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CONTENTS

FINGER DERMATOGLYPHS AND INFANTILE CEREBRAL PALSY

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It is known that dermatoglyphic features are the component of the hereditary disease syndromes such as Daun's syndrome, oligophrenia, schizophrenia, various chromosome aberration and other (Guseva, 1986).

Finger dermatoglyphs (FD) are one of the simplest and reliable genetic markers. FD are disposed on the finger distal phalanges, formed for embriogenesis stage, being unchangeable during human ontogenesis. The main features of FD are finger pattern, and ridge count.

In this study we made an attempt to research prospects of using FD as a marker of the risk of the infantile cerebral palsy.

Subjects used in this study were: a total of eight infantile cerebral palsy children, (4 boys and 4 girls), at the age of 2–6 years old, their eight mothers, and about three hundred normal children, (140 boys and 151 girls), at the age of 4–16 years old, presenting control group.

Methods used of this study were standard procedure of taking finger-prints, standard determination of the main FD features: pattern (arch, loop, whril), total ridge count (TRC), total pattern complexity (D10). Mean values, standard deviations and linear regression were calculated with conventional methods. Differences between groups were tested with Student's t-criterion, values for $P < 0.05$ were considered significant.

The main total qualitative characteristics concluding pattern frequency total pattern complexity are presented the identical values among examined groups.

Total ridge count is the main total quantitative FD characteristic having a tendency to be decreased according to groups: control, mothers, sick children. There was no significant TRC difference between control group and mothers and between mothers and sick children. Significant TRC difference was found between control group and sick children (table).

Such a particular quantitative FD characteristics as ridge counts of each finger had diverse correlation between the groups. There were no found significant differences of ridge count of any fingers between

mothers and sick children. Significant differences of ridge count were between control group and mothers and between control group and sick children. Group of mothers had lower mean values of ridge count of right and left second fingers. The group of sick children differs from control group by low mean values of ridge count on second and third right fingers and second, fourth and fifth left fingers (table).

Table

FD of the sick children, their mothers and control group

FD features	Sick children		Mothers		Control group		P Values	
	mean	s.d.	mean	s.d.	mean	s.d.	Sick children control group	Mothers control group
Arch (%)	1.13	1.73	1.00	2.14	1.11	1.98	N S	N S
Loop (%)	6.63	1.92	6.13	2.03	6.24	2.51	N S	N S
Whirl (%)	2.25	2.37	2.87	1.96	2.65	2.66	N S	N S
D10	11.13	3.68	11.87	3.56	11.52	3.92	N S	N S
TRC	83.13	29.78	95.63	33.51	116.19	44.04	< 0.05	N S
Ridge count finger of right hand								
N 1	13.50	4.27	14.75	5.75	16.28	12.10	N S	N S
N 2	4.13	5.49	4.37	4.81	9.71	6.33	< 0.05	< 0.05
N 3	6.50	3.82	8.50	4.72	10.16	6.08	< 0.05	N S
N 4	11.50	4.07	13.63	6.69	13.35	5.76	N S	N S
N 5	8.38	3.58	9.00	4.47	10.88	5.28	N S	N S
finger of left hand								
N 1	12.00	4.04	10.75	5.70	13.62	5.84	N S	N S
N 2	5.13	4.70	5.25	4.65	9.38	6.25	< 0.05	< 0.05
N 3	7.00	6.72	9.37	4.13	10.48	5.83	N S	N S
N 4	8.75	3.99	11.62	5.12	13.00	6.00	< 0.05	N S
N 5	6.25	3.62	8.38	4.89	11.16	5.31	< 0.005	N S

Individual D10 and TRC values of sick children (figure 1) and their mothers (figure 2) had tendency to be under the trasting interval of regression line comparing with the regression of TRC on D10 of control group. This was especially typical for sick children and less for their mothers.

Summarizing all said above we can propose FD as one of the particular feature for evaluting of the genetic risk for infantile cerebral palsy. The significant FD features are low TRC according to D10 and low ridge count on the right and left fingers.

