	0,151	0,069	2,345	0,000	0,103	0,882	–0,370	1,728	0,422
A03	25,79	4,06	15,75	8,3	45,7	25,71	0,08	0,108	0,100	1,964	0,001	0,294	0,870	–0,209	1,568	1,207
A04	25,77	3,84	14,90	10,1	42,6	25,74	0,03	0,064	0,080	1,512	0,021	0,398	0,866	–0,107	1,479	1,642
A05	25,73	3,57	13,89	9,9	41,2	25,73	0,00	–0,005	0,060	0,789	0,582	0,512	0,865	0,018	1,384	2,107
A07	25,66	3,11	12,11	12,3	38,1	25,73	–0,07	–0,138	0,093	2,164	0,000	0,694	0,875	0,266	1,231	2,858
A09	25,59	2,47	9,65	11,2	33,8	25,73	–0,14	–0,390	0,351	5,568	0,000	0,905	0,928	0,689	1,055	3,724
B01	25,86	5,39	20,85	4,8	52,6	25,77	0,09	0,114	0,060	1,681	0,007	0,103	0,921	–0,286	1,701	0,536
B03	25,76	5,00	19,39	4,0	50,1	25,70	0,07	0,060	0,085	1,247	0,089	0,294	0,915	–0,109	1,497	1,536
B04	25,74	4,75	18,44	4,4	46,6	25,75	–0,01	–0,019	0,085	0,891	0,405	0,407	0,915	0,010	1,378	2,123
B05	25,69	4,51	17,54	5,4	45,1	25,73	–0,04	–0,062	0,069	1,419	0,036	0,512	0,917	0,133	1,264	2,682
B07	25,60	4,06	15,84	6,9	41,7	25,73	–0,13	–0,197	0,121	2,916	0,000	0,694	0,927	0,383	1,069	3,638
B09	25,52	3,47	13,60	4,8	37,3	25,70	–0,18	–0,413	0,360	5,829	0,000	0,905	0,964	0,763	0,844	4,739
C01	26,74	4,60	17,22	10,4	48,5	26,63	0,12	0,159	0,108	2,500	0,000	0,104	0,882	–0,371	1,783	0,426
C03	26,68	4,20	15,73	10,6	46,1	26,59	0,09	0,117	0,076	2,176	0,000	0,289	0,868	–0,208	1,601	1,215
C04	26,65	3,95	14,82	10,6	46,2	26,59	0,05	0,059	0,073	1,412	0,037	0,405	0,866	–0,101	1,498	1,665
C05	26,62	3,69	13,88	11,6	44,7	26,62	–0,01	0,000	0,085	0,885	0,413	0,512	0,864	0,017	1,398	2,101
C07	26,54	3,21	12,09	12,2	38,8	26,62	–0,08	–0,131	0,068	2,185	0,000	0,695	0,875	0,266	1,223	2,857
C09	26,46	2,55	9,62	12,9	34,7	26,61	–0,15	–0,374	0,289	5,563	0,000	0,905	0,928	0,689	1,028	3,706
D01	26,72	5,57	20,84	3,0	55,3	26,63	0,09	0,126	0,131	1,912	0,001	0,105	0,921	–0,283	1,751	0,549
D03	26,65	5,17	19,39	4,4	49,3	26,58	0,07	0,056	0,069	1,524	0,019	0,294	0,915	–0,110	1,524	1,534
D04	26,59	4,90	18,41	6,1	50,5	26,61	–0,02	–0,014	0,095	0,786	0,567	0,409	0,915	0,013	1,385	2,137
D05	26,56	4,67	17,58	4,7	47,2	26,62	–0,06	–0,079	0,114	1,317	0,062	0,507	0,916	0,127	1,266	2,656
D07	26,49	4,20	15,87	4,4	41,4	26,61	–0,12	–0,204	0,147	3,079	0,000	0,694	0,929	0,386	1,033	3,670
D09	26,38	3,59	13,60	7,2	40,0	26,61	–0,23	–0,431	0,413	6,341	0,000	0,905	0,961	0,764	0,784	4,747

A01 indicates results for group A with a preset $r_{HW} = 0.1$, and accordingly for other groups. Significance levels are not given because only semi-quantitative results were sought.

DISCUSSION

This preliminary study used sample populations normally distributed in H and W to generate BMI. As soon as the means of H and W and their variances were fixed, r_{HW} was the main determinant of the other BMI statistics. In order to satisfy all the necessary prerequisites for an appropriate use of BMI r_{HW} cannot be chosen freely. The best results must only be expected for a "male" sample population like C, and a correlation coefficient $r_{HW} \approx 0.5$. "Female" samples would hardly meet all the criteria.

Though this conclusion was drawn from the idealised normally distributed samples only, it seems to hold for real populations as well: male rather than female samples are better candidates for meeting the desired zero-correlation between H and BMI, and a slope of 2 in the log(W)-log(H) regression analysis. The random effect average correlation r_{HW} was reported to be 0.026 for males and –0.119 for females [3]. The same study has shown that the average slope in female groups was significantly lower than the average slope for men. Among 40 groups of male samples there was a slope of 2 in only 25 cases (62.5%) within the 95% confidence interval, but 12.5% of cases (in 4 samples out of 32) only in female samples.

In conclusion, if a normally distributed sample population is needed as a reasonable model in BMI studies, variables have to be within narrow margins only. The results also support the advice to prefer population- and gender-specific relationships between H and W instead of a fixed index like BMI, which is used for both men and women and for different ethnicities [2].

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Appendix

```
* SPSS SYNTAX PROGRAM
for generating two normally distributed variables H and W
linearly correlated with a preset correlation coefficient r.
* Copyright York Hilger, 06/2010.

* enter number n of desired datasets.
* enter mean M(H), and SD(H).
        input program.
                loop #i = 1 to n.
                compute H = rv.normal(M(H),SD(H)).
        end case.
        end loop.
        end file.
        end input program.

*standardise DumW, a dummy variable for W.
        compute DumW = H – 100.
        desc DumW /save.

* enter mean M(W), compute WDes of desired W.
        compute WDes = M(W).

* enter SD(W), compute SDWDes of desired SD(W).
        compute SDWDes = SD(W).

* enter correlation coefficient r and compute RDes, the desired r.
        compute RDes = r.

* parameter for deviation Dev of ZW.
        compute         PDev = 9.4201 – 32.326*RDes+ 45.2188 *
                        RDes**2 – 23.071 * RDes**3.
         if (RDes< 0.20) PDev = 1.1621 * (RDes**(–0.9204)).
         if (RDes> 0.80) PDev = 0.3645 + 3.8587 * RDes**2 – 4.1429 *
                        RDes**3.
         compute Dev= rv.normal(0,PDev).

* standardise ZW.
        compute ZW = ZDumW + Dev.
        desc ZW/save.
* compute W.
```

*compute W = ZZW * SDWDes + WDes.*

* controlling result: compute correlation between H and W.
corr H with W.

* end of program.
delete var ZW, ZZW.

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METABOLISM AND GROWTH FACTORS IN EARLY EMBRYOGENESIS OF INVALID FOR IMPLANTATION OBTAINED IN VITRO FERTILIZATION (IVF) HUMAN EMBRYOS

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ABSTRACT

The aim of this work was the detection of growth factors, metabolic enzymes, genes and apoptosis in invalid for implantation human *conceptus*.

Different n 2–6 days old 63 embryos, retardated in growth, were donated after IVF and ICSI. Immunohistochemistry was used for the detection of lactate dehydrogenase (LD), hexokinase, bFGF, FGFR1, IGF, IGF1R, TGFα, Oct 3/4, *wnt, barx1*, caspase 6.

The results showed the variable expression of LD on the 3rd day and increase on the 4th day. Few cells were hexokinase positive on the 3rd and the 6th day. Despite variable bFGF expression, FGFR1 was richly expressed on the 3rd and the 4th day. IGF was seen in occasional cells of the 4-day-old embryo, but IGF1R was found in all the developmental time, except the 4th day. Few cells showed Oct3/4 and TGFα expression in 3-day-old embryo. Apoptosis affected blastomeres on the 3rd and the 4th day. *barx1* and *wnt* were expressed from the 4-cell embryos.

Conclusions. The variable expression of LD, bFGF, rich for FGF1R and limited for hexokinase and TGFα between days 3 and 4 possibly is the reason for growth retardation in invalid for implantation human embryos. Downregulation of IGF1R expression correlates to the increase of apoptosis. First gene expression starts from the 4-cell stage and blastomeres show pluripotency.

***Key words:** embryos, IVF/ICSI, metabolism, growth factors, human*

INTRODUCTION

Infertility is a complicated, delicated and psychological life quality decreasing disease the incidence of which is high in European countries, including Latvia, and varies from 20–30% of population couples. Thus, *in vitro* fertilization (IVF) is a choice method to get an offspring for reaching such a couple. However, the success of this method is different in different age groups, mainly reaching around 20% and the main complications are connected to the retardation of embryo and/or different number of pronucleus [5, 9]. The research of last year revealed that the high growth factor ligand, receptor gene expression, metabolic processes and cell death seem to be associated with good quality embryos, and therefore are potential markers for embryo viability [14, 15]. In order to discover why growth factors and their receptors, as well as gene expression, make human embryos unusable for implantation, the human embryos must be studied morphologically. During IVF morphological criteria are the only means usable today to select embryos before their uterine transfer in order to obtain pregnancy with the best chances of success [2].

Different stages of the mouse embryo – 1-cell, 2-cell, 6–8cell, morula and blastocysts – were examined in different ways to determine whether a growth factor or gene has had any impact with the outcome of IVF embryos [20]. There is increasing evidence about a number of growth factors – the fibroblast growth factor and its receptors, the insulin growth factor and its receptors, the epidermal growth factor, affecting the rate of embryo development, the proportion of embryos developing to the blastocyst stage, the blastocyst cell number, metabolism and apoptosis [10]. Also, metabolic enzymes are important for the development of embryo due to their ability to increase or decrease growth properties [6]. Finally, previous studies clearly showed that programmed cell death or apoptosis is triggered in arrested human embryos. However, the pathogenetical mechanism during which embryo fragments interfere with the development of non-arrested embryos remains to be clarified [13]. Despite to the above mentioned facts, due to the ethical consideration and difficulties in obtaining material, the main part of research still deals with the animal, but not the human material. Thus, the aim of our work was the detection of different metabolic enzymes, growth factors and genes in not valid after *in vitro* fertilization human embryos (due to the abnormal chromosome complex and/or growth retardation).

MATERIAL AND METHODS

Patients. Human embryos collection and research was done in accordance with the permission of the Central Medical Ethical Committee of Latvia from 22 May 2007. Embryos were obtained from 19 patients aged from 23 to 41 years. Infertility grade varied from I to II stage, in four cases was connected to endometriosis, in three cases seemingly was raised by oviduct pathologies, but unknown aetiology was detected in 2 cases. Also, oviduct and uteral pathologies were observed in 4 females, but 6 cases demonstrated persisting male factor (Table 1). The main procedure done for fertilization was intracytoplasmic sperm injection (ICSI), but 6 couples underwent IVF.

Embryos. The next mediums were used for embryo preparation: for embryos growing from 0 to 2 day ISM 1, Medicult; for embryos growing from 3 to 5 day ISM 2, Medicult (Finland). All together we got 63 embryos: 2 were 2 days old, 51 were 3 days old, 7 were 4 days, but 3 – 6 days old. *Conceptus* evaluation was detected in accordance with the used in IVF clinics evaluation grades, when the quality of embryo was evaluated by 2 numbers: the first indicates the number of cells, the second – the grade of embryo and/or the class of blastocyst [20]. We indicated the normal structure behind each case in Table 2.

The embryos invalid for implantation were stained for immunohistochemistry by using the biotin-streptavidin method [11] with the following antibodies: hexokinase (rabbit, 1: 100, *abcam*, UK), lactate dehydrogenase (LD, goat, 1: 200, *abcam*, UK), the insulin growth factor I receptor (IGFIR, goat, 1: 100, *RD Systems*, UK), the insulin growth factor (IGF, mouse, 1: 50, *RD Systems*, UK), the basic fibroblast growth factor (bFGF, rabbit, 1: 200, *abcam*, UK), the fibroblast growth factor receptor one (FGFR1, 1:100, *abcam*, UK), transforming the growth factor alfa (TGF α, mouse, 1: 100, *abcam*, UK), the epidermal growth factor receptor (EGFR, mouse, 1: 50, *Santa Cruz Biotechnology, Inc*, Europe), Oct ¾ (mouse, 1: 250, *Santa Cruz Biotechnology, Inc*, Europe), *wnt* (rabbit, 1: 100, abcam, UK), *barx1* (rabbit, 1: 250, *abcam*, UK), *msx2/hox8* (mouse, 1: 250, *abcam*, UK), caspase 6 (mouse, 1: 250, *abcam*, UK).

Table 1. Information about the patients

Female age (years)	Diagnosis	Used Sperm Husband (H)/Donor (D)	Procedure ICSI/ IVF
23	Infertility II. Endometriosis externa I	H	ICSI
25	Infertility I	H	IVF
27	Infertility I	H	ICSI
28	Infertility II. Status post salpingectomia bilateralis	H	ICSI
29	Infertility II. Oligoteratozoospermia	H	ICSI
30	Infertility I. Astenoteratozoospermia	H	ICSI
30	Infertility I	H	ICSI + IVF
30	Infertility I	H	IVF
31	Infertility I	D	IVF
34	Infertility II. Teratozoospermia	H	ICSI
35	Infertility I. Endometriosis externa III	H	ICSI
37	Infertility I. Endometriosis in anamnesis. Teratozoospermia	H	IVF
37	InfertilityII. Adnexitis bilateralis chronica adhesiva Teratozoospermia	H	IVF
38	Infertility I. Genetical pathology of husband	Donor	IVF
38	Infertility I. Endometriosis externa	H	ICSI
40	Infertility II. Status post tuboectomia	H	ICSI
40	Infertility I. Myoma uteri.	H	ICSI
41	Unknown factors for infertility	Donor	ICSI
41	Unknown factors for infertility	Donor	IVF

ICSI – intracytoplasmic sperm injection
IVF – *in vitro* fertilization

For structure quantification the semi-quantative counting method was used. The designations were the following: 0 – negative reaction; 0/+ – occasionally marked structures in the view field; + – few positive structures in the view field; ++ – moderate number of marked structures in the view field; +++ – numerous number of marked structures in the view field; ++++ – abundance of marked structures found in the view field.

Table 2. Information about embryos

Female age (years)	Day	No of *conceptus*	*Conceptus* evaluation	Normal structure
28	2	2	50% fragmentation	4-5.1-3
23	3	3	5.5	8-12.1-3
27	3	2	50% fragmentation	
29	3	3	50% fragmentation	
30	3	9	4.5x7; 3.5x2	
30	3	1	4.3	
31	3	3	4.5; 50% fragmentation	
34	3	2	5.350% fragmentation	
35	3	3	7.3x2; 5.3	
37	3	6	5.3, 1PN, 3PN	
37	3	3	5-6.4-5	
38	3	3	5.5; 7.5; 3PN	
38	3	6	7.4; 6.4x4; 3.5	
40	3	3	5-6.4-5	
41	3	2	5-6.4-5	
41	3	2	50% fragmentation	
30	4	5	5.3x3; 8.3x2; 50% fragmentation	III–VI class blastocyst
40	4	2	4.4	
25	6	3	16.5; 50% fragmentation	

RESULTS

Lactate dehydrogenase demonstrated variable expression in 3-day-old embryos – from the absence until the total staining of cells (Table 3) with few positive blastomeres in the main part of cases (Fig. 1). Also, 4-day-old *conceptus* demonstrated a moderate number of LD expressing cells.

Hexokinase immunoreactivity was unequal in the age aspect – few positive cells were marked in 3 and 6-day-old embryos, while 4-day-old blastomeres did not show any immunoreactivity for this enzyme. However, some small blastomeres of morula showed hexokinase immunoreactivity (Fig. 2).

Table 3. Relative appearance of different metabolic enzymes, growth factors and their receptors, and apoptosis in invalid human embryo after IVF

Factors/*Conceptus* age (days)	LD	Hex	bFGF	FGFR1	IGF	IGF1R	Caspase	Oct3/4	TGFα
2; n=2					0	++			
3; n=51	0–+–++++	+	0–+–++++	++++	0	+	+	+	0/+–+
4; n=7	++	0	0	++++	0/+	0	+/++		
6; n=3		+			0	+++			

0 – negative reaction;
0/+ – occasionally marked structures in the view field;
+ – few positive structures in the view field;
++ – moderate number of marked structures in the view field;
+++ – numerous number of marked structures in the view field;
++++ - abundance of marked structures found in the view field;
The most common appearance of the distribution is underlined.

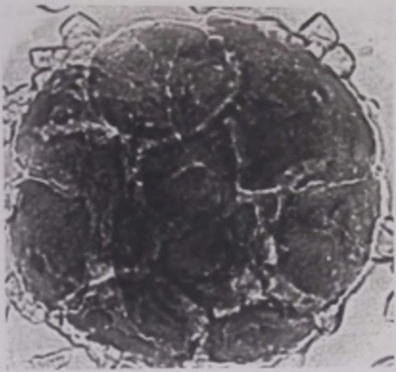

Fig. 1. Moderate number of lactate dehydrogenase-containing cells in 3-day-old human embryo. LD IMH, X 400.

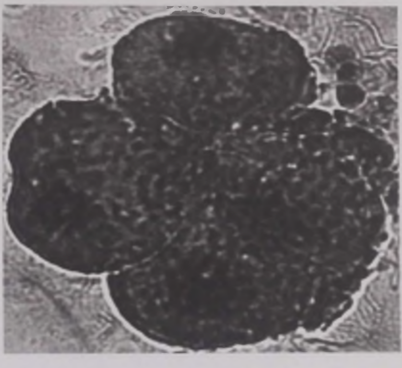

Fig. 3. Intensive expression of bFGF in blastomeres of 3-day-old human embryo. bFGF IMH, X 400.

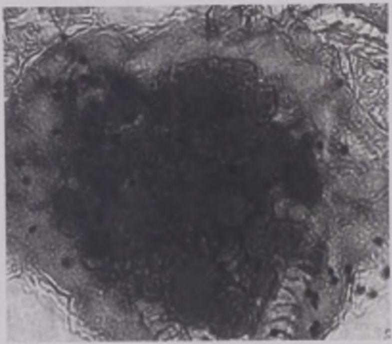

Fig. 2. Hexokinase positive cells in human morula. Hexokinase IMH, X 240.

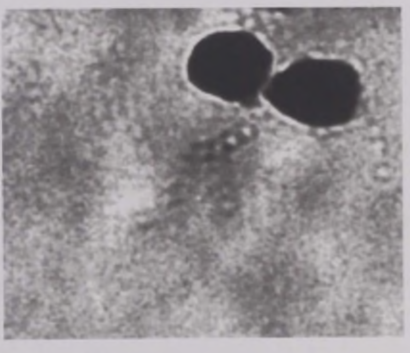

Fig. 4. Overexpression of FGFR1 in human blastomeres. FGFR1 IMH, X 240.

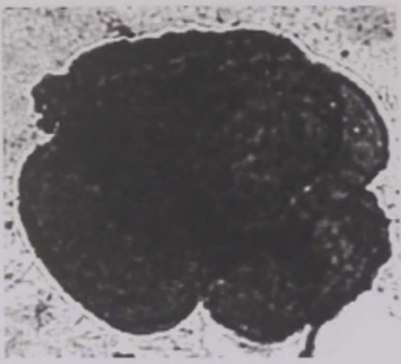

Fig. 5. Practically total staining for IGF1R in 4-day-old human embryo. IGF1R IMH, X 400.

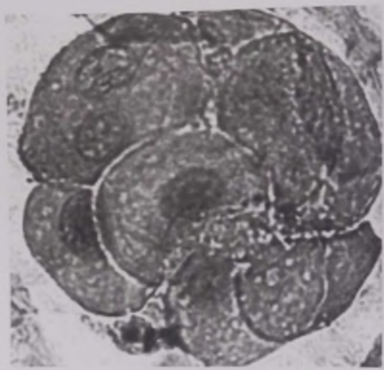

Fig. 7. TGFα immunoreactivity in few blastomeres of 3-day-old human embryo. TGFα IMH, X 400.

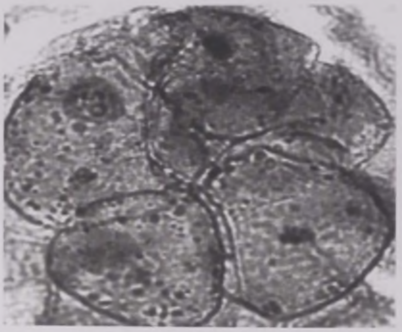

Fig. 6. Few caspase 6-containing blastomeres in human 4-day-old embryo. Caspase 6 IMH, X 400.

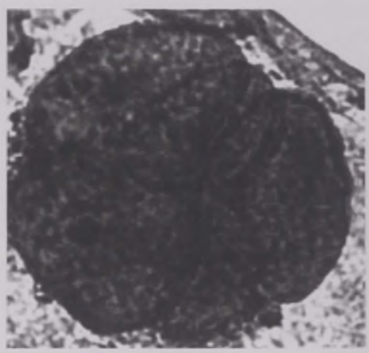

Fig. 8. Few *wnt* expressing blastomeres in 4-day-old human embryo. *Wnt* IMH, X 400.

bFGF showed various, but mainly rich expression (Fig. 3), while FGFR1 was even overexpressed in 3-day-old blastomeres (Fig. 4) and the cells of blastocysts. Occasional blastomeres showed IGF expression in morula and early *conceptus* only in 4-day-old embryos.

Few to moderate cells of 2 and 3-day-old embryos expressed IGF1R despite the lack of it in 4-day-old blastomeres. Numerous cells of 6-day-old embryos richly expressed IGF1R (Fig. 5).

Caspase 6 stained few cells of 3-day-old and numerous cells in 4-day-old *conceptus* (Fig. 6).

Oct ¾ was expressed on degenerating blastomeres surface, while some morula cells showed also TGFα immunoreactivity (Fig. 7) in 3-day-old embryos.

Gene expression started from 4-cell stage when *wnt* was expressed by occasional blastomeres (Fig. 8). Also *barx1* intensively stained separate blastomeres, but only of 2n *conceptus*.

Commonly, EGFR and *msx2/hox8* were not expressed by blastomeres after IVF embryos.

DISCUSSION

We observed mainly the growth retardation and abnormal pronucleus number in human embryos after IVF. In agreement with our findings, Trounson and Bongso (1996) [19] reported that human IVF embryos often show abnormal or delayed cell division.

In invalid for implantation human embryos we found a variable expression of LD with moderate its appearance in 4-day-old *conceptus*. Lactate dehydrogenase is an enzyme that converts lactate to pyruvate and has been reported to be highest at the zygote stage, decreasing at the blastocyst stage [14, 20]. The other metabolic enzyme, hexokinase, catalyses the first reaction in glycolysis and increases during the later stages of human and mouse embryos. Its enzymatic activity reaches the highest level in blastocysts [3, 12]. Hexokinase expression varied in age aspects and covered only few cells in the embryos investigated by us. Thus, we suggest that variations of LD-containing cells between days 3 and 4 and only few of hexokinase-containing blastomeres possibly are the reason for the growth retardation in invalid for implantation after IVF human embryos.

IGF expression was not characteristic for the whole first week development, while IGF1R was expressed in all the retardated human embryos, except the day 4. This receptor binds insulin-like growth factor with a high affinity. IGFI is a receptor-mediated autocrine and/or paracrine growth and/or survival factor for mammalian embryo development which promotes the growth and the development of mouse preimplantation embryos. It stimulates the viability of embryo by decreasing of apoptosis in animal preimplantation embryos [16]. Probably this growth factor plays also a similar role in human, as in our 4-day-old embryos the apoptosis marker – caspase 6 was increased, but IGF1R was not detectable at all. Preimplantation embryos express the genes involved in the regulation and execution of apoptosis and their cells can undergo this default pathway in the absence of exogenous survival signals. Evidence is now accumulating from several species that apoptosis in the embryo is regulated by soluble peptide growth factors acting as survival factors in an autocrine or paracrine manner. To date, these include TGF alpha and the members of the insulin-like growth factor family. Apoptosis may also be affected by environmental factors, including culture conditions and the composition of media [4]. Apoptosis usually starts after the 4-cell stage – after the onset of embryonic gene activation. The onset of apoptosis in individual cells may be stimulated by chromosomal or nuclear anomalies [7].

The variable bFGF expression with the overexpression of FGF1R and indistinct TGFα appearance was observed in the 3^{rd} day old growth retardated human *conceptus*. EGFR were not seen in any of *conceptus* cell. There are limited data in literature about the growth factor expression in human preimplantation embryos. So, Smotrich *et al.* (1996) [18] found TGF alpha and EGFR at the 4-cell stage human preembryos, but in 8- to 14-cell preembryos additionally also IGFIR were detected. However, other authors have also seen bFGF presence in all the stages of oocyte maturation and after fertilization up to the 16-cell stage, but not EGFR immunoreactivity in bovine preimplantation embryos [21]. Seemingly, still there is a controversial view about the expression pattern of growth factors and their receptors – one says that these events are gene depending, but the other points to the primary role of the same growth factors on expression of genes [17, 18, 21]. Without a speculation on the primarity of the molecular events during early blastogenesis, we suggest an important (probably growth stimulating) role of FGFR1 due to their rich expression in growth retardated human preimplantation embryos.

Only few blastomeres were Oct3/4 positive in 3-day-old embryos. This means that there is some cell activity maintained in retardated embryos for the development as the transcriptional factor Oct is a critical regulator of pluripotency in the mammalian embryo [1].

Gene *wnt* and *barx1* expression was seen from the 4 cell stage in growth retardated human embryos. Although there is a difficulty to detect the precise developmental time, these data respond to the results obtained by other authors [20]. Overall, the IVF embryos have an increased alteration (both up and down-regulation) in the expression of many genes. Also, the same IVF and embryo culture have a profound effect on the gene expression pattern and the phenotype of mouse preimplantation embryos, and proliferation, apoptosis, and morphogenetic pathways are the most common pathways altered after IVC [8]. However, the data of Wang *et al.* (2005) [20] indicate that genes have remarkably similar expression patterns between *in vitro* and *in vivo* embryos throughout preimplantation stages in the mouse. It is not known if the method of fertilization affects the global pattern of gene expression, thus the further research has to be devoted to the research of human IVF embryos.

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EVALUATION OF CADETS' PHYSICAL PREPAREDNESS AND FITNESS

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ABSTRACT

We paid a special attention to the level of cadets' physical fitness and endurance in the National Defence Academy of Latvia. There are high physical fitness standards and requirements for the professional military personnel. The physical fitness characteristics and physical working capacities are necessary for performing military tasks in the specific environment. Those depend on the health quota and physical preparedness. We provided the longitudinal evaluation of anthropometric data and the determined physical fitness of the cadets in the NDA of Latvia.

We have examined 62 persons and provided the analysis of anthropometric data of cadets. We have made the assessment of the main anthropometric characteristics: body height, body mass, body circumstances. We have evaluated the results of standard physical tests and the results of three annual standard physical exercises.

The variation of the body height value was in the interval between 168 cm and 192 cm in the examined group. The body mass characteristic varieties were in the interval 63 kg to 101 kg. The largest part (over 70%) of cadets has the body mass in the interval 70kg – 85 kg and height parameters in the interval 175–185 cm. We have used the height-weight index, the body mass index for the characteristics of the body constitution type and the tendency to overweight. There were 60–70% of cadets in different cadets groups who have the tendency to overweight.

Physical fitness characteristics were evaluated according to the results in the physical load test – the Harvard step-test. There were 70–80% of cadets with a satisfactory and good physical preparedness level according to the HSTI data. The results in the annual fitness test corresponded to the quota, but revealed the difference between cadets groups.

Key words: *Physical preparedness, physical fitness, anthropometric data of cadets*

INTRODUCTION

Special interest is given to the physical preparedness and fitness in the military environment. The military personnel work in a specific environment that needs bodily strength readiness to carry out a hard physical load, fast activities and the decision making process. Therefore physical and fitness parameters should be high. During the two year's period we have carried out monitoring of cadets'-the future officers' -anthropometric characteristics and the physical endurance level that allowed to us to assess the fitness level of future officers. Problems of physical fitness, the assessment of health capacity and the physical preparedness level are actual nowadays [1, 2, 3]. In the last years special attention was drawn to the psychological stress impact on physical capacity [4,5], the hard physical load and its influence upon the health capacity [6,7,8].

The target of our paper was the evaluation of cadets' physical preparedness and the results in standard physical exercises.

MATERIAL AND METHODS

Physical and anthropometric characteristics of cadets (n=62) were collected during the period of two years (2007/2008). We included 23 cadets in 2007 and 39 cadets in 2008. They were from different groups according their speciality: air forces, naval forces, ground forces and military specialists.

We fixed parameters of the height, the body mass and the body circumstances. Then we provided the analysis and the assessment of collected data. We have used the anthropometric index and the parameters for the evaluation of the physical body statement. We characterised physical fitness on the basis of the results in the physical load test (standard physical exercises) and the results in annual standard physical (sport) exercises: sit-up, push-ups and the cross country race.

RESULTS AND DISCUSSION

Cadets were enrolled in the Basic Staff Officer Course (BSOC) after graduation from civilian higher schools. The cadets of BSOC were aged from 23 years 11 months to 27 years 8 months. Cadets were enrolled in the Navy/Air Force officer (NFOC/AFOC) course after graduation from secondary schools aged from 19 years 7 months to 21 years 1 month. Cadets were enrolled in the Basic Officer Specialist Course (BOSpC) after graduation from civilian higher schools (medical doctor's degree, lawyer's degree, chaplain's or music specialist's degree) aged 23 years 4 months to 33 years. We measured anthropometric parameters (height, body mass and the body circumferences) in the examined groups. The height parameters in cadets groups (2007) have not any significant differences. The average level of height in the BSOC cadets' group (2007) was 181.4±2.5 cm with individual variations from 168 cm to 191 cm. The average level of height parameters in NFOC/AFOC were 181.1±1.4 cm that changed in the interval from 171 cm to 190 cm. The average height parameters have differences (in 2008) among three groups. The cadets' height parameters in the BSOC 184.5±3.4 cm were the highest. The individual variation of cadets' height parameters in the BSOC were from 171 cm to 192 cm. The height parameters in the Basic specialist – officer course (BOSpC) were the lowest – 176.2±1.2 cm with changes from 174 cm to 179 cm. The middle position of the average height characteristics belonged to the cadets of the NFOC/AFOC group, where they were 178.9 ±1.2 cm, with variations from 170 cm (minimal data) to 188 cm (maximal data). We have subdivided height parameters in subgroups with a 5 cm interval: lower than 170 cm; from 170 to 175 cm, from 175 to 180 cm; from 180 to 185 cm, from 185 to 190 cm, from 190 to 195 cm and more than 195 cm. The larger part of the cadets had the height in the interval 175cm and185cm: 85.7% of the NFOC/AFOC (2007) group's cadets, 55.5% the BSOC (2007) group's cadets, 76.5% the NFOC/AFOC (2008) group's cadets, 50% the BSOC (2008) group's cadets, and 100% the BOSpC (2007) group's cadets (Fig.1).

A body mass characteristic is the most variable characteristic. There were wide individual variations of the body mass characteristics in the examined groups. The body mass data in the NFOC/AFOC (2007) group has individual changes from 68 kg to 101 kg. The average level of body mass in the NFOC/AFOC (2007) group was 96.9±3.6 kg, which is over the average level in the BSOC cadet's group (79.7 ±2.3 kg), the individual variations of body mass in the BSOC group were between 70.5 kg and 100 kg.

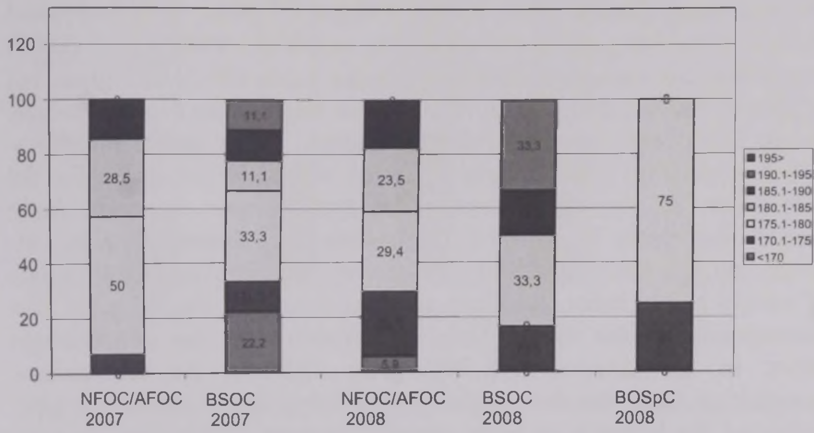

Fig. 1. Distribution of the height data in the examined group (%)

The body mass data (2008 BSOC cadet's group) was 79.0±3.5 kg, it was close to the body mass parameters of the previous year and the individual variations of body mass were in the interval from 65 kg to 87 kg. The highest level of the body mass average data was determined for cadets of the BOSpC (2008) group 82.5±5.1 kg. The average body mass data for the NFOC/AFOC (2008) group's cadets were the lowest – 74.0±1.4 kg, -with variations interval from 63 kg to 84.5 kg. We have subdivided the body mass value into intervals with 5 kg: less than 70 kg; from 70 to 75 kg, from 75 to 80 kg; from 80 to 85 kg, from 85 to 90 kg, from 90 to 95 kg, from 95 to 100 kg and more than 100 kg. The larger part of cadets had the body mass data in the interval between 70 kg and 85 kg. There are 78.6% NFOC/AFOC (2007) cadets, 77.7% BSOC (2007) cadets, 82.3% NFOC/AFOC (2008) cadets, 50% BSOC (2008) cadets, 75% BOSpC cadets.

We have used some coefficients and indices for the evaluation of the body constitution, they were derived from the body mass data. It allowed us to provide the assessment of the anthropometric characteristic in the examined groups. We have used the weight-height index, it characterized the individual body constitution type. Cadets from the

BSOC (2007) have the weight-height index variation in the interval 404.5g/cm – 543 g/cm, the average weight-height index level was 484.5±15.0 g/cm. The average weight-height index level was lower in the next year (2008), when it was 427.2±11.7 g/cm, with individual changes from 380 g/cm to 453 g/cm. The cadets of NFOC/AFOC (2007) group have the average weight-height index value 440.1±11.7 g/cm, but in 2008 it was 415.0±7.4 g/cm. The highest value of the average weight-height index was determined for the BOSpC group cadets in 2008 – 468.0 g/cm (Fig. 2). We have used the weight-height index for the assessment of the body constitution type. There are three body constitution types: hyperstenic, normastenic and astenic. The weight-height index is also the indicator of overweight. We subdivided the data of weight-height index into three subgroups beneath the 385 g/cm, that corresponded to the astenic body constitution type, the weight-height index in the interval 385–410 g/cm reflected the normostenic constitution type, the data of the weight-height index above 410 g/cm indicated the hyperstenic body constitution type and/or increasing the body mass. The numbers of cadets with the high level of weight-height index were dominating in all the examined groups. There were 78.5% of persons with the hyperstenic body constitution type in the NFOC/AFOC group (2007), and 66.6%persons in the BSOC (2007). The numbers of persons with a high level of weight-height index in 2008 were 58.8% in the NFOC/AFOC cadets group, 100%in the BOSpC group, and 66.6% in the BSOC cadets' group. The body mass index value exceed the quota for 33.3% of cadets in the BSOC 2007, 21.4% of cadets in the NFOC/AFOC group in 2007, 17.6% of cadets in the NFOC/AFOC group in 2008 and 75% of cadets in the BOSpC 2008, at the same time the BMI did not exceed the quota in the BSOC group in 2008.

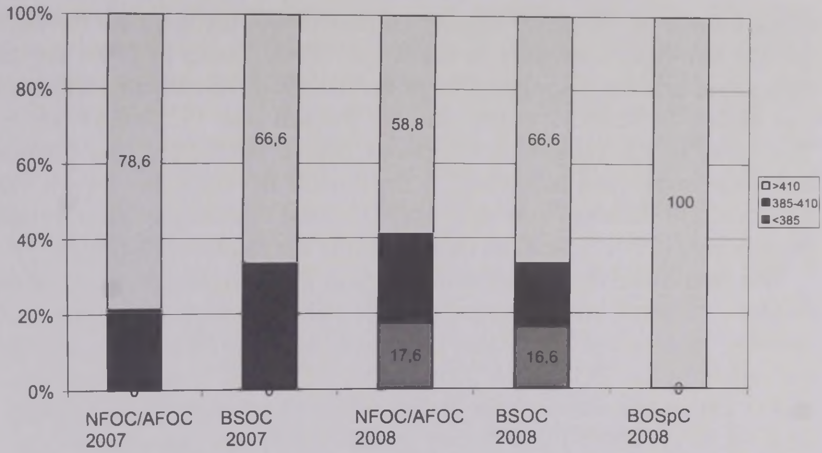

Fig. 2. Distribution of the weight-height index value in theexamined groups (%)

The muscle development degree assessment provided data separately for the left and the right extremity by using of the upper arm circumference in two physiological positions (relaxed and contracted). The results pointed out that the muscles of the right upper arm were stronger than the left one. The muscle development degree coefficient has the highest value for the cadets of the NFOC/AFOC group in 2007 – 16.32±0.57 points (the right upper arm). The highest level of the average muscle development degree coefficient for the left upper arm was in the BSOC cadets' group (2008) 14.52±0.78points. The lowest average value of the muscle development degree coefficient was determined in the BOSpC cadets' group: for the right upper arm – 13.35±2.52 points, and for the left upper arm – 13.6±1.89 points. The highest average value of the muscle development degree coefficient was determined in the BSOC cadets' group in 2008: for the right upper arm 15.9±1.50 points, and for the left upper arm 14.5 ±1.13 points. The average value of the muscle development degree coefficient in 2007 for the cadets of the BSOC group was lower: for the right upper arm 15.03 ±1.04 points and for the left extremity – 14.21±1.27 points. In the NFOC/AFOC group in 2008 the average value of the muscle development degree coefficient was equal (small differences): for the right extremity there were 14.52±0.78 points and for the left extremity – 14.3 ±0.65 points. The average value of the muscle development degree coefficient was different for the right and the left upper extremity in the NFOC/AFOC group in 2007: for the right upper arm the average value of the muscle development coefficient was higher 16.32±0.57 points and for the left one 13.37±0.67 points. The value of the muscle development degree coefficient was divided into three subgroups according to the muscle development degree: the weak muscle development degree (5–12), the middle muscle development degree (12–17), and the strong muscle development degree (>17).