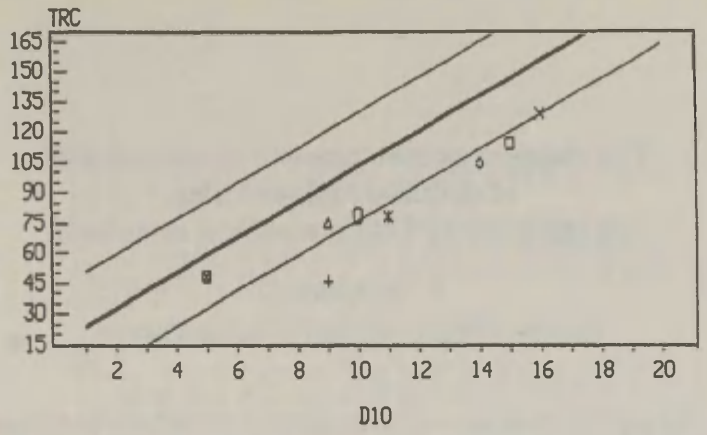

Figure 1. Individual D10 and TRC values of sick children comparing with the regression of TRC on D10 of control group

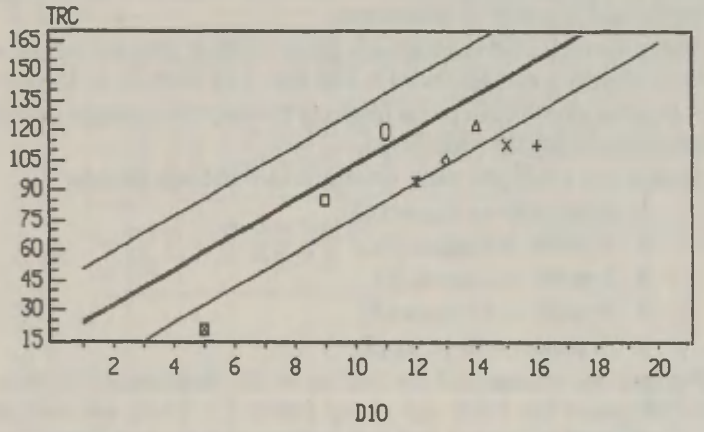

Figure 2. Individual D10 and TRC values of mothers of sick children comparing with the regression of TRC on D10 of control group

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The changes in craniometric characteristics of children and juveniles (on the basis of Tääksi medieval cemetery)

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The present study is based on an analyses of childrens and juveniles craniums found from Central Estonia at Tääksi cemetery. The cemetery is dated from the 14th to18th century (Sokolovski, 1989).The archeological excavations have been carried out during 1987–1989 under the quidance of V. Sokolovski.

There were found surprisingly great number (20) of measurable skulls of children and juveniles at the age of 18 months to 18 years.

It became possible in some respects to study the changes in cranial dimensions during the childhood.

At first the craniums were arranged into the age groups:

1. 18 months — 4 years (3).
2. 5 years — 6 years (5).
3. 7 years — 8 years (5).
4. 9 years — 12 years (4).
5. 15 years — 18 years (3).

Further the means and the indices of the craniometrical features were calculated for every age group (table 1). There are also given the craniometrical means and the indices of male and female series (unpublished data R. Allmäe). It must be noted that the skulls at the age of 10–14 years are insufficiently represented. The scantiness of the whole material and ignoring the sexual dimorphism is expressed in "skipping" indices especially,but the general trends of the formation of craniometrical features can be observed.

The growth of the cranium can be described as an increase of cranial measurements: height measurements describe the vertical, length measurements longitudinal and the width measurements horizontal growth of skull.