We have fixed thorax circumferences in three physiological positions (inspired, expired and the pause position) and determined the lung vital capacity parameters. The value of thorax circumferences is the highest for cadets in the BOSpC in 2008 – 93.2 ±1.94 cm. The average value thorax circumferences was the lowest in the NFOC/AFOC cadets group: 88.4 ±0.81 cm (2008) and 91.6±1.25 cm (2007). We determined thorax excursion parameters that characterized thorax elasticity degree. The average values of thorax elasticity were above the standard level.

The physical fitness level was evaluated according to the results in the physical load test (the modified Harvard step). We have calculated the Harvard step test index, the value of the index characterized the cardiovascular system adaptation ability to the physical load (Fig. 3). The physical fitness level in the NFOC/AFOC group was higher than in the BSOC cadets' group. We have fixed that the cadets' physical fitness level increased more than for 10% from 2007 to 2008 in the BSOC and the NFOC/AFOC groups. The average value of the Harvard step test index in the BSOC cadets group increased from 70.8±2.4 (2007) to 78.5±3.0 (2008), the physical fitness characteristics in the NFOC/AFOC (HSTI) had grown from 76.2±2.7 (2007) to 81.3±3.8 (2008). The values of the Harvard step test index have been divided into physical fitness subgroups: the satisfactory physical fitness level; the middle physical fitness level; the good physical fitness level; the excellent physical fitness level. The middle and the good physical fitness level is in 77.7% cadets in the BSOC group, 78.5% cadets in the NFOC/AFOC group. There are two times more cadets in the BSOC group in 2008 who have a good physical fitness level (83.3%), it is two times bigger than the number of cadets with a good physical fitness level in the NFOC/AFOC group in 2008 (41.2%). The level of physical fitness in the BOSpC cadets group was lower than in the BSOC and the NFOC/AFOC groups.

Annually the military personnel should undergo through the physical test system. The results of physical tests reflect the degree of the physical endurance and preparedness level, strength characteristics, speed and deft characteristics, physical working capacities. There are three physical tests in the annual physical fitness checking up system: push-ups, sit-ups tests and the cross-country race (3,000m for men /1,500m for women). Cadets from the NFOC/AFOC group (2007) in push-up tests have shown the best results (the average value in points was 87.4±3.6) that is 1.5 time higher than in the NFOC/AFOC group in the next year (2008) when the average data of results in the push-up test was 57.0±6.8 points. The average data of the result in push-up test of the BSOC group cadets was (89.7±4.7points) in 2007. It was higher than in the next year (57.8±7.5points). The average data of results in the push-up test in the BOSpC cadets group in 2008 was 76.0 ±18.4 points. Cadets from the NFOC/AFOC group (2007) get the best results in sit-up tests; the average value in points was 91.5 ±8.7, that is 1.5 times more than in the next year (2008) sit-up test (59.7±4.7points). Cadets from the BSOC group get in the sit-up test 83.3 ±5.6 points that was for 10% higher than in 2007 when cadets get 74.6±6.5 points. The BOSpC group's cadets received 75.0 ± 9.7 points in the sit-up test.

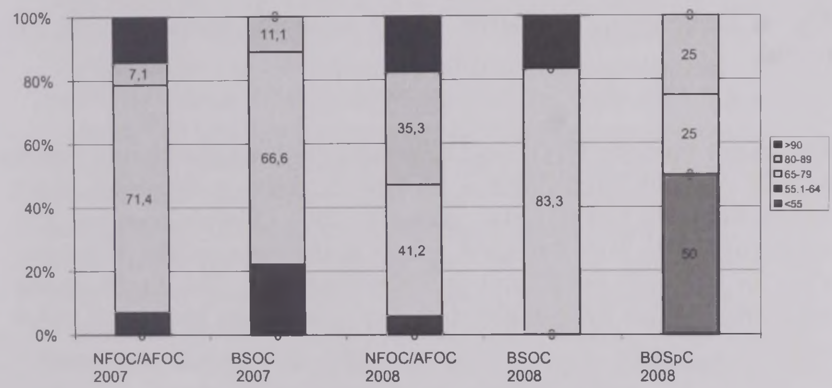

Fig. 3. Distribution of the HSTI value in the examined groups (%)

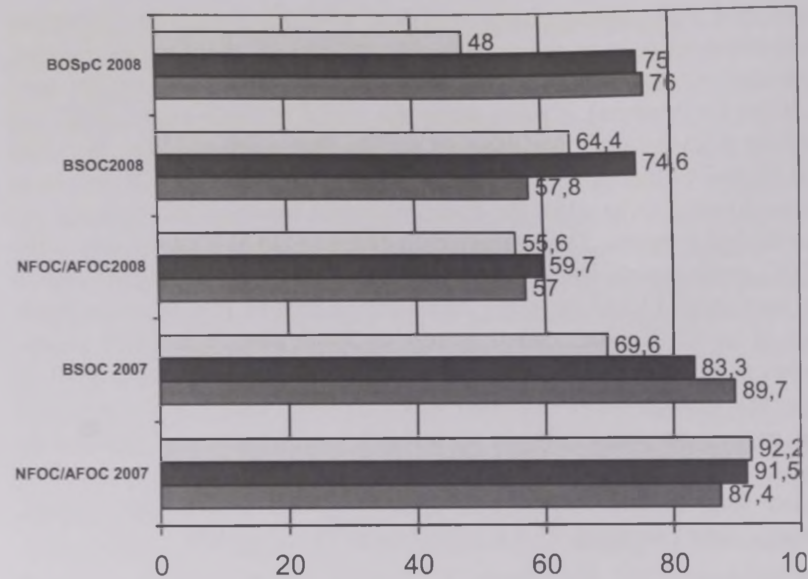

Fig. 4. Distributions the cadets' results in annual sports exercises (in points).

The cadets from the NFOC/AFOC group (2007) get the highest results in 2008 (92.2 ±4.6points) that is 1.6 times higher than the results of the cadets from the NFOC/AFOC group in 2007 (55.6±5.2 points). The results of cadets from the BSOC group in the cross country race were close in 2007 (69.4±4.8) and in 2008–(64.4±9.6). The results in the cross country race for the BOSpC cadets' group were lower – 48.0±4.4 points.

CONCLUSION

1. The individual variations of cadets' height parameters changed in the interval from 168 cm to 192 cm. The larger part of cadets has height parameters in the interval 175–185 cm. There are 85.7% of the NFOC/AFOC (2007) cadets' group, 55.5% of the BSOC (2007) cadets' group, 76.5% of the NFOC/AFOC(2008) cadets' group, 50% of the BSOC(2008) cadets' group and 100% of the BOSpC group of

cadets who have height parameters in the 10cm interval (175–185cm).

2. The body mass parameters have individual differences, their variation boundaries were from 63 kg to 101.0 kg. The larger part of cadets has the body mass parameters in the interval from 70 kg to 85 kg. There are 78.6% of the NFOC/AFOC (2007) group of cadets, 77.7% of the BSOC(2007) cadets' group, 82.3% of the NFOC/AFOC group (2008) of cadets, 50% of the BSOC (2008) cadets' group, 75% of the BOSpC group of cadets who have the body mass parameters in the 15kg interval (70–85kg).
3. The weight-height index in the examined group pointed to the hyperstenic body constitution type and can be used as an increased body mass indicator. There are 78.5%% of cadets in 2007 and 58.8% of cadets in 2008 from the NFOC/AFOC group, 66.6% of cadets in the BSOC group in 2008 and 100% of the BOSpC group of cadets who have the weight-height index value that corresponded to the hyperstenic body constitution type.
4. The body mass index is used as an indicator of the increased body mass, when the BMI value is over 24.99 kg/m². There are 33.3% of cadets in the BSOC (2007) group, 21.4% of cadets in 2007 and 17.6% of cadets in 2008 from the NFOC/AFOC group, and 75% of the BOSpC group of cadets 2008 who have the body mass index over the quota that indicates the tendency of increasing the body mass..
5. The physical fitness assessment was made by using the results of the Harvard step test. The physical fitness level corresponded to the middle and good degree in the examined group. There are 77.7% of cadets from the BSOC group and 78.5% of cadets from the NFOC/AFOC group in 2007 who have a middle and a good degree of physical endurance and physical preparedness. There are two times more cadets in the BSOC group (83.3%) in 2008 with a good physical fitness degree than in the NFOC/AFOC cadets' group (41.2%). The physical fitness level in the BOSpC group of cadets was beneath the cadets' physical fitness level in the BSOC and the NFOC/AFOC groups.
6. The results of physical Standard exercises characterized physical endurance, the physical strength level. The results in the push-up test and the cross country race in 2007 were higher (1.5 times) than in 2008. The cadets from the BOSpC group have the results in standard physical exercises that were lower than in the BSOC and the NFOC/AFOC cadets' groups.

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BONE MATURITY OF 10–16-YEAR-OLD CHILDREN IN TRANSDANUBIA (HUNGARY)

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ABSTRACT

The peak bone mass is considered as the endpoint of childhood bone development. This process is mainly genetically predetermined. On the other hand, it is influenced by environmental factors, such as nutrition and physical activity. These both modulate the bone mass during the whole childhood, while the hormonal influence tends to be the most intense around the pubertal ages. The bone maturity of 10–16-year-old children is discussed in this paper based on the data of Western Hungarian growth studies. Our investigations involved two locations: the town of Körmend and the Balaton region (Keszthely, Gyenesdiás, Hévíz).

***Key words**: bone maturity, condylar valoues, skeletal mass, Hungary*

INTRODUCTION

The peak bone mass is considered as the endpoint of childhood bone development. This process is mainly genetically predetermined. On the other hand, it is influenced by environmental factors, such as nutrition and physical activity. These both modulate the bone mass during the whole childhood, while the hormonal influence tends to be the most intense around the pubertal ages [1,10]. The qualitative and quantitative characteristics of childhood nutrition are, especially in the phase of intense growing, of great importance. Insufficient protein, fat and minerals supply affect both the physical and psychical development. In obese girls, for example, the menarche shifts towards earlier ages, while pathological leanness may disturb the hormonal cycle resulting in amenorrhoea.

The bone maturity of 10–16-year-old children is discussed in this paper based on the data of Western Hungarian growth studies.

MATERIAL AND METHODS

Our investigations involved two locations: the town of Körmend and the Balaton region (Keszthely, Gyenesdiás, Hévíz).

The Körmend Growth Study was launched in 1958, and it has been repeated in regular 10-year intervals. This happened to be the first study in Hungary describing the tendencies and changes in growth and maturation of children as the manifestation of the phenomenon known as the secular trend ("classical secular trend study") [3,4,5,6,7,8,9, 15,16,17]. In our paper, for the sake of the appropriate temporal match, the data of the 1998 study was used (n = 989).

In 1977, within the confines of a primary osteoporosis prevention programme, a growth study was launched. (Keszthely, Gyenesdiás, Hévíz n = 990). Ultrasonographic measuring of the heel bone was carried out, too, in order to esteem the mineral content of the bone tissue [12,13,14]. Additionally, somatometric measurements were performed following the protocol worked out by Knußmann in 1988 [11].

The bone mass was analyzed in the ratio of the body mass, following the method developed by Drinkwater and Ross in 1980 [2].

RESULTS AND DISCUSSION

Based on the ultrasonographic data, the bone mass of both boys and girls over the age of 10, on average, reaches the 60 per cent of the peak bone mass characteristic for young adults, but at least 50 per cent of that.

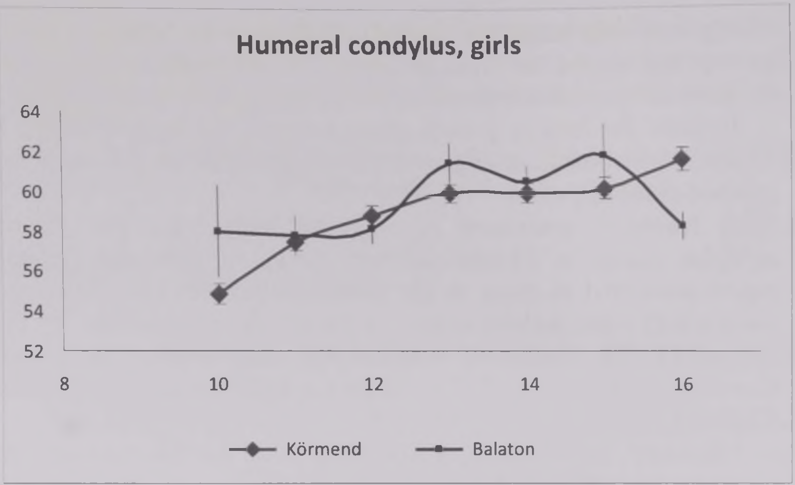
Anthropometric findings of the two research locations are the following:

1. Changes of body height are similar in both samples. In boys, a steady growth rate can be observed between the ages of 10–14, then, after the growths spurt in adolescence, a moderate growth rate is typical.

   In girls, the intense growth phase between the ages of 10–12 is followed by a less intense growth period just until the plateau phase reached at the age of 14.
2. Body height is associated to a greater body mass and greater condylar values in 12-year-old boys living in the Lake Balaton region compared to those in the Körmend sample. This difference implies a stronger skeletal system of the Balaton region boys. By the age of 13, this difference between the two samples levels off. However, by the age of 13, the body mass and the condylar values of Körmend children become greater than those of the other sample.

   The body mass and the condylar width of the 13-year-old girls living in the Balaton region is definitely greater than those in the Balaton sample. By the age of 14, this difference levels off and no significant difference can be observed anymore (Fig. 1.).
3. Analyzing the humeral condylus and the thighbone refers to the robusticity of the skeletal system. The bone mass and the condylar width are in close correlation with the body mass. The correlation to body height is much weaker, and, based on the Körmend data, tends to weaken increasingly in the past 50 years [18].

   The bone mass was analyzed in the ratio of the body mass, following the method developed by Drinkwater and Ross (Fig. 2.). We found significantly greater bone mass values in 12-year-old Balaton region boys and 13-year-old Balaton region girls compared to the Körmend sample. Different body exercise and mobility may account for this finding.
4. The effect of physical activity on ossification and mineralization is one of the important factors influencing the peak bone mass. Physical strain against the gravitation is the most effective effort in the point of enhancing the bone mass. On the other hand, exaggerated physical activity, such as some competitive sports, may be harmful, act as stress factors, delay puberty or stem pubescence. The danger is especially pronounced when simultaneously dietary restrictions, revealing in body mass subsidence or stagnation, are introduced. The bone mineralization is under strong hormonal control. Praepubertally, the mineral bone mass increases by few per cents per annum. At the end of the adolescence, sexual hormones play an important role in bone consolidation.



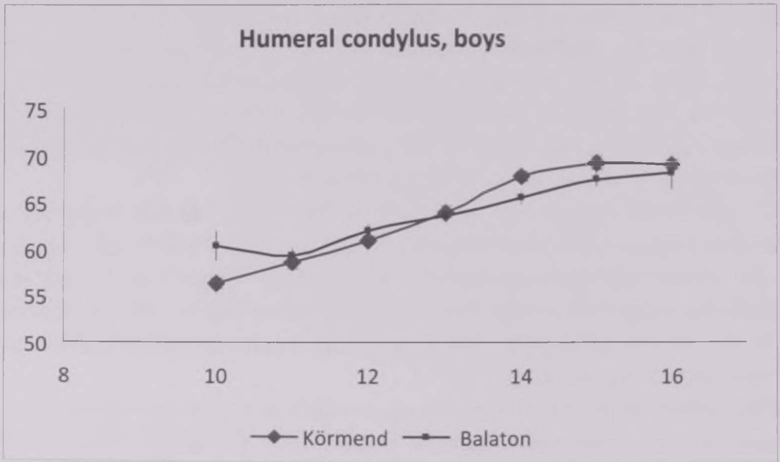


Fig. 1. Condylar values (mm)

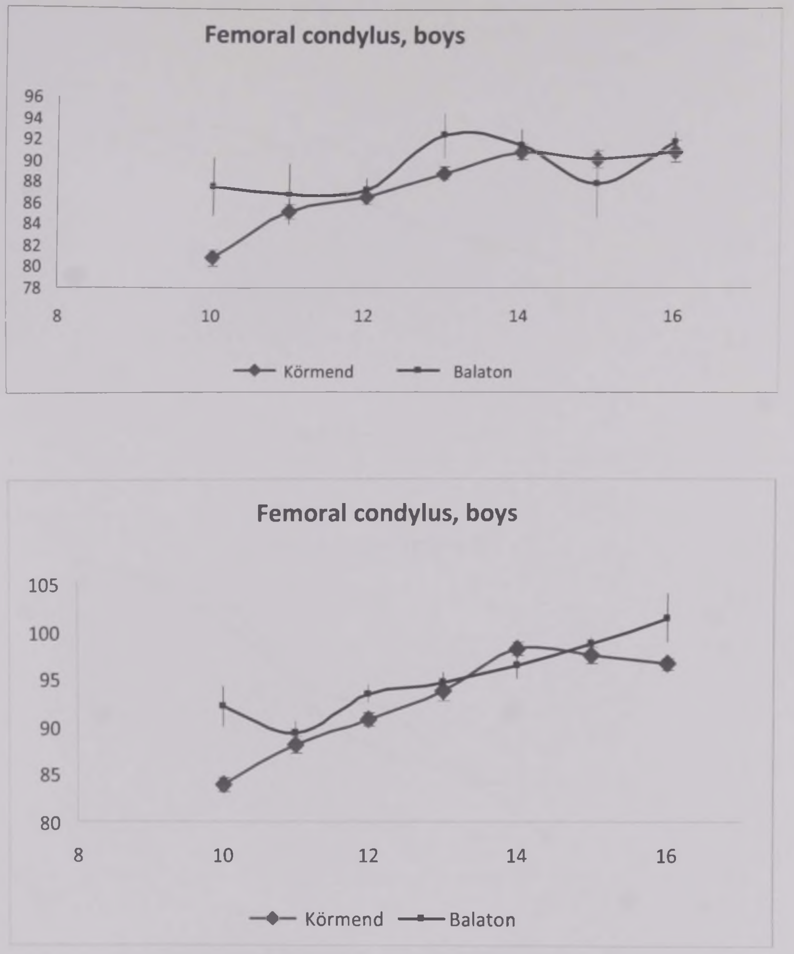


Fig. 1. Condylar values (mm)

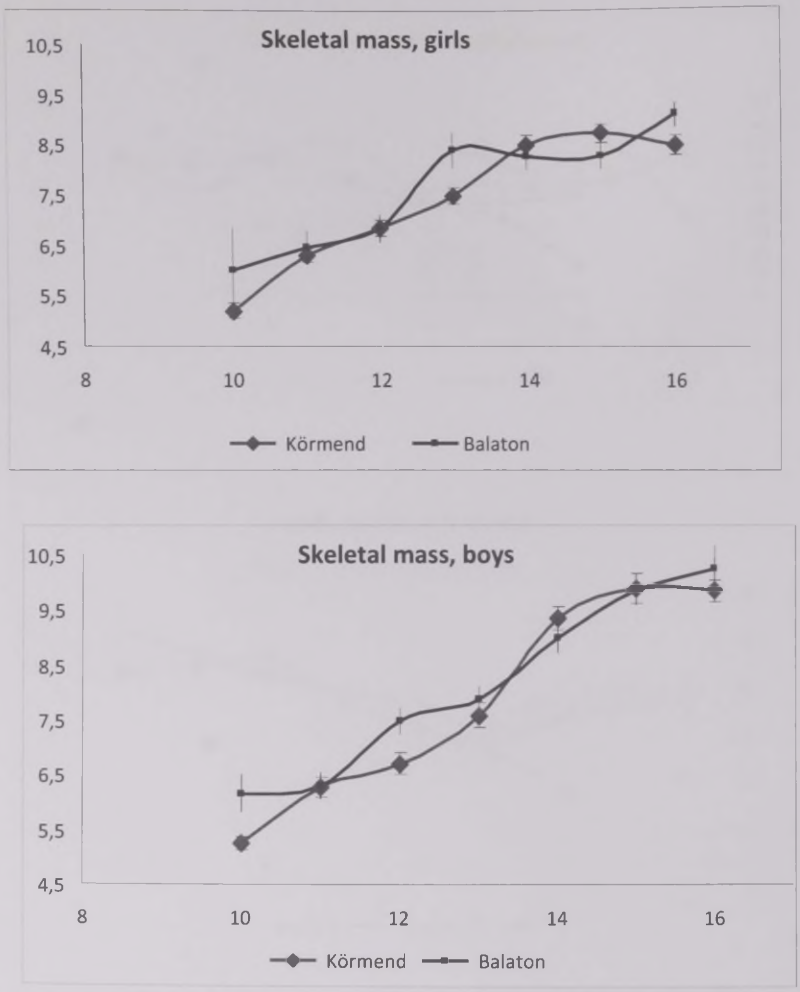


Fig. 2. Skeletal mass (kg)

Anthropometry may help us to trace the timing and the stages of adolescence growth spurt. Furthermore, it may permit a better prognostication of bone mass changes and help us in differentiating normal and pathological bone accumulation processes.

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TRAUMATIC LESIONS ON POSTCRANIAL SKELETON ON THREE BULGARIAN MIDDLE AGE POPULATIONS. RISKS IN HABITUAL ACTIVITY

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ABSTRACT

Anthropological-osteological series from the necropolises, dated in Bulgarian Middle Ages, from Balchick, (in the end of the 8^{th} – the beginning of the 9^{th} century AD), Pliska, (the 9^{th} century AD), Anhialo, (about the 12^{th} century AD) and by Church St. 40 Martyrs in Veliko Tarnovo, (second half of the 13^{th} century – first half of the 14^{th} century AD) are investigated for the presence of traumas on the postcranial skeleton. Only lesions regarded as consequences of incidents during habitual activities are included. Demographic distribution of found traumatic lesions is achieved only in the series from Church St. 40 Martyrs. Traces of traumatic lesions are grouped on bones of limbs, vertebral column and ribs. The latter appear to be most frequent (comprise 27.5% from registered fractures in Church St 40 Martyrs and are also registered in Anhialo and Pliska). All the rib fractures are found in males, at the age over 40 years. In most cases the rib fracture combines with other postcranial traumatic lesions. On upper extremities fractures are most often registered on clavicles, often they combine with a traumatic lesion on other bones of postcranial. The healing process of these traumas in most cases terminated with a high dislocation of the fractured ends and the form of healed bones is highly irregular with shortening and twisting. Fractures of radius and ulna comprise 15 and 12.5% from the fractures in Church St 40 Martyrs with the prevalence of affection of the distal end and *processus styloideus*. This trauma is found in males and females. From the bones of the leg fibula is most often affected (20% from the registered fractures in Church St. 40 Martyrs) with defects on the distal end. Ankylosis affects both males and females, exclusively joints of lower limbs, in most cases on the ankle. The other

region specifically affected by ankylosis is the cervical part of the vertebral column. Myositis ossificans is found in all the studied series more often on lower limbs' bones and less often on the upper limbs. The cases of ankylosis of cervical vertebra present a more risky occupancy of individuals. Most of the traumas of the lower limbs, recognized on the material from Church St. 40 Martyrs, can be explained with the accidents during walking on uneven terrains (characteristic of the environmental conditions of the place).

INTRODUCTION

Finds of traumatic lesions on bones from archaeological sites constitute one of the clues in the process of reconstruction of the paleopopulation's life, as a record of inter/intra population violence, the risks of habitual activity, hazards in the dynamic, interactive process of environmental adaptation of human groups.

MATERIAL AND METHODS

The investigation is focused on three anthropological osteological series from the necropolises, dated in Bulgarian Middle Ages, from different main periods and ethno-cultural groups (Tabl 1) – Balchick, end of 8th – beginning of the 9th century AD [5–8], from an Early-Middle age tribe at the beginning of the construction of the First Bulgarian Kingdom, with its economic life, which develops in the region of North-East Bulgaria, closely connected with the North Black Sea Steppes, highly dependent on the stock breading; Pliska, North-Eastern Bulgaria, the 11th century AD [2–3] from territory, targeted in the period by Late Nomadic invasions, close to the new invaders, the tribes with stock breading economy and a high importance of war in their social and economic life; Anhialo, South-Western Bulgaria [2], about the 12th century AD (preliminary results) in the period an administrative and clerical provincial center of the Byzantine Empire; the graveyard around Church St. 40 Martyrs in Veliko Tarnovo, the second half of 13th – first half of the 14th century AD [9–14], from the capital and the royal centre of the Second Bulgarian Kingdom, representing a town population from the late period of the Middle Ages, economically oriented the trade and crafts, the administrative and clerical organization of the state.

Table 1. Age and gender distribution of the anthropologically identified material from the studied series (Balchik – the distribution of the material from inhumations).

		Infans I	Infans II	Juvenis	Adultus		Maturus		Senilis		Total
					M	F	M	F	M	F	
Balchik	N	30	5	0	6	11	5	5	3	2	67
	%	44.78	7.46	0.00	8.96	16.42	7.46	7.46	4.48	2.99	
Pliska	N	5	1	2	4	0	3	3	–	–	18
	%	27.78	5.56	11.11	22.22	0	16.67	16.67			
Anhialo	N	19	4	3	13	10	6	4	2	–	61
	%	31.15	6.56	4.92	21.31	16.39	9.84	6.56	3.28		
St 40's	N	18	18	10	60	27	105	15	23	5	281
	%	6.4	6.4	3.6	21.3	9.6	37.4	5.3	8.2	1.8	

As consequences of incidents during habitual activities traumatic lesions on the postcranial skeleton are regarded. They cannot be connected with weapons, in particular the traces from cut wounds. Only series from Church St. 40 Martyrs from Veliko Tarnovo allows demographic distribution of found traumatic lesions. The other studied series are in a smaller number (Pliska), in a poor condition of material (Balchik) or with a high number of adolescents (Anhialo). In these series only unique finds of traumatic lesions are found.

RESULTS

Traces of traumatic lesions are grouped on the bones of limbs, the vertebral column and costae. The latter appear to be most frequent and in the biggest series they comprise 27.5% from the registered fractures and the cases are also registered in Anhialo and Pliska. All the finds of rib fractures are in the individuals, identified as males (Table 3), determined at over 40 years of age on death. Only one fracture from Pliska is registered on a skeleton, determined at 30–40 years of age. The strong connection with the individual's age and this type of trauma is found in the series, which allows demographical analysis – Church St 40 Martyrs. Here the relative number of affected individuals, identified as males, distributed in ten years age intervals, increases dramatically with age (Table 2), reaching 17.4% from the skeletons of individuals, determined as in senile age on death. The find from Anhialo is also registered on an individual, determined at over 70 years of age. More than half of the cases of rib fracture (8 of 11 individuals in Church St 40 Martyrs) combine with lesions, interpreted as traumatic, on the other parts of postcranial skeleton (Table 3), five of them on upper extremities (including three cases on the clavicle).

Fractures of bones of upper extremities are most often registered on clavicles (Table 4), found on six individuals from Church St 40 Martyr's, Veliko Tarnovo, (15% from the determined fractures in the series) and one case in Pliska. Again affected individuals from Church St. 40 Martyrs are identified as males and one from Pliska – as a female. The material is scarce to give stable data about the lateralization of this trauma, but in five cases (four from Church St. 40 Martyrs and one from Pliska) the defect appears on the right clavicle. It appears that the acromial end is more often affected – in three individuals (two from Church St. 40 Martyrs and the one from Pliska), detected only on the right bones. Two of the remaining right clavicles have fractures respectively on the sternal end and the mid-shaft and on the left bones trauma appears only on the mid-shaft. In most cases (four from Church St. 40 Martyrs of five, as the skeleton from grave N 12 with a fracture on the clavicle was too destructed to provide data) fracture on clavicle combines with the traumatic lesion on other bones of the postcranial skeleton – ribs and extremities (Table 4). The healing process of these traumas in most cases terminated with a high dislocation of the fractured ends and the form of healed bones is highly irregular with shortening and twisting.

Table 2. Age distribution of rib fractures

	40–50	50–60	60–70	70+
Total	4	3	3	2
St 40 Martyrs	4	3	3	1
% St 40 Martyrs	6	7	14.3	50

Table 3. Incidence of fractures, ribs

	dx	sn	Tt	Incidence on individual			Combined, limb bones	
				1	2	3+	Upper	Lower
Balchik	0	0	0	–	–	–	–	–
Pliska	0	0	1	1	–	–	0	0
Anhialo	1	0	1	1	–	1	0	0
Veliko Tarnovo	4	5	11	7	2	2	5	3
Total	5	5	13	10	2	3	5	3

Table 4. Fractures on clavicle. Localization on bone

	Dx				sn	Total	Combined		
							Ribs	Limb	
series	Sternal	Mid-shaft	Acromial	Total	Midshaft			Upper	Lower
St 40	1	1	2	4	2	6	2	1	1
Balchik	–	–	–	0	0	0			
Pliska	–	–	1	1	0	1	0	0	0
Anhialo	–	–	–	0	0	0			
Total	1	1	3	5	2	7			

In the biggest series (this from Church St. 40 Martyrs) in the place near the clavicle, according to the incidence, there are fractures of radius and ulna, found on six and five individuals respectively (or comprising 15 and 12.5% from the fractures in the series) (Table 5). It appears that no lateralization on trauma can be emphasized, but fractures on the distal end and *processus styloideus* of these bones prevail (Tabl. 5). In seven cases, where both bones of the forearm (radius and ulna) are present, the other bone (radius/ulna) is unaffected. From the 11 individuals with forearm bones fractures, two are identified as females, with fractures on *processus styloideus* and the distal third of the diaphysis of the right radiuses. In only one case the fracture of humerusis detected, at the proximal third of the diaphysis, healed with the disposition of fragments and twisting.

From the bones of the leg, the fibula appears to be most often affected (Table 6). This fracture is registered only in the series from Church St. 40 Martyrs with the highest portion from the registered fractures – 20% (seven individuals). The fractures are situated on the distal end, with no specific lateralization. The unique case of the fracture of the femur, presents a severe trauma with the fracture of the neck and mid-shaft, healed with the pathological formation of articulation on the neck and dislocation with shortening and twisting on the mid-shaft. In one case (in Church St. 40 Martyrs) the fracture is found on the first metatarsal of the right foot.

The cases of ankylosis on the joints of extremities after a sustained trauma, are found only in the material from Church St. 40 Martyrs (six individuals), identified in four cases as males and two as females. Of this type of lesion exclusively joints of lower limbs are affected, in the most cases (four) the ankle, in one case the knee and one – the articulation between the first and the second phalanx of the thumb of the foot. In the ankle joint in two cases ankylosed tibia and fibula, distally, in one – left talus and calcaneus and in one – the most severe case, tibia, talus, calcaneus and cuboid.

The other region specifically affected by ankylosis is the vertebral column, mostly cervical part. Such traumas are observed in one case from Anhialo, on C4-C5 and three cases from Church St. 40 Martyrs, Veliko Tarnovo, on C3-5 (in process), C4-6 and C5-6 respectively. The latter two cases present the ankylosis of neural arches, laterally, from the right side. In the series from Church St. 40 Martyrs one case of ankylosis of Th3–4 and adjacent ribs is observed.

Table 5. Fractures on humerus, radius and ulna. Localization on the bone, the right and the left bones. St. 40 Martyrs

bone	dx				sn									Total
	procsimal	distal	*processus st.*	Total	procsimal	midshaft	distal	*processus st.*	Total	procsimal	midshaft	distal	*processus st.*	
Hm				0	1				1	1				1 *(2,5 %)*
Ul	1	1	1	3		1		1	2	1	1	1	2	5 *(12,5 %)*
Rd		2	1	3			1	2	3			3	3	6 *(15 %)*

Table 6. Fractures on femur, fibula and ischium. Localization on the bone, the right and the left bones. St. 40 Martyrs

	right		left					Total				Total
	Distal	Total	Neck	Proximal	Mid-shaft	Distal	Total	Neck	Proximal	Mid-shaft	Distal	
Femur			1	1			1	1	1			1
Fibula	4	4		1	1	1	3		1	1	5	7
Metatarsal 1	1	1									1	1
Tt		5					4					9

Table 7. Miositis ossificans. Localization on the bone.

	Clavicle	Hummerus			Femur				Metatarsal 1
	Deltoid proximal	Deltoid distal	Deltoid total	Brachialis	Vastus lateralis	Biceps	Adductor longus	Gastroc nemius	Dorsal interosseus
Balchik					1				
Pliska		1	1						
Anhialo							1	1	
St 40 Martyrs	1		1	1	1	1			1
Total	1	1	2	1	2	1	1	1	1

With inflammatory etiology the cases of myositis ossificans, found in all the studied series should be explained (Table 7). Lower limbs are more often affected and less often – the upper limbs. These defects on the latter can be associated with the deltoid muscle, its proximal and distal attachment and in one case with the proximal attachment of the brachialis muscle. On bones of the lower limb these defects are found on femora and can be associated with the proximal attachment of the vastus lateralis of the quadriceps muscle, in one case it was difficult to consider, but probably the proximal attachment of vastus lateralis and/or short head of biceps femoris, the distal attachment of the adductor longus muscle and the proximal attachment of the medial head of gastrocnemius were affected. In one case the first metatarsal of the right footis affected, at the place of the attachment of the dorsal interosseus and the joint capsule with the first phalanx. In only one case the skeletal remains with such a lesion are identified as originating from a female, the rest of the material is sexually identified as originating from males. In most cases the right bones with one exception of the left clavicle (Church St. 40 Martyrs) are affected.

DISCUSSION

In interpreting the portion of the rib trauma from all the registered traumas it should be pointed out that this material is much more destructed in comparison to the other parts of the postcranial skeleton, so the real levels of rib traumas should be much higher. The preservation of ribs in the material from Balchik does not allow the registration of absence/presence of traumatic lesions. The cases of traumas found on the ribs, combined with traumatic lesions on other parts of the skeleton can be interpreted as the results of one incident in the individual's life. This would support the interpretation of causes of these defects as traumas, which occurred in the course of habitual activity. Such a result is in concordance with the collection obtained from Lisboa (National Museum of Natural History, Lisbon), that there is no correlation between thoracic illnesses as a cause of death and rib fractures [1]. Meanwhile, the dependence between the individual's age and the rib fracture is observed in the material from series from Church St. 40 Martyrs with the increase of this trauma with age. Similar cases can be seen in the Lisboa collection [1]. The association of this trauma with the advanced age could partially explain the lack of it in the skeletons, identified as females, as in the series from Church St. 40 Martyrs, females are determined at lower ages at death than males. The observed higher number of the combination of rib and clavicle fractures can be a clue for reconstructing the event, leading to this trauma as occurred in similar conditions. No combination of the rib/clavicle trauma with the cervical vertebra trauma traces is observed.

The case of ankylosis of the two thoracic vertebra and their adjacent ribs cannot find the interpretation as a traumatic lesion, but as a consequence of the thoracic disease, most probably tuberculosis, after the observed "woven" bone structure of the vertebral ends of some ribs from the same individual. The other cases of ankylosis of cervical vertebra can be explained as caused by trauma, one of them combined with the trauma of fibula. These traumas present more risky occupancy of individuals, accidents occurring with falling down from a high position, at a high speed. All of them are found in males and are to be connected with a higher mobility of males, their function in the political system as warriors and probably their ridding journeys.

Most of the traumas of lower limbs, recognized on the material from Church St. 40 Martyrs, can be explained with the accidents during walking on uneven terrains (characteristic of the environmental conditions of the place). Most of these traumas are situated on the ankle, less on the knee. The two cases of miositis ossificans, connected with attachment sites of the deltoid muscle and brachialis in one should be explained with traumas, occurring with strong force of adduction of the arm and the extension of the forearm, after overloading and accidents during work. The case of both fractures (on the neck and the shaft) of the femur from Church St. 40 Martyrs could be explained with an accident, and may be in relation to the old age of the individual, as such injuries are characteristic of the elderly people. It appears that in the series from Balchik, Pliska and Anhialo traumas are less common and less severe. To some point it is explained with the highest number of adults in the series from Church St. 40 Martyrs and big portions of infants in the other studied series. On other hand, the series of Pliska is of a small number and the population, presented in it, had a specific occupation, after the cases of the cranial trauma, caused by warfare. The necropolis from Balchik presents only partially the population as a high number of graves is connected with the cremation ritual and the anthropological material from some sections is not available for study. The necropolis from Anhialo is still being investigated.