The maximum and relative growth for different length, height and width dimensions calculated on the basis of Tääksi craniological material are given in table 2. The relative growth of the dimension is calculated as a per cent from 2–4 years (in some cases 5–6 years) old

Table 1

The craniometrical means and indices of different age groups of Tääksi children, juveniles and adults

measurement / age groups	2.–4.	5.–6.	7.–8.	9.–12.	15.–18.	male	female
1. max. cranial length	154.5	166.6	168.0	175.0	176.7	184.6	177.1
8. max. cranial width	127.5	128.6	132.0	133.8	136.3	141.4	137.9
17. cranial height	–	120.0	125.6	129.0	133.5	136.0	130.3
20. porion-bregma height	97.5	105.8	107.6	111.8	111.3	113.9	110.4
9. min. frontal width	86.0	86.4	89.6	90.5	94.7	96.7	94.4
10. max. frontal width	107.0	107.3	112.2	113.0	113.0	120.9	117.5
11. biauricular width	95.0	99.0	100.2	102.5	114.3	119.1	114.3
12. occipital width	100.0	100.8	102.4	104.5	105.0	110.8	107.7
48. upper facial height	48.0	50.8	55.3	57.3	61.3	69.0	66.3
47. total facial height	–	85.0	95.5	95.0	108.0	111.9	103.3
45. bizygomatic width	–	102.3	109.8	109.3	129.0	133.3	124.3
43. upper facial width	84.3	86.8	91.2	91.0	99.0	104.9	101.4
46. bizygomaxillary width	70.3	74.0	81.5	81.3	90.0	95.7	92.2
55. nasal height	34.7	38.2	41.0	42.5	46.2	50.5	47.3
54. nasal width	19.0	20.0	21.0	21.8	22.3	24.5	24.3
51. orbital width	35.0	36.8	37.0	37.0	40.7	42.2	40.8
52. orbital height	30.0	30.0	30.5	30.3	29.7	32.4	30.8
40. basion-prosthion length	71.0	81.0	80.7	86.3	90.0	98.5	91.8
5. basion-nasion length	78.0	88.0	89.8	92.0	96.7	102.3	97.6
69(1). height of the mandibular corpus	19.7	21.0	23.2	24.5	28.3	30.0	26.9
65. bicondylar width of mandibula	80.0	91.0	97.0	96.3	115.5	118.1	112.7

Continued Table 1

measurement / age groups	2.–4.	5.–6.	7.–8.	9.–12.	15.–18.	male	female
INDICES							
8:1	82.5	77.2	78.6	76.4	77.1	76.5	77.8
17:1	–	72.0	74.8	73.7	75.5	73.6	73.5
20:1	63.1	63.4	64.0	63.8	63.0	61.7	62.3
17:8	–	93.3	95.1	96.4	97.9	96.1	94.4
9:8	67.4	67.1	67.8	67.6	69.4	68.4	68.4
10:8	83.9	83.4	85.0	84.4	82.9	85.5	85.2
11:8	74.5	76.9	75.9	76.6	83.8	84.2	82.8
12:8	78.4	78.3	77.5	78.1	77.0	83.1	86.6
48:17	–	42.3	44.0	44.4	45.9	50.7	50.7
48:45	–	49.7	50.4	52.3	47.5	51.7	53.3
47:45	–	83.1	86.9	86.9	83.7	83.9	83.1
45:8	–	79.5	83.2	81.6	94.6	94.2	90.1
43:45	–	84.8	83.0	83.2	76.7	78.6	81.5
46:45	–	72.3	74.2	74.3	69.7	71.7	74.1
46:43	83.5	85.3	89.4	89.4	90.8	91.2	90.9
65:45	–	88.9	88.3	88.1	89.5	88.5	90.6
65:11	84.2	91.9	96.8	93.9	100.8	99.1	98.4
65: 8	62.7	70.7	73.4	71.9	84.7	83.5	81.7
54:55	54.8	52.4	51.2	51.1	48.3	48.5	51.3
52:51	85.7	81.5	82.4	81.7	72.9	76.7	75.4
40: 1	45.9	48.6	48.0	49.3	50.9	53.3	51.8
55:48	72.9	75.2	74.1	74.2	75.4	73.2	71.3

group. The maximum growth is calculated from 2–4 years old group to 15–18 years old group.

The length dimensions As we see the cranial length shows there a biggest maximum growth (table 2), but the length dimensions of facial skeleton indicate much active relative growth.

The height measurements of the facial part of cranium are showing the greatest increase in relative growth (the total facial height shows also the biggest change in maximum growth). Exception is the orbital height; on the grounds of Tääksi material, the maximal change of this dimension has negative value (it can be explained by the scantiness of material). Netherless it is evident that the values of the orbital height measurements are barely changing during the childhood. The relative growth is largest for the height measurement of mandibular corpus. Also the height of the nose indicates remarkably intensive relative growth. The growth of cerebral height dimensions is less active than that of the facial height measurements.