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COMPARISON OF WINNERS' AND LOSERS' PROFICIENCY AT ESTONIAN CHAMPIONSHIPS FOR 13–15-YEAR-OLD MALE VOLLEYBALLERS

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ABSTRACT

The paper studies the results of Estonian championships for 13–15-year-old male volleyballers held in Tartu in 2005, in Viljandi in 2006 and in Rakvere in 2008. The participants were the eight best teams regularly practising volleyball in respective years. In the course of their mutual games winning and losing teams were found. The matches were recorded with the computer program *Game*. To record the performance of both teams in parallel, two computers and two volleyball experts were used at each game. All the participating teams played with one another once. The total number of games played in Tartu was 28, in Viljandi 19 and in Rakvere 28.

For both teams the number of elements of the game (serve, reception, attack, block) performed by each individual player and the whole team were registered; the mean indices of proficiency of performance of elements of the game and the number of points won were calculated per player and for the whole team.

Comparison of proficiency of winning and losing teams shows that it were usually significantly different. The mean number of serves is greater and the number of points gained from serves is almost twice higher in winning teams. The number of spikes was significantly greater in winners only at the first tournament, but the number of points gained from them was significantly higher at all the three tournaments. The mean index of proficiency of spikes was higher in winners, but the difference was statistically significant only at the second tournament in Viljandi. The number of blocks performed by winners and losers did not differ significantly between winners and losers at all the three tournaments. The index of proficiency was significantly higher in winners at the two first tournaments but not at the last one. The mean number of points gained at three tournaments is 112.5 in winners and 72.55 in losers.

Key words: *young male volleyballers, recording system Game, index of proficiency*

INTRODUCTION

The Estonian Volleyball Federation organizes national championships between the eight best teams of the 13–15-year age group in alternate years for male and female teams. During the last decade regular championships for male volleyballers of Class C (up to 16-year-olds) have been held in Tartu in 2005, in Viljandi in 2006 and in Rakvere in 2008. During all these competitions, the players' performance was recorded by the computer program *Game*, and players were measured anthropometrically [3–5].

The current paper analyzes comparatively the proficiency of winning and losing teams at all these three tournaments. The article does not include players' anthropometric analysis.

MATERIAL AND METHODS

The sample consisted of 197 boys aged 13–15 years from the eight most successful volleyball teams of Class C (up to 16-year-olds) who participated in Estonian championships in Tartu in 2005, in Viljandi in 2006 and in Rakvere in 2008.

Assessment of players' proficiency

To record the games, an original computer program was used, which was first presented by R. Nõlvak (Stamm) [1] in 1995 and has been introduced in a specialist journal in the USA [2]. In this study two computers equipped with the program *Game* were used for simultaneous recording of the performance of two opposing teams. Parallel recordings were made by volleyball experts – the authors of the present paper,

M. Stamm and R. Stamm. All the participating teams played with each other once.

The total number of games played in Tartu in 2005 was 28, in Viljandi in 2006 – 19 and in Rakvere in 2008 – 28.

The assessment of players' proficiency proceeded as follows: during the match, the expert registered each case when a player performed a technical element (serve, reception, block or spike). This was done by pressing three keys on the computer keyboard, thereby registering (1) the element performed, (2) the grade for its performance on a five-point scale (1 – excellent ... 5 – failed) and (3) the number of the player who performed the element. 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.

In addition to the index of proficiency the program calculates the following data for each set and for the whole match:

1) number of performances of technical elements of the game (serve, reception, block, spike) for each player and for the whole team;
2) average indices of proficiency of each element for each player and for the whole team;
3) points scored by performing the elements by each player and by the whole team.

For all the technical elements (serve, reception, block, spike) the total number of their performance for all games was calculated as well as the average number of their performances in one game.

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 $\overline{x}$ and SD were computed and the significance of the differences between the results of different teams was checked by t-test.

RESULTS

The results for all the three tournaments have been presented separately in Tables 1, 2 and 3. When comparing the proficiency of winning and losing teams, we can see that at all the three tournaments there were significant differences between them. The mean number of serves by winners (52.04; 52.11 and 52.50) was significantly greater than the mean of serves of losers (40.21; 38.21 and 41.14). The number of points gained by serves was almost twice higher in winning teams. The winners' average proficiency index for serve was also essentially higher than that of losers – at the second tournament in Viljandi respectively 0.44 and 0.40 and the third tournament in Rakvere 0.48 and 0.41

Although the number of receptions of serves was higher in losers at all the three tournaments, their mean index of proficiency is significantly higher in winners at the first (0.61) and third tournaments (0.59) than in losers (0.51; 0.52).

The number of spikes was essentially higher in winners only at the first tournament (45.29), but the number of points gained from them was significantly higher in winners at all the three tournaments. The mean index of proficiency of spikes was higher in winners, but the difference was statistically significant only at the second tournament in Viljandi (0.65).

The number of blocks performed at all the three tournaments did not differ significantly between winners and losers. The number of points gained from blocks, however, was significantly higher in winners at all the three tournaments. The index of proficiency was significantly higher at the first two tournaments.

The total number of points won was significantly higher in winning teams compared to losing teams. Thus, the winners gained at all the three tournaments 38.21 + 37.84 + 39.16 = 115.2 points, the losers, however, on average 24.61 + 21.89 + 26.05 = 72.55 points.

Table 1. Comparison of proficiency of winning and losing teams in 2005 (28 games)

		Winners		Losers		
No.		Mean	SD	Mean	SD	p-value
1	Serves	**52.04**	5.90	40.21	8.27	**<0.001***
2	Points won	**6.57**	2.38	3.25	2.56	**<0.001***
3	Index of proficiency	0.73	1.71	0.37	0.05	p=0.260
4	Reception	35.57	8.15	**45.96**	6.20	**p<0.001**
5	Index of proficiency	**0.61**	0.06	0.51	0.08	**p<0.001**
6	Attacks	**45.29**	10.70	38.79	8.78	**p=0.014**
7	Points won	**21.71**	5.19	14.64	4.53	**p<0.0001**
8	Index of proficiency	**0.62**	0.09	0.52	0.10	p=0.061
9	Blocks	16.71	7.68	16.71	6.29	p=1
10	Points won	**5.57**	2.89	3.68	2.42	**p=0.010**
11	Index of proficiency	**0.50**	0.13	0.43	0.11	**p=0.034**
12	Points won total	**38.21**	6.94	24.61	7.04	**p<0.0001**

Table 2. Comparison of proficiency of winning and losing teams in 2006 (19 games)

		Winners		Losers		
No.		Mean	SD	Mean	SD	p-value
1	Serves	**52.11**	6.51	38.21	13.00	**<0.001***
2	Points won	**7.68**	3.35	3.00	2.08	**<0.001***
3	Index of proficiency	0.44	0.05	0.40	0.07	**0.029***
4	Reception	33.21	11.59	45.84	6.78	**<0.001***
5	Index of proficiency	0.57	0.10	0.50	0.10	0.050
6	Attacks	37.84	12.19	39.26	14.67	0.747
7	Points won	**17.42**	5.14	12.21	7.69	**0.019***
8	Index of proficiency	**0.65**	0.11	0.52	0.11	**<0.001***
9	Blocks	15.74	4.62	13.53	4.49	0.143
10	Points won	**5.89**	2.08	3.58	2.24	**0.0021***
11	Index of proficiency	**0.58**	0.13	0.45	0.11	**0.0026***
12	Points won total	**37.84**	4.55	21.89	10.95	**<0.001***

Table 3. Comparison of proficiency of winning and losing teams in 2008 (28 games)

		Winners		Losers		
No.		Mean	SD	Mean	SD	p-value
1	Serves	**52.50**	6.71	41.14	12.83	**p<0.001**
2	Points won	**7.18**	3.47	3.86	2.69	**p<0.001**
3	Index of proficiency	**0.48**	0.06	0.41	0.06	**p<0.001**
4	Reception	37.18	11.84	**47.21**	6.69	**p<0.001**
5	Index of proficiency	**0.59**	0.10	0.52	0.10	**p=0.0208**
6	Attacks	44.21	13.25	41.54	14.48	p=0.47
7	Points won	**21.61**	7.19	15.14	6.35	**p<0.001**
8	Index of proficiency	0.59	0.09	0.56	0.09	p=0.179
9	Blocks	19.11	8.21	18.38	6.24	p=0.801
10	Points won	**5.43**	3.25	3.46	1.41	**p=0.012**
11	Index of proficiency	0.46	0.09	0.78	1.85	p=0.436
12	Points won	**39.16**	8.57	26.05	9.13	**p<0.001**

DISCUSSION

The current analysis demonstrated once again the necessity for comparison of players and teams of this age group. Regular annual Estonian championships make this possible. For that purpose the original computer program *Game* is appropriate as it does not incur substantial financial expenses.

Our system, where two computers and two experts are used for parallel recording of the performance of both teams is appropriate for that purpose. This system can be recommended for use at championships annually.

Unfortunately we have no comparative material from literature where an analogous program would be used for adolescent players; therefore, we have to limit ourselves to presenting only our own data. We have also presented our results at international conferences [6, 7].

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THE TARTU PERIOD OF PROFESSOR OF SURGERY NIKOLAI PIROGOV

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INTRODUCTION

Nikolai Ivanovich Pirogov was born on 13 (25) November 1810 in Moscow as the son of a 9th-class commissioner. He received primary education partly with the help of a private tutor, partly in V. Kryazhev's boarding school, which was one of the best educational institutions in Moscow at that time. His father Ivan Pirogov worked as an accountant at an army provisions store. After a theft had been discovered at his workplace, he was not able to continue educating his talented son. I. Pirogov's friend Yefrem Mukhin, a famous professor in Moscow, suggested that the boy should be prepared for entering the Medical Faculty of Moscow University, where Mukhin had great influence. Medical student Vasili Feoktistov coached N. I. Pirogov for entrance examinations; his father, however, asked the officials of the provisions store to show his 14 years old son's age on the birth certificate as 16 (Levitski 1903: 261). From 1824, the minimum age for entering the University of Moscow was sixteen. Therefore, the documents record the year of his birth as 1808 (EHA, Stock 402, Series 1, Item 3528; Stock 402, Series 3, Item 1323). Pirogov had been playing the doctor since he was a little boy (Pirogov 1950; Pirogov 1985), and his great role model was namely Professor Mukhin.

In 1824 N. Pirogov entered the Faculty of Medicine at Moscow University.

On 25 November (New Style) 2010 we mark Nikolai Pirogov's 200th birth anniversary. As his Tartu (Dorpat) period played an essential role in his formation as a scientist, next a short overview of that period will be presented.

THE TARTU PERIOD

Nikolai Pirogov had entered Moscow University and dedicated himself fully to his studies. The time flew quickly and graduation was drawing near.

Once the clinicist Prof. Matvei Yakovlevich Mudrov arrived at the lecture earlier than usual. Instead of starting his lecture on vascular diseases, he announced, "The council of our university received a prescript from St. Petersburg to select the best graduates in order to send them to continue their education abroad. These young men will become department heads at Russian universities" (Mogilevski 1954: 40). On the following day Yefrem Osipovich Mukhin, a family friend of the Pirogovs, asked Nikolai Pirogov to come to his home. He became much more concrete. "Nikolai, have you heard that seven of you will be proposed to go to study abroad in order to take over from us, old men? Are you ready to continue your studies after graduating from the university?" (Mogilevski 1954: 40). Nikolai agreed immediately, although he had not decided yet in which branch of medicine he would like to specialize. He was also in a predicament as the family was expecting his help, but he did not want to abandon the idea of continuing his education. The thoughts were swirling in his head, "Yefrem Osipovich is a professor of physiology; he will be happy if I choose his speciality. By doing so, I'll thank him for his selfless attention." He said indeed that he would choose physiology, but Professor Mukhin was of the opinion that physiology would not suit Pirogov, and so Nikolai promised to give an answer the next day. By the following day he had sorted himself out and decided in favour of surgery.

Academician Parrot had reached an agreement in St. Petersburg about establishing an Institute of Professors at the University of Tartu. The idea was that young men who had graduated from universities in Russia would be trained to work as professors in various areas of science. In 1828 twenty candidates were meant to be admitted to the University of Tartu for two or three years and then sent to foreign universities for the same period. After the end of training, young professors had to take an obligation to work in their speciality at respective departments of Russian universities.

For Pirogov, physician's exams began. Professor Loder's assistant examined him in anatomy. Pirogov knew anatomy excellently. The following exam was in physiology. He was asked questions in Latin on blood circulation and the activity of digestive organs. His grade was excellent. The next was pharmacology. Professor Kotelnitski asked questions about the effect of mercury in the case of various diseases and about the characteristics of invigorating remedies. He was completely satisfied with the answer. Pirogov also received the highest grade from Mudrov in therapy and clinical treatment. Professor Alfonski examined him in surgery. Pirogov gave an excellent answer to the complicated question about inflammations and their different outcomes. Pirogov received the last excellent grade from Professor Mukhin in forensic medicine (Mogilevski 1954: 42). After the end of the exams, the day arrived when Pirogov signed his doctor's oath. The very night after graduating from the university, Nikolai Pirogov was called to see a patient (Mogilevski 1954: 43). This was not a university exam any more but real life. One had to react in reality and Pirogov got into trouble. He sent for a barber for help, but nonetheless the patient died by the morning. His first defeat was a hard blow for Pirogov. He realized that, as a young doctor, he did not know much about diseases and still had a lot to learn.

In the semi-darkness of the large hall with massive marble columns, the trainees lined up: Ivan Shikhovskoi – physician, Sokolski – physician, Redkin – lawyer, Kornukh-Trotski – physician, Konoplyov – Orientalist, Shumanski – historian, and Nikolai Pirogov. They set out for St. Petersburg in pairs. Pirogov travelled together with Shumanski (Mogilevski 1954: 44).

The log road from Moscow to St. Petersburg nearly shook the travellers to pieces; the wheels of the kibitka seemed to be rolling over the keys of a piano. A few days after their arrival in St. Petersburg, the young men were introduced to Prince Lieven, Minister of Public Education. Next, they had to take exams at the Academy of Sciences. The physicians were examined by Professors Danil Mikhailovich Vellanski and Ivan Fyodorovich Busch from the Medical Surgical Academy. Nikolai Pirogov received the following grades: obstetrics – good, surgery – good, Latin – poor, German – decent, French – average, the overall assessment – passed.

A few days after the exams the future professors set out for Dorpat. They travelled as a threesome – Redkin (the only one who failed the exams but later became Rector of St. Petersburg University), Sokolski and Pirogov. Having reached Narva, Pirogov was enthusiastic about the Narva waterfall and saw the sea for the first time in his life. He wrote, "I will never forget the day when I first saw the immeasurable expanses of the blue sea..." (Mogilevski 1954: 49).

With the shaft-bells of post horses ringing, Nikolai Pirogov and his friend reached Tartu on the warm morning of a sunny day in June 1828. They stopped in front of the Frey guesthouse where the landlord kindly received them. Next to the landlord, however, a man with an expressionless face was standing – Professor Perevoshchikov from the Institute of Professors. The next Sunday he introduced the future professors to those working at the university at that time. Wearing state uniforms and triangular hats, with swords dangling at their sides, the young men walked from street to street, attracting general attention. During this Sunday round of visits, Professor of Surgery Moier seemed most likable to Pirogov. He was of tall stature, broad-shouldered, with rough facial features, thick greying reddish hair, sincere blue eyes shadowed by thick eyebrows, and graceful long fingers. Namely Ivan Filippovich Moier was to become Pirogov's supervisor. Moier's home language was Russian and when during the general talk he noticed that Pirogov was short of German words, he kindly switched to Russian.

Flats had been rented for the future professors before their arrival. Pirogov, Shikhovskoi and Kornukh-Trotski settled in Rehber's house in Gildi Street. Dinner was cooked for the students by the tavern-keeper Hackstädter.

Thus, Nikolai Pirogov had become a student of Professors Institute at the University of Tartu (EHA Stock 402, Series 4, Item 488). The institute had rigid rules that regulated the students' life to the smallest details, but the students' board and lodging were fully paid for by the government. Watching how the rules were observed and management of studies were the responsibility of the director, who was appointed from among the university staff (1828–1830 V. M. Perevoshchikov, 1830–1838 J. F. Erdmann) (Tamul 1979: 85–89; Siilivask 1982: 96–97; EHA, Stock 402, Series 4, Item 488, pp. 48–50 ff; Item 512, p. 25 ff, Item 526, pp. 144–146).

Rector of the University Ewers sent a report to St. Petersburg on 23 June 1828 where he said that he had given "150 roubles to each of the aforementioned gentlemen for initial expenses ... on account of sums allotted to them." Nikolai Pirogov spent that money on books and went to look around the town with an empty pocket and a light heart (Mogilevski 1954: 56).

The first day of his studies arrived. Director of the Professors Institute Perevoshchikov told Pirogov that during the first semester he would upgrade his skills in anatomical preparation under Dr. Wachter. He would study theory of surgery and get instruction in surgical operations from Professor Moier. Pirogov's wish to take Greek lessons was also satisfied. Great emphasis was placed on independent work: taking notes from books, writing critical articles or reviews and doing practical research: anatomical preparation, dissection, assistance at surgical operations. While preparing anatomical specimens, N. Pirogov worked under the supervision of prosector G. J. A. Wachter. They became great friends. In his book *Problems of Life. An old doctor's diary* (Issakov 1986: 159; Pirogov 1950: 337), Pirogov noted that he learned more from *privatissimum* with Wachter during the first semester in Tartu than from the numerous lectures at German and French universities. Wachter taught a short course of anatomy to Pirogov alone, using fresh cadavers and specimens preserved in ethanol.

Instruction on surgical operations, however, was given to Pirogov by Prof. J. Chr. Moier. Moier, who was becoming lazy in the silence and isolation of Tartu, experienced new inspiration when he saw what a gem he was polishing.

Pirogov, in his turn, worked tirelessly in the stuffy air of the anatomical theatre and learned to know the human body. The task given to him by the faculty was ligation of arteries. After the contract with Rehber's widow expired, Nikolai Pirogov moved to Moier's house and, in the evenings after the intense working day, met the well-known people of his time. Pirogov wore his beautiful state uniform only on holidays; otherwise he wore suits remade from old clothes, as he spent his money on books and live material necessary for anatomical research – dogs, cats and calves.

Because of the rumour spread by his fellow student Fyodor Inozemtsev about Pirogov's fondness for alcohol, he left Moyers' house and was accommodated into one room with Inozemtsev who had arrived from Kharkov University. While Nikolai would have liked to deliberate on his daily activities, endless tea-drinking and chatting was going on there, and tobacco smoke filled the whole room. It was impossible to read or write anything there (Mogilevski 1954 :65).

Pirogov toiled in the anatomical theatre, forgetting even to eat, so that the attendant had to remind him of that, but he did not attend lectures, and Professor Moier had to call him to order. Director Perevoshchikov spied after the students and sent reports to St. Petersburg. He did not like Pirogov and sent negative messages about him, and Pirogov even earned a reprimand. Director Perevoshchikov wrote in his reports that Pirogov did not always attend Professor Erdmann's lectures diligently; in tests on pathology his scores were only average; he mixed up the term in mineralogy, and he was extremely weak in the theoretical part of medicine. However, he always listened carefully to Prof. Moier's lectures on surgery. He dealt mostly with practical anatomy, practised dissections on cadavers and wrote papers on some areas of surgery (Mogilevski, 1954: 65; Pirogov 1950: 315).

Pirogov worked tirelessly. He founded a small experimental laboratory of his own. First he ligated blood vessels on cadavers, performing thousands of ligations and achieving immaculate technique and speed. As there were not enough cadavers for Pirogov in Tartu (Dorpat), they were weekly brought by stagecoach from Riga. Later, the anatomical theatre purchased dogs, rabbits and rams, and Pirogov started vivisection.

In 1829 he achieved his first success. He received a gold medal for his paper on the ligation of arteries.

In 1831, Tartu was hit by an epidemic of cholera. Attempting to establish the origin of the disease, Pirogov dissected hundreds of corpses of cholera victims, but he was unable to discover the cause the disease.

On August 31 1832, Pirogov defended his doctoral dissertation *Num vinetura aortae abdominalis in aneurysmate inguinali adhibitu facile ac tutum sit remedium?* (Is ligation of abdominal aorta in the case of inguinal aneurysm an easy and safe remedy?) The paper derived conclusions on circulation disorders that develop after abdominal aorta ligation and gave suggestions for avoiding complications after the operations. He was the first to study and describe the topography of abdominal aorta. He proposed two options for approaching the aorta – through the peritoneum und extraperitoneally. Pirogov's thorough experimental study which linked the problems of practical medicine with topographical anatomy and physiology was so novel and remarkable that it made the whole academic circles of Tartu (Dorpat) speak about it. Pirogov drew his conclusions from numerous experiments on animals (dogs, calves, rams) and several operations on people in the case of inguinal artery aneurysm.

From 1833–1835, N. Pirogov upgraded his skills in Germany. He worked with Prof. Schlemm in C. F. von Graefe's clinic in Charité hospital of Berlin and under Prof. Langebeck in Göttingen. It was namely Prof. Langebeck who taught Pirogov his immaculate surgical technique. He taught him to listen to the perfect melody of the operation and to synchronize the work of legs and the whole body with the work of hands. He did not tolerate sluggishness and required quick, punctual and rhythmical work.

On the way home, Pirogov fell seriously ill and had to remain in Riga for treatment. As soon as he got out of sickbed, he started operating, as the rumour that a good surgeon was staying in town spread quickly. He began to do rhinoplasty, modelling a new nose for a noseless barber. He amputated limbs and operated on tumours. Returning to Russia, Pirogov hoped to get a vacant professor's post in Moscow, but his wish did not materialize. Minister Uvarov gave the position to Pirogov's fellow student from the Professors Institute, F. Inozemtsev. Thereafter, Pirogov returned to Tartu and started working in Moier's clinic. His first operations surprised his colleagues by their speed and perfection. When Moier retired, he recommended Pirogov as his successor. Although the Faculty of Medicine considered Pirogov too young for a professor, he was nonetheless elected to the post of extraordinary professor of Tartu (Dorpat) University on 9 March 1836 with 14 votes for and 8 votes against him. Minister Uvarov was not against Pirogov's election either. Following Prof. Moier's advice, Nikolai Pirogov made preparations for the journey to St. Petersburg, in order to introduce himself to the minister and wait for the final decision of the University Council about his election to the post of professor of surgery. In order not to idle, Pirogov worked in different hospitals of St Petersburg and, during six weeks, delivered lectures on surgical anatomy to the doctors of Obukhov hospital. He also delivered a lecture on rhinoplasty at St. Petersburg Academy of Sciences. The ministry delayed Pirogov's confirmation to the post of professor of surgery in Tartu (Dorpat) as the theology professors in the University Council had suggested that the professor should be a Lutheran. This made Pirogov nervous, and he intended to accept the proposal to become a professor of surgery in Kharkov (Mogilevski 1954: 102).

Pirogov returned to Tartu at the end of March 1836. He started his lectures on surgery early in April. He lectured on the theory of surgery according to Chelius and on operating according to Velpeau (Levitski 1903: 263). He also supervised practical training at the surgery clinic.

A notice appeared on the wall in the vestibule of main building of the University. It advertised the beginning of lectures on surgery by Extraordinary Professor Nikolai Ivanovich Pirogov in the Anatomical Theatre. Students flocked to the semicircular anatomical theatre on Toome Hill. The auditorium was full of people; some laughed loud, some cracked jokes about the youth of the professor. Pirogov entered the lecture theatre unnoticed. He started the course by teaching joints. Making mistakes in difficult German syntax, which made the students smirk and laugh, Pirogov began his lecture. He also demonstrated anatomical specimens. This was something new for the students of Tartu. Soon the auditorium became quiet and everyone was listening with great interest. A week after the beginning of the lectures the surgical clinic was opened (Mogilevski 1954: 105).

On 6 March 1837, Pirogov was appointed to the post of full professor. Pirogov started on practical and theoretical surgery simultaneously. The students got used to practical application of the knowledge they had acquired from lectures and books. In the operating theatre Pirogov required that his students explained exhaustively what they were going to do. Before each operation, the student had to describe in detail the anatomy of the organ operated on (Sepp, Mõttus 1982 : 103).

In 1836–1840, because of the great number of ophthalmologic patients and a shortage of beds in the surgical clinic, Pirogov was forced to found, together with 15 students, a private ophthalmologic hospital with ten beds. This was the first ophthalmologic hospital in the Baltics (Siilivask 1982 :231).

In 1837, Pirogov introduced the stiff starch bandage in clinical practice (Siilivask 1982: 246). In 1837 and 1839, Pirogov issued the two-volume book *Annalen der chirurgischen Abtheilung des Clinicums der Kaiserlichen Universität Dorpat* (*Annals of the Surgery Department of Tartu University Clinic)* (Pirogoff 1837, 1839). This was Pirogov's testimony as a doctor – he was severely critical of his own activity in medicine. His students were impressed by the honesty and courage of their teacher, and, as a token of deep respect, they presented Pirogov with his portrait (Mogilevski 1954: 108). In 1837–1838 he published the book *Anatomia chirurgica truncorum arteriarum atque fasciarum fibrosarum* (*Surgical Anatomy of Artery Trunks and Fasciae),* complete with an atlas consisting of 50 original drawings. The book brought Pirogov the Demidov Prize of the Russian Academy of Sciences (Mogilevski 1954: 117) and won him great recognition abroad. Before

Pirogov, almost no one had dealt with fasciae. Such fibrous layers were known to exist; during operations surgeons stumbled on them and cut them through without paying attention to them. Pirogov set himself the aim to study the direction of each fascia in relation to the neighbouring blood vessels, muscles and nerves. Descriptions of oprations were illustrated with drawings, which stand out for their proportionality and exactness. This was the beginning of a new science – surgical anatomy.

For the first semester of 1838, Pirogov travelled to France, where he acquainted himself with the situation of surgery there. When meeting the famous professor of anatomy and surgery A. Velpeau, Pirogov found him studying Pirogov's own *Surgical Anatomy of Artery Trunks and Fasciae.* Pirogov was also greatly impressed by surgery lectures of the young surgeon Labat.

Back in Tartu, Pirogov began to study the healing of Achilles' tendon's wounds and published a monograph on it in 1840 – *Ueber die Durchschneidung der Achillessehne*.

During his Tartu (Dorpat) period, Pirogov supervised 13 doctoral dissertations (Siilivask 1982: 246). These dealt with blood vessels pathology, rhinoplasty, section of Achilles' tendon, intestine suture etc. His student V. A. Karavayev became a professor in Kiev and A. Kieter in Kazan and St. Petersburg.

On 31 January 1841, N. Pirogov was transferred to the post of professor at the Medical Surgical Academy of St Peterburg.

On 13 December 1852, the 50th anniversary of the reopening of the University of Tartu (Dorpat), N. I. Pirogov was elected honorary doctor of the University along with F. G. Struve and K. E. von Baer (Das zweite Jubelfest... 1852).

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TEENAGERS' PHYSICAL DEVELOPMENT AND FITNESS PARAMETERS TESTED BY THE *EUROFIT* METHOD

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ABSTRACT

Hypothesis – the age-appropriate load improves teenagers' physical development. Sportsmen's physical preparedness is better than the physical preparedness of the rest of schoolchildren.

The aim of study.

To study and compare the physical development and the physical preparedness of teenagers – sportsmen and teenagers with insufficient movement activity.

The objectives of study.

1. To acquire the methods of performing the Eurofit test.
2. To determine separate anthropometric parameters, the body posture of teenagers and teenage sportsmen.
3. To state the physical preparedness by tests of the Eurofit method; to analyze and compare the acquired results.

The method of study.

1. The study is carried out by the Eurofit method description.
2. The analysis of results is carried out in corformity with laws and regulations of the Eurofit test.

Results I

Analyzing the parameters of physical development in total, we could conclude that the teenagers of the experimental group (basketball players) showed higher parameters of physical development necessary when going in for sport.

The teenagers with a bigger body mass (assessing the skin and subcutaneous fat folds thickness sum) are advised to have the diet and eating habits controlled.

Results II

Analyzing the mean value parameters of physical preparedness between both groups, we stated that basketball players outweigh their untrained peers in speed during flexibility testing – the strength test. In other tests the untrained control group peers outweigh the trained basketball players. Some basketball players are seen to have a low physical preparedness level, which lowers the mean value of the group in each test.

Analyzing the test results by the evaluation scale I variation of the Eurofit method, we found that most commonly the physical preparedness level in basketball players is moderate and above the average level, in some tests – the Flamingo balance test – at a higher level in 42.9% cases, the hand movement speed test is at a higher level – in 66.7% cases.

Key words: *teenager, physical development, preparedness.*

INTRODUCTION

Physical activity is connected with changes in the human body and lifestyle, the health status and other factors. Studies of many authors witness that physical activity in young age has a significant importance in preserving functional abilities in mature age and old age. Just in young age there develop (hidden at the beginning) disorders of various organ functions, especially in the circulatory system and the immune system. The increase of physical activity brings adequate development to a certain age and it is also an important prophylactic measure.

In teenage, with the enhanced secretion of sex hormones in blood, begins the puberty period, characterized with changes in almost all the organ systems. In this age, specificities of hormone balance may cause harmonic or dysharmonic physical development of teenagers.

Equal chronological age does not yet guarantee a similar biological age. As a result, teenagers may have quite different functional abilities.

The circulatory system at teenage is not sufficiently developed yet. The heart volume in the age of 14 years makes only half of an adult person's heart volume. The heart weight on average is 185 grams. The heart rhythm in this age is 70–80 contractions per minute. As a result of training, the heart mass increase is faster than in untrained teenagers. Athletes' heart increases at the expense of the left chamber. Heart's physiological hypertrophy begins approximately one year after starting regular endurance trainings [1, 3, 4].

The development of the respiratory system in teenage is very intensive. Lung ventilation at relative rest in teenage, is mainly increasing at the expense of the breathed air volume, which is related to the increase of the lung life volume. Lung ventilation at the age of 12 years from 4–61 per minute increases up to 8–101 per minute in the age of 16 years [1, 2, 4].

Metabolic intensity slightly decreases, yet, it does not exceed the parameters of an adult person. Energy consumption in the age of 13 years is on average 1.4 kcal/kg per hour (minimum 6–8 kcal/kg per day), but for adults 1.0 kcal/kg per hour [7]. For teenagers the heat return per one kg of weight is by 30% higher than for adults [7, 8, 9].

The central nervous system in the age of 10–12 years acquires already the sizes of an adult, yet, functional abilities have not yet reached their optimal variant. In teenage the movement coordination worsens, in behaviour negativism, increased emotions, fast mood swings dominate. Similar instability can also be observed also in the vegetative innervation of internal organs, the frequent change of the face colour, sweating, sudden changes in the heart rate, lowering of blood pressure with possible fainting and other vegetative reactions [1, 4, 5]. Teenage is the transition from childhood to adulthood. This process concerns all the sides of development – mental, ethic, physical, etc. [11, 15].

In the development of physical features three sensitive periods can be seen– fats, moderate and slow [8, 12, 13, 14].

On the basis of each physical ability there is a morphophysiological condition why in the definite age one can develop a certain physical ability. Physical abilities are flexibility, agility, strength, endurance, speed.

Physical abilities develop in close relationship, they have to be developed targeted, considering the biological age periods and having regular training [4, 13].

In order to assess the physical fitness of 6–18 –year-old children, the European Committee Council for Sport Development has recommended the *Eurofit* tests [6]. The *Eurofit* tests are easily carried out, contain 10 tests which depict 6 ways of physical abilities, 9 parameters of physical fitness, anthropometric and stature parameters.

MATERIAL AND METHODS

The study was carried out in 2008. It included 82 teenagers in the age of 15–16 years who were dividend into 2 groups – the control and experimental group. The control group included 41 teenagers from Riga 95. Secondary school who were physically active children. They participated in sport classes at school twice a week for 40 minutes. The second was an experimental group where 41 basketball players of The 3rd Children's and Youth Sport School were included. They, beside sport classes at school, participated in training 4 times a week for 2 hours and in free time participated in sport competitions. For determining the physical development, we used the anthropometric methods. Teenagers were measured for the height (cm), body weight (kg), by means of the caliper for the skin and subcutaneous fat layer in 4 body parts was determined. Physical fitness was tested by the *Eurofit* method [6]. In our study the following tests were performed: the static strength test with the hand grip, the flamingo balance test, the hand movement speed test, the elasticity test by sitting and extending foreward, the physical abilities test by veloergometer PWC_{170}. For all the participants of the study the body posture in frontal and sagittal planes anteriorly and posteriorly as well as the plantogramm of the foot was determined.

The questionnaire was introduced by inquiring about physical activity and the health status. The acquired data were statistically processed by SPSS, MSExcel, CIA computer programs at RSU Department of Physics. The calculations of physical fitness load were made by BOV Medical Centre Ltd. The *Eurofit* evaluation scale I variation [6].

RESULTS AND DISCUSSION

A human physical development is characterized by anthropometric parameters. One of the chief developmental parameters is the body height. In the control group teenagers the mean height value was 178.6 ± 4.9 cm, minimum height was169.3 cm, maximum – 188.3 cm. In the experimental group teenagers – basketball players the mean body height value was 187.5 ± 8.8 cm, the minimum height – 167.0 cm, maximum – 203.2 cm. On average the basketball players are taller by 8.9 cm.

The mean body mass in the control group teenagers was 75.0 ± 17.5 kg, the minimum mass value – 54.2 kg, maximum – 107.0 kg. In the experimental group teenagers' mean body mass value was 81.5 ± 14.1 kg, the minimum mass value – 59.0 kg, maximum – 110.0 kg.

The body mass index (BMI) characterizes each individual's mass composition. The BMI mean value in the control group teenagers 23.5 ± 5.3 kg/m^2, minimum BMI 18.6 kg/m^2, maximum 30.3 kg/m^2, buti n basketball players' mean BMI 23.1 ± 2.6 kg/m^2, minimum 18.8 kg/m^2 and maximum – 29.1 kg/m^2. The mean value of BMI of teenagers in both groups included in the study is in norm, but in some individuals it exceeds the norm.

In order to state the excessive weight more precisely in some individuals, it is important to calculate the active and passive body mass. The percentage component of the body fat mass is greatly various and depends on the gender, age, genetic factors, metabolic intensity, physical activity, ect. factors. [8, 12].

If the subcutaneous mass is lower by 5%, then the body's protective ability remarkably decreases [1].

For all teenagers included in the study the sum of 4 skin and subcutaneous fat tissue folds in millimiters (frontal part of the upper arm, at the backside, under the scapula and above the edge of intestinal bone)were determined. In the control group teenagers the sum of the skin and subcutaneous fat tissue fold the mean value was 41.8 ± 20.9 mm, the minimum 18.0 mm, the maximum 86.0 mm; the sum of the skin and subcutaneous fat tissue fold the mean value in basketball players was – 44.0 ± 11.8 mm, the minimum 29.0 mm, the maximum 70.0 mm.

Analyzing the total parameters of physical development, we can conclude that the experimental group teenagers (baskteball players) have higher parameters of physical development, which is also necessary going in for sports in the chosen field.

Physical fitness can be defined as the sum total of many factors, which are exposed in the cardiovascular, respiratory system working ability, the strength and endurance of the muscular system. As extra factors, one can consider elasticity and the body structure. Physical fitness directly affects the physical and mental working abilities [7, 8].

Strength is a man's physical feature which is exposed as the ability to overcome the external resistance by muscle effort or to fight against it by means of strength. Strength is directly dependant on the muscle mass. The development of the muscle mass and the strength occurs simultaneously, and it is also dependent on the beginning of the activity of sex glands. Strength is closely connected with speed and endurance, therefore we distinguish the maximum strength, the fast strength, the endurance of strength. Strength dinamometry at the age of 12 years has little difference from the junior school-age children's parameters and ranges from 50–60 kg, but in the age of 15 years it already exceeds 90 kg (in the age of 18 years – 125 kg).

For the detection of static strength, we used the hand grip, which was measured by a manual dinamometer (kg). In the control group teenagers, the mean value of absolute hand grip strength was 42.4 ± 6.0 kg; minimum 30.0 kg, maximum 50.0 kg; in basketball players the mean value was 42.5 ± 6.1 kg, minimum 28.0 kg, maximum 51.0 kg. Relative dinamometry of the hand muscle strength (hand grip kg/body mass kg) in the control group teenagers was on average 58.6 ± 11.4, minimum 23.6, maximum 74.8; the mean value of basketball players was 52.7 ± 7.1, minimum 23.6, maximum 74.8; the mean value of basketball players was 52.7 ± 7.1, minimum 30.0, maximum 71.2. Comparing the levels of the mean parameters by the *Eurofit* method evaluation scale I variation [6], the basketball players of the middle 29th level physical fitness group comprised 57.1% teenagers, but from the control group only 28.6%; 50% from this group are below the middle level and the low level. Thus, static strength parameters in schoolchildren are more commonly below the middle level, but in basketball players more commonly at the middle level.