The width measurements. It is formely known that the growth velocity of the dimensions of facial part is greater than that of cerebral part (Miklasevskaja, 1968; Heapost, 1994 s.o.). In Tääksi material above mentioned difference is particulary well expressed in the width measurements of the skull.The relative growth of the cerebral width dimensions is considerably smaller than that of the facial skeleton with the exception of the biauricular breadth which indicates the greater maximum and relative growth in comparison to the other width measurements of braincase.

One part of the width measurements of facial skeleton show intensive maximum and relative growth (45, 46, 65). Notably mighty is the development of the bicondylar width of mandibula. The second part (43, 54, 51) of the width dimensions indicates relatively reserved increase.

The indices calculated on the basis of the cranial dimensions describe the different proportions of the skull.

If the value of the index is clearly increasing or diminishing according to the age — we can observe the change in this proportion. If the index fluctuates only a little with age, we can observe the proportional development of two measurements. If the fluctuation of index is extensive with age — the trend of the formation of that proportion cannot be followed.

The indices of the cerebral part of cranium. The cranial (cephalic) index (8:1) is decreasing with the childrens age, it is generally known ruel (Suchy, 1968; Miklasevskaja, 1968, Aul, 1982 s.o.). The diminishing of the cranial index is not distinctly expressed in Tääksi material (table 1).

Table 2

The maximum and relative growth of cranial dimensions of Tääksi children and juveniles (from 2–4 years to 15–18 years old group)

The dimensions	length		The dimensions	height		The dimensions of the cranial part	width		The width dimensions of the facial part		
	max(mm)	rel%		max(mm)	rel%		max(mm)	rel%		max(mm)	rel%
1.	22.2	14.3	17.	13.5	11.2*	8.	8.8	6.9	45.	26.7	26.0*
5.	18.7	23.9	20.	13.8	21.8	9.	8.7	10.1	43.	14.7	17.4
40.	19.0	26.7	47.	23.0	27.0*	10.	6.0	5.6	46.	19.7	28.0
			48.	13.3	27.7	11.	19.3	20.3	54.	3.3	17.3
			55.	11.5	33.1	12.	5.0	5.0	51.	5.7	16.3
			52.	–0.3	–1.5				65.	35.5	44.3
			69(1)	8.3	42.1						

*from 5–6 years old group

The cranial length and height growth is proportinal (17:1; 20:1). Also the width measurements of the cranium (9:8; 10:8; 12:8) are increasing proportionally, except ratio biauricular — cranial width (11:8), the first mentioned dimension is growing faster with the age.

The indices of the facial part of cranium. The cephalometrical analyses of schoolchildren indicate the increase of the morphological facial index — the height growth of the face is more active than that of breadth (Suchy, 1968; Miklasevskaja, 1968; Aul, 1982; Heapost, 1984). The trend of formation of this main face proportion (47:45) cannot be observed on the basis of Tääksi material. The upper facial index (48:45) is increasing — the growing velosity of upper facial height is more active, the face is changing more leptoprosopic with the age of children. The upper facial — bizygomatic (43:45) and the upper facial — bizygomaxillary (43:46) indices are decreasing. The bizygomaxillary — bizygomatic (46:45) index indicates proportional growth of these two measurements.The bicondylar width of mandibula and the bizygomatic breadth are growing in the same rate (65:45). The changes in upper facial breadth are less active than that of other facial width dimensions. The nasal height is increasing according to the upper facial height (55:48).

The other indices. The cranial height shows a less active growth than that of the facial height (48:17). The facial length of cranium indicates more intensive growth than that of cranial length (40:1). The nasal index (54:55) indicates the formation of nose dimensions — nose is changing more leptorrhine with the age. The orbital index is diminishing, the orbits are changing chaemaerrhine with the age (52:51).

Conclusions.

1. The most intensivly increasing measurements of cranium are these connected to the development of denture and masticatory organs (65; 