Agility is a man's ability to react fast and correctly to unusual situations. Agility is characterized by the coordination of movements, balance, orientation in space, the plasticity of movements, elasticity. Agility, to a great extent, is determined by the degree of the development of the central nervous system. Agility quickly improves by the age of 13–15 years; in the age of 14–15 years the movement coordination reaches that of an adult person [4, 7, 8]. The Flamingo balance test was used for the determination of the static balance.

Compared balance test results by the *Eurofit* method evaluation scale can be seen in Figure 1.

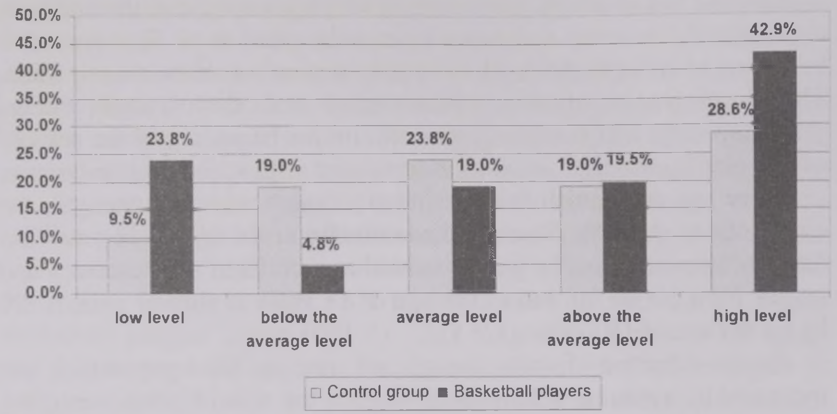

Fig. 1. Flamingo balance test.

Test results show that in almost half of basketball players the balance test is at a high level, but in the control group schoolchildren only one third reaches it.

Speed is a man's ability to react fast to external irritations and to perform fast movements [7, 8, 9]. Speed qualities are genetically determined, therefore they can be little trained. For the detection of the speed of the hand movement, we used the test – striking on the plate. Testing the speed of the hand movement by the *Eurofit* method we stated, that for the control group teenagers the high level is 42.9%, but for the basketball players the high level is 66.7% cases. (Fig. 2)

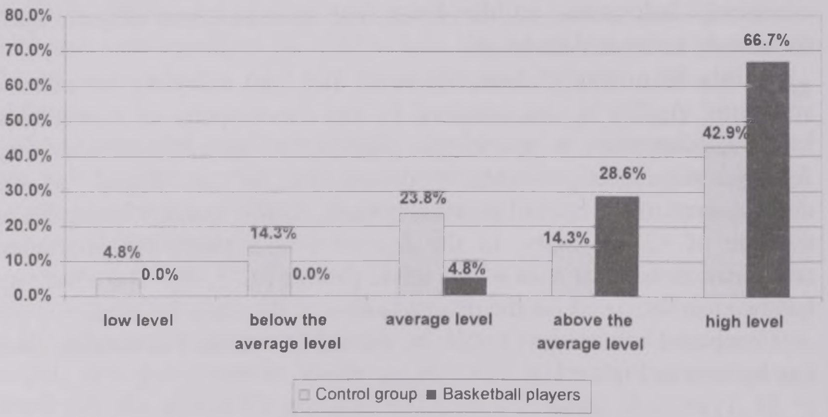

Fig. 2. The hand movement speed test

In basketball players the low level and below the middle were not observed.

Elasticity is the ability to make movements of wide range. It is measured in degrees or centimeters. Elasticity depends on the mobility of joints, elasticity and extensability of ligaments, muscle tendons. For the development of elasticity in boys the most appropriate is the age of 11–14 years, in girls 9–12 years [1, 4, 7].

For testing of elasticity we used the test – sitting and extending forward. The mean value in the control group teenagers was 19.7 ± 8.9 cm, minimum – 1.0 cm, maximum 35.0 cm. For basketball players the elasticity is similar – the mean value 20.7 ± 10.9 cm, minimum 2.0 cm, maximum 32.0 cm. In both groups most commonly a low level elasticity is observed – in the control group 38.1%, in basketball players – 42.9% cases.

For explosive strength or fast strength detection, we used the test – leaping away from the side. The mean value in the control group teenagers in this test was 213.2 ± 31.2 cm, minimum – 120.0 cm, maximum 250.0 cm, the mean value in basketball players was 219.6 ± 16.3 cm, minimum 182.0 cm, maximum 255.0 cm.

Endurance is the ability of a human body for a longer period to fight against tiredness, not diminishing the intensity of the physical load.

The general development is enhanced by aerobic processes. For the development of endurance longstanding, persistent, regular workis needed. On the basis of endurance or the body's aerobic abilities there lie a lot of important morphofunctional development of physiologic systems exists. Such a development is possible in the cases when the respective trainings take place during the fast growth of the body. Therefore, any sport representatives should use the junior and teenage children for physical fitness [3]. Endurance can easier adapt to moderate ohysical development [9, 12].

Teenagers' physical working abilities were determined by the veloergometer test – PWC_{170}. During this test the person tested is pedalling for 9 min on the veloergometer on 3 various value physical loads, which are the changes by every 3 min so that at the end of the test one should reach the heart rate of 170 beats per minute.

The mean value of PWC_{170}. in the control group teenagers was 1.8±0.4 ($p>0.001$), in basketball players – –2.7 ± 0.5 ($p>0.001$). The compared level of working abilities between the groups is seen in Figure 3.

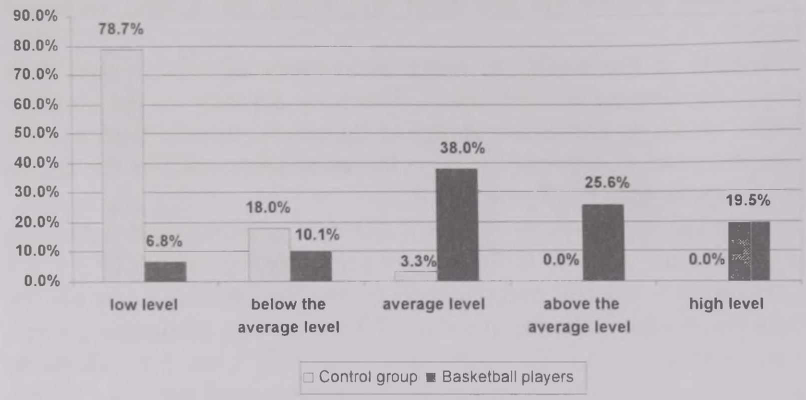

Fig. 3. PWC 170 test results

Teenage basketball players were going in for training for 2 hours 3–4 times a week, besides, most of them for 3 years. The training load beneficially affects the development of the cardiovascular system, the respiratory system, therefore althetes are seen to have much higher working abilities than children with insufficient physical activity.

Analyzing all the test results of physical activity in total, we stated that the physical condition at the higher level is seen in basketball players who undergo regular training. According to the *Eurofit* method evaluation scale I variation, we found that in total the physical fitness for basketball players in 81.3% cases was at a low level, below the average level and the average level.

CONCLUSION

Parameters of physical development –the mean value of the height, body mass, body mass index, 4 skin and subcutaneous fold sum are higher in basketball players than in the control group peers with insufficient physical activity.

1. Control group teenagers were seen to have normal stature in almost 30% cases, in basketball players only 10% cases. More than in half of basketball players, i.e. 61.9% cases stature asymmetry was seen, in one case – scoliosis. The majority of the teenagers under survey were seen to have normal feet.

2. In the control group schoolchildren who did not go in for training, the physical fitness tests were at a low level or below the middle level, except for movement speed and the balance test.
3. Comparatively, basketball players' physical fitness in total is at a higher level than in the control group schoolchildren.
4. In half of the basketball players, however, physical fitness is at the low level or below the middle level. It means that one needs an individual training plan to increase the young people's physical condition.
5. Teenage basketball players' physical working abilities by PWC_{170} test results are at a higher level than in their peers with insufficient physical activity.

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THE ACTIVITIES OF THE ESTONIAN NATURALISTS' SOCIETY IN 2009

Tõnu Viik

The Estonian Naturalists' Society has 23 subunits. The subunits that work as sections are as follows: the section of amateur meteorologists, of anthropology, of biology, of botany, of entomology, of forestry, of geology, and of theoretical biology; the Commission of Lakes, the Estonian Malacological Society, the Estonian Mycological Society, the Estonian Teriological Society and the Jakob von Uexküll Centre. Commissions with special tasks focus on the history of natural sciences, the library, natural education, observation networks, terms of ecology and plant names. In addition, the Society has assemblies of ecology, of honorary members and the round table of nature conservation. The commission of botanical rarities was founded in the summer of 2009.

In 2009 eight General Assemblies of the Estonian Naturalists' Society were held, one review meeting on the year of activity and six lectures from the series "From natural scientists to the teachers of natural sciences". The meetings of the subunits, conferences, seminars, gatherings, camps, exhibitions, etc. were organized.

The Naturalists Day was XXXII in succession and it was held in Mustvee and its neighbourhood, the topic for presentations was Lake Peipsi. On the first day of the event, several presentations were heard about Lake Peipsi from the relicts of ice-age up to the research of water-quality and pollution problems, the meteorological station at Tiirikoja was visited and Ain Kallis talked about the meteorological observations. On the second day an excursion was organized by Ene Ilves on the coast of Lake Peipsi and the Saare manor. The traditional book of presentations was not published.

The Society participated in the organising committee of the conference "Diversity and evolution" dedicated to the 200th anniversary of Charles Darwin on 12 February in the hall of the University of Tartu. The society also participated in the organising committee of the I conference on fylogenetics and systematics "The Origin and Formation of Diversity" on 24 and 25 November which was dedicated to the 150 anniversary of the publishing "Origin of Species" by Charles Darwin.

Traditional events carried out by subunits of the Society were: The Spring School of Theoretical Biology "Theory of Origin" at Karilatsi on 29–31 May, the Autumn School of Geology "Geology without borders" at Viljandimaa on 16–18 October and the Autumn School of Teriology at Soomaa on 11–13 September. The topics considered were reflected in the volumes issued in connection with the events. The Jakob von Uexküll Centre organised on 31 July – 2 August jointly with the Institute of Philosophy and Semiotics of the University of Tartu the Summer School of Ecosemiotics that has become a traditional event also. The anthropology section organised on 23 March jointly with the Institute of History of Tallinn University the Science Day dedicated to Karin Mark's 87th anniversary and in October the traditional conference commemorating Juhan Aul's anniversary was held jointly with the Centre of Physical Anthropology of the University of Tartu. With this event the 70th anniversary of the section was also celebrated and *Papers of Anthropology XVIII* presented.

The subunits organised their traditional scientific meetings and other activities: there was a gathering of Friends of Mosses at Läänemaa, the Mycological Society organised two mushroom camps, in spring and in autumn, it participated in the organisation of several mushroom expositions, held topical lectures on mushrooms, supervised the Study Days and Hikes. Within the framework of the Naturalists' Day there was a meeting of the amateur meteorologists. The members of different sections participated in environmental and species monitorings, observational and scientific projects, working groups of expert assessment and participated in different conferences with reports.

The Society participated in fulfilling the projects funded by the Ministry of the Environment, the Foundation of the Environmental Investments Centre, the Environmental Department, the Tallinn Environment Department, the Financial Mechanism of the European Economic Area and the Financial Mechanism of Norway, the Open Estonia Foundation, the Estonian Union of Terminology, the Union of Setomaa Parishes, the Foundation Tuuru and the NGO Läänemaa Bird Club, the Estonian Road Administration and the Tallinn Botanical Garden.

The Society completed the protection organisation plan of Vapramäe, it composed several expert opinions concerning the assessment of environmental impacts and a detailed plan, participated in preparing the European Water Policy frame directive, carried out the inventory of the forests suitable to flying squirrels and the inventories of different botanical species.

The Society continued to develop the databases of observations of nature and its presentation in cooperation with the information network of biological diversity. The public database is a good and interesting study aid to schools and nature centres, which can be used by everyone over the Internet. The Society continued to monitor the diversity of Estonian biota and landscapes, within the monitoring of water bodies, in the framework of state monitoring of water bodies the big invertebrates were studied.

As of 31 December 2009 the library of the Estonian Naturalists' Society had 161,550 printed items. Within a year library received 145 new books and 117 issues of periodicals. The publications were exchanged with 58 institutions and organisations from 18 countries.

PUBLICATIONS

In 2008, five pieces of printed matter and one Internet journal were published by the Estonian Naturalists' Society:

1. "Geology without borders" (Schola Geologica 5)
2. Lepinfo 18
3. Linda Kongo: bibliography 1957–2008
4. Folia Cryptogamica Estonica. Fasc. 45
5. Folia Cryptogamica Estonica. Fasc. 46
6. Internet journal "Friend of Mosses", no. 12

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DYNAMICS OF CONSTITUTION AND PERSONALITY INDICES IN SAINT PETERSBURG INHABITANTS THROUGH TIME

Olga D. Volchek

ABSTRACT

Indices of constitution and meteosensitivity in 1,004 women and 846 men born in 1930–1979, as well as personality indices in 1,677 women and 736 men born in 1930–1986, in correlation with the geocosmic conditions in the year of birth and the previous year have been studied. Constitution indices include weight and height, head circumference, eye color and hair color, hair curliness at the age of 18–20. Personality indices are characteristics of temperament and self-actualized personality. They are measured by the GTF (general temperament features) questionnaire by V. M. Rusalov and by the POI questionnaire (on self-actualized personality by A. Maslow). Geocosmic indices are solar activity, the geomagnetic field and the interplanetary magnetic field (IMF), gravity, neutron flux and the number of junctions of Mercury/Venus/Mars/Jupiter with the Sun or the Moon at new moon. Significant difference has been shown for average annual values of the studied indices, as well as for 5-year-average values ($p \leq 0,05 \div 0,001$). The correlation analysis showed that changes in the studied indices in people correlate with natural conditions in the year of birth and the previous year at the level of significance $p \leq 0,05 \div 0,005$.

Key words: *adaptability, adaptive types in time, appearance, genetic memory, genotypic, geocosmic conditions, constitution, meteosensitivity, sensitivity, ecotype.*

Constitution and appearance are an important part of personality. They are included in the ecotype description by T. I. Alekseyeva [2] and in the general descriptions of the representatives of different ethnic groups. It has been shown that there is a correlation between personal traits and phenoscopic and antroposcopic indices [3, 4, 10]. Furthermore, one's appearance influences one's self-esteem, social contacts and achievements, including scholarly achievements [9].

Specific reactivity – and, consequently, meteosensitivity – reveals the degree of one's adaptation to the environment given and, consequently, one's health resources. Studies on meteosensitivity are considered important due to the current changes in weather and climate. Personal sensitivity and emotionality characterize one's temperament and personality and are reflected in one's abilities and professional trends. According to A. Maslow, sensitivity means how deeply and precisely aware one becomes of one's own feelings and needs. The concept of sensitivity can be considered to include feelings of different modalities. Emotionality is closely related to sensitivity in humans and reflected in their behavior and personal traits.

Eye and hair colors are features of appearance. The iris can be treated as a diencephalic screen moved forward and specializing in receiving and transforming the light flow from the outside and neuron impulses from the inside of an organism. The pigmented light-filtering shield defines the eye color. In each person it serves as the individual base to highly specific reactions of the organism to light. The eye color correlates to reactivity, vitality tone, pain and medicine sensitivity, predisposition to certain diseases and adjustment ability. There is a hypothesis that even dreams depend on the eye color. According to old physiognomists, it is possible to judge personality by the eye color. For instance, people with the mixed gray-green-and-brown eyes color the (so-called "mid-Russian eyes") are normally timid and inconsequent. Such people are obedient to their fate and life, which is usually a capricious combination of grief and rapture, of trust and skepticism, surely accompanied by wonder expectations and upcoming happy days. The above information on the eye color can be partly related to the hair color, as well.

Humankind has been spread over the continents and divided by eye, hair and skin colors during many thousands of years in accordance with sophisticated geocosmologic laws ruling the adaptation to areas with different quantities of light and solar energy. As a result, the northern latitudes, which are exposed to low radiation, were inhabited by people with a weak "pigment cover", i.e. with pale complexion and eyes of light colors, and the middle and southern latitudes, where radiation is high and powerful, were occupied by people with a strong "pigment cover", i.e. with dark complexion and the eyes of dark colors [6].

It has been noticed that the harmful influence of electromagnetic fields (EMF) is less obvious in the dark-eyed and dark-haired people, i.e. in the people with dominant genes [8]. This fact is of great importance since the total tension of the artificial EMF has increased by 100–10,000 times (at different points of the Earth surface), in comparison to the natural EMF. Such EMF tension misbalances the environment and exceeds the adaptive potential of humans [1, 5].

The purpose of the research was to study changing of appearance, sensitivity (meteosensitivity) and emotionality through time in Saint Petersburg citizens in relation to the changes of general environmental factors in the year of birth and the previous year. The genotypic features taken into account were the eye color, the hair color and hair curliness. We also collected information about the respondents' meteosensitivity in the age of 18–20.

DATA AND METHODS

We studied the following appearance indices: height and weight, head circumference, the eye color and the hair color, hair curliness in the age of 18–20.

There were six categories for the hair color: fair, light brown, brown, red, dark-brown and black, and there were three groups for hair curliness: curly, wavy and straight.

The categories for the eyes color were the following: brown (including light brown, brown and dark brown), light blue (light blue, pale light blue), blue (blue, dark blue), grey (light grey, grey, dark grey), green (green, grey-green) and the eyes of combined color.

We judged on meteosensitivity by the chosen answer to the question of how intensely the person reacted to weather changes. There were three possible answers: a – I get through the weather changes easily, b – I feel unwell when the weather is changing, and c – I do not notice weather changes. Choosing the variant "c" is considered to be a sign of the minimal possible meteosensitivity.

We have collected the data about the appearance and meteo-sensitivity from 1,004 women and 846 men born in 1930–1978. The number of people for every year of birth according to the European calendar is from 20 to 67, for every year of birth according to the Eastern calendar – from 50 to 122.

Emotionality was measured by the GTF (general temperament features) questionnaire by V. M. Rusalov and sensitivity was measured by the POI questionnaire (on self-actualized personality by A. Maslow).

413 men and 962 women were tested with the temperament questionnaire GTF. 323 men and 715 women born in 1934–1986 were tested with the POI questionnaire. The data on 328 respondents were collected thanks to S. A. Manichev.

The analysis of correlations between the indices in question and environmental conditions was processed with regards to the conventional geocosmic indices– solar activity, the solar magnetic field, the geomagnetic field, gravity, the neutron flux. The indications of the indices are the following: W – Wolf number, the relative number of sun spots, S – the area of sunspots, Kp – the electromagnetic field storminess, Dst – geocosmic activity, IMF – the interplanetary magnetic field, G – gravity, a long-period component of the Moon and the Sun tidal forces potential, neutr. f. – the neutral flux.

Some astronomic indices were used, as well: MrcM, VnM, MrsM, JupM, SatM – the number of junctions of Mercury, Venus, Mars, Jupiter, Saturn with the Moon at new moon; SumM – the sum of the planets junctions with the Moon at new moon; MrcS, VnS, MrsS, JupS, SatS – the number of junctions of Mercury, Venus, Mars, Jupiter, Saturn with Sun; SumS – the sum of the planets junctions with the Sun (7).

All the data was processed with the method of epochs superposition for the year of birth according to the European calendar and the cycles of the Eastern calendar. We have calculated average annual values and 5-year average values for 1931–1980. The significance of the results was checked with t-criterion and Fisher's Up criterion.

RESULTS AND DISCUSSION

Final results are shown in Tables 1–6 and Figures 1–4.

Appearance. We have found great changes in the dynamics of the studied indices, in most cases $p \leq 0{,}01 \div 0{,}001$ (*see: Tables 1–3 and Pictures 2–4*). The number of people with a particular eye color, hair color and meteosensitivity varies greatly in the studied period. For instance, the share of green-eyed men varies from 40% (1936–1940 years of birth) to 0% (1976–1978 years of birth) and the share of fair-haired men varies from 1.31% (1946–1950 years of birth) to 24.1%

(1976–1978 years of birth). The share of curly men varies from 47.6% (1931–1935 years of birth) to 20.7% (1976–1978 years of birth).

The share of green-eyed women varies from 37% (1936–1940 years of birth) to 11.9% (1940–1945 years of birth) and the share of fair-haired women – from 3.3% (1930–1935 years of birth) to 10.2% (1976–1979 years of birth). The share of curly women varied from 45.4% (1930–1935 years of birth) to 13.4% (1961–1965 years of birth).

The analysis of the average annual values in women born in 1963–1977 shows significant varieties in the set of the studied indices for every year within this period. For example, the women born in 1967 tend to be highly meteosensitive (42.9% of them report a strong reaction to weather changes). The lowest share of highly meteosensitive women (12.5%) is for 1964. About a half (56.2%) of women born in 1967 have dark-brown hair and most of the women (75%) are curly. The share of people with a combined eye color is the highest (18.7%) in the women born in 1967.

Among the women born in 1973 there are 19.6% of highly meteosensitive people. The share of women with brown and dark-brown hair is also large, as well as the share of women with straight hair, which is 75.6%. The share of women with light-blue eyes (16.4%) is the highest in the women born in 1973. The shares for the brown-eyed and green-eyed are 29.1% and 30.1%, respectively.

It was found out that the average emotionality value, as well as other temperament characteristics values, had been widely varying. For example, the average annual emotionality values for the people born in 1946–1986, without regard of sex, varies from 4.79 scores (in the born in 1956) to 7.74 (in the people born in 1978), with the significant difference at $p<0,01$.

Having compared the values of the studied indices by years of birth in accordance with 10-year and 12-year cycles of the Eastern calendar, we got the results approving the many-centuries-old idea that there is a significant difference between the people born in different years of the cycles [3,11,12].

Table 1. Average eye color shares for 5-year periods, %.

Years of birth	Men						Women					
	Br	*L.Bl*	*Blue*	*Grey*	*Grn*	*Mix*	*Br*	*L.Bl*	*Blue*	*Grey*	*Grn*	*Mix*
1931–35	39.1	13.0	0	21.7	13.0	13.0	27.6	10.3	6.9	31.0	20.7	3.4
1936–40	18.2	10.9	5.4	12.7	40.0	12.7	29.6	11.1	1.8	18.5	37.0	1.8
1940–45	35.7	32.1	0	14.3	7.1	10.7	30.9	16.7	2.4	30.9	11.9	7.1
1946–50	34.2	15.1	6.8	21.9	19.2	2.7	24.7	12.9	4.3	25.8	22.6	9.7
1951–55	28.9	14.5	10.5	10.5	22.4	13.1	38.5	6.4	5.1	14.1	28.2	7.7
1956–60	27.2	18.5	8.9	18.5	11.9	15.2	39.6	6.9	6.9	18.9	24.1	3.4
1961–65	32.2	20.7	10.3	18.4	9.2	9.2	37.9	11.4	2.5	16.4	25.3	6.3
1966–70	40.2	18.9	2.4	22.0	9.4	7.1	34.4	8,.4	2.6	15.6	30.5	8.4
1971–75	34.6	16.1	2.9	23.9	13.7	8.8	31.2	12.0	2.2	17.7	27.4	9.4
1976–78	32.1	28.6	3.6	28.6	0.0	7.1	28.0	9.0	0.0	13.0	34.0	16.0
Up	3.01	2.33	2.57	2.86	5.6	3.12	1.57	1.81	3.07	2.5	3.07	1.39
p≤	0.001	0.01	0.005	0.001	0.001	0.001	0.06	0.04	0.001	0.005	0.001	0.09

Note: 1. The eye color index "Br" includes light brown, brown and dark brown shades, "L.Bl" – light blue and pale light blue shades, "Blue" – blue and dark blue shades, "Grey" – light grey, grey and dark grey shades, "Grn" – green and grey-green shades, "Mix" – combined shades (grey-yellow, grey-blue, grey-light blue);
2. "Up" is the value of the significance criterion by Fisher, "p" is significance for underlined values.

Table 2. Meteosensitivity values for 5-year periods, %.

Years of birth	*Women*			*Men*		
	Weak	*Strong*	*No*	*Weak*	*Strong*	*No*
1930–1935	40.62	40.62	18.75	42.31	34.61	23.1
1936–1940	29.09	41.82	29.09	50.0	12.50	37.5
1941–1945	28.57	42.86	28.57	38.23	41.17	20.59
1946–1950	33.67	42.86	23.47	38.37	18.60	43.0
1951–1955	36.25	33.75	30.0	47.25	14.28	38.5
1956–1960	32.79	31.15	36.06	45.74	10.63	43.61
1961–1965	31.08	29.73	39.19	38.0	15.22	46.74
1966–1970	47.54	26.23	26.23	40.65	18.70	40.6
1971–1975	45.24	27.0	27.76	30.98	13.14	55.87
1976–1979	37.29	27.12	35.59	42.3	3.85	53.85
Up	2.48	2.69	1.87	2.43	2.62	3.86
p≤	0.005	0.005	0.03	0.01	0.005	0.001

Note: "Weak" is for a weak reaction to the weather changes reported, "Strong" is for a strong reaction to the weather changes reported, "No" is for no reaction to the weather changes reported.

Table 3. Average sensitivity and emotionality values, scores

Years of birth	**Emotionality**		**Sensitivity**	
	Women	**Men**	**Women**	**Men**
1936–1940	7.8	6.8	6.75	4.4
1941–1945	5.5	6.28	3.0	4.92
1946–1950	7.28	5.27	4.23	4.53
1951–1955	7.55	5.57	4.93	4.78
1956–1960	6.39	5.22	6.07	4.94
1961–1965	7.77	5.42	5.57	5.42
1966–1970	6.96	6.0	6.5	5.67
1971–1975	7.24	5.67	6.02	5.57
1976–1980	6.88	6.52	6.95	6.47
1981–1985	6.03	4.85	7.2	7.23
T criterion	*3.38*	*2.42*	*6.26*	*5.29*
p≤	*0.001*	*0.025*	*0.001*	*0.001*

The correlation analysis has shown that the dynamics of the studied personal characteristics correlates to the dynamics of the studied environmental indices with $p \leq 0,05$ or $p \leq 0,01$. Also, there are numerous correlations with the astronomic indices. The results are illustrated with Fig. 1 and 2 (for meteosensitivity and eye color) and with Tables 4–6 (for the other indices).

Emotionality. The correlation analysis for the average annual emotionality values and the environmental conditions in the year of birth (1946–1986, both men and women) did not result in any significant correlations. But there are significant correlations ($p<0,05$) for the mentioned indices if the year previous to the birth date is taken into consideration (see Table: 4).

Table 4. The correlations between emotionality values (1,361 respondents, born in 1946–1986, both men and women) and astronomic indices for the year previous to birth date

Geocosmic index	**r**	p≤
MrsM – number of junctions of Mars and the Moon at new moon	–0.348	0.025
SumM – sum of junctions of Mercury, Venus, Mars, Jupiter and Saturn with the Moon at new moon	–0.393	0.01
VnsS – number of junctions of Venus and the Sun	–0.321	0.05

The results of the correlation analysis for the average emotionality values for 5-year periods in women born in 1936–1985 (N=806) and geocosmic indices (10 points, 6 points of which are for Dst) show the correlation index $r=0.844$ ($p<0,05$) for emotionality and Dst. There are no correlations found for the same indices in male respondents.

The average emotionality values vary from 4.88 to 6.23 in men and from 5.92 to 7.76 in women within the 10-year cycle of the Eastern calendar. The results of the correlation analysis are demonstrated in Table 5.

Table 5. The correlations between emotionality and geocosmic indices within the 10-year cycle of the Eastern calendar

Geocosmic index	Men		Women	
	For year of birth	For the year previous to birth date	For year of birth	For the year previous to birth date
W	0.734**	0.819**	–	–
IMF	–0.588	–0.748**	–	–0.561
JupM	0.68*	–	–	–
MrcM	–	–	–	–0.550

Note: W – solar activity index, IMF – interplanetary magnetic field, JupM – number of junctions of Jupiter and the Moon at new moon, MrcM – number of junctions of Mercury and the Moon at new moon; * – $p<0.05$, ** – $p<0.01$.

Sensitivity. Sensitivity values in men (N=300, born in 1950–1965, top managers from different cities in Russia), according to the results of POI, vary from 4.1 scores (in the born in 1951) to 6.1 scores (for the born in 1964), $p<0.05$. We found significant correlations in that group of respondents only for the year previous to birth date. The correlations are for astronomic indices only (see: Table 6).

Table 6. The correlations between sensitivity values in the male top-managers born in 1950–1965 and geocosmic indices

Geocosmic index	r	p≤
StrnM – number of junctions of Saturn and the Moon at new moon	–0.435	0.1
VnsS – number of junctions of Venus and the Sun	–0.496	0.05
JupS – number of junctions of Jupiter and the Sun	–0.446	0.07
StrnS – number of junctions of Saturn and the Sun	–0.663	0.01
SumS – sum of junctions of the five planets and the Sun	–0.716	0.005

The correlation analysis for the sensitivity values and geocosmic indices for the 5-year periods (see: Table 3) revealed the influence of IMF on women: $r=-0.639$, $p=0.05$. The highest r-value in men is also for IMF ($r=-0.464$), but it is only at the level of tendency.

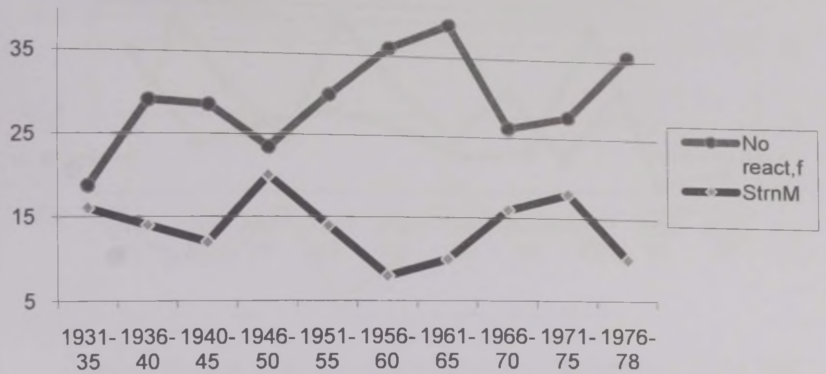

Fig. 1. The correlation between meteosensitivity values in women, %, and the number of junctions of Saturn and the Moon at new moon – StrnM (multiplied by 10), r= –0.811; p≤0.01. "No react, f" is for the share of women born in the certain 5-year period who responded no reaction to weather changes.

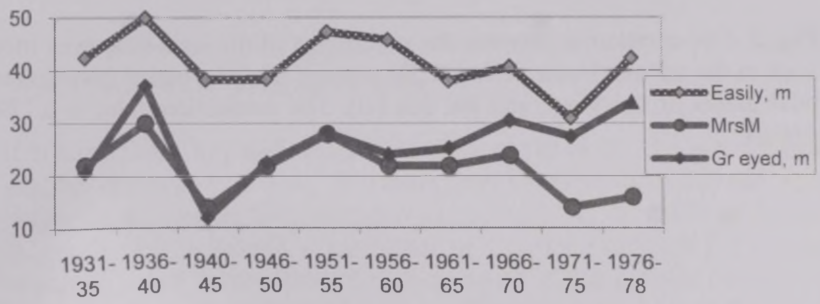

Fig. 2. The correlation between meteosensitivity values, the share of green-eyed men, and the number of junctions of Mars and the Moon at new moon. The correlation value is 0.772 for "Easily, m" and MrsM; 0,744 for "Gr eyed,m" and MrsM, p≤0.01.

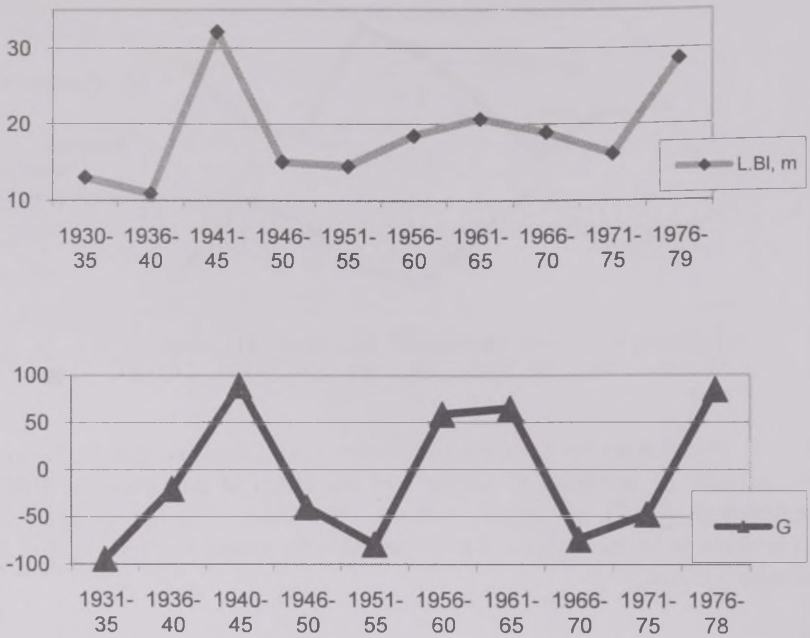

Fig. 3. The correlation between the percentage of the light-blue-eyed men born in the certain 5-year period (L.Bl, m) and the long period potential of tidal power of the Moon and the Sun (G). The correlation value is 0.779, $p \leq 0.01$.

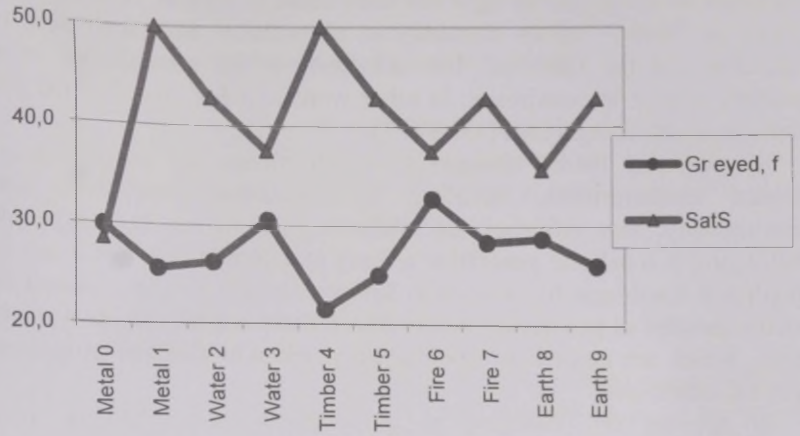

Fig. 4. The correlation between the percentage of green-eyed women (Gr eyed,f) and the dynamics of the junctions of Saturn and the Sun (SatS) for the year of birth according to the 10-year Eastern calendar. The correlation value is –0.76, $p \le 0.01$. SatS values are multiplied by 50. Years of the 10-year Eastern calendar (0.1 – metal, 2.3 – water, and so on) refer to the years in the European calendar ending with the same figures.

DISCUSSION OF THE RESULTS

It is known that any definite period of the cycle of the Eastern calendar can be characterized with a certain combination of solar and geomagnetic activity indices and gravity (indices W, G, IMF) and, consequently, with a specific combination of weather conditions [7]. During evolution, such regularities have been saved in the genetic memory of humans. Thus, the regular changing of gravity caused by changing of joint positions of the planets in the Solar system can serve as a leading sign of upcoming weather changes, helping the adjustment mechanism in humans to anticipate reality.

The results we have got for changing of the eye and the hair color in humans accord with the information by S. A. Korytin, who gathered data on the dynamics of fur color shares in wild sables during 200 years. It was found out that both the quantity and the color of the sable, which is a genotypic feature, has been varying during the time period. The variation of the shares of light and dark sable is regular. As a rule, the share of "blond" sables increases in accordance with solar activity decrease and the share of "brown-haired" sables grows when solar activity is near its maximum. In other words, sables' genetic fund has been regularly reorganized [13, p.107].

Beyond any doubt, changes in constitutional and psychophysiological characteristics, including meteosensitivity, sensitivity and emotionality, can influence the abilities combination in the people belonging to a definite generation or born in a certain year and it can be predicted. Consequently, as well as human ecotypes in space, caused by characteristics of geographic environment, there are human ecotypes in time, which are caused by seasonal and perennial changes in general natural conditions.

It appears that changing in psychophysiological and personal characteristics in people through years and centuries serves as the basis for changes in the national character and wave processes in society.

CONCLUSION

1. Appearance values (anthropological and phenotypic indices, as well as meteosensitivity, emotionality, sensitivity) are significantly different in the representatives of different cohorts by the year of birth.
2. There are significant correlations between the indices above and the general natural conditions for the year of birth or the previous year, with astronomic indices being the most influential.
3. Gravity changes, caused by the cooperative motion of the planets in the Solar system and repeated in cycles, influence the geomagnetic environment and the weather on the Earth. It appears that the repeated changes have been imprinted in the human's genetic memory and can serve as the main sign of upcoming weather changes, thus providing human adjustment mechanisms with anticipation of reality.
4. As well as human ecotypes in space, caused by the characteristics of geographic environment, there are human ecotypes in time, which are caused by seasonal and perennial changes in general natural conditions.
5. Ethno-psychological characteristics and the national character are controlled by natural conditions to a certain degree, which provides

humans with a better adjustment to the current and upcoming conditions of the physical environment. The crucial periods of such influence are preconceiving and embryogenesis.

"Easily" is for the share of the men born in the certain 5-year period who reported getting through weather changes easily. MrsM is for the number of junctions of Mars and the Moon at new moon, multiplied by 10.

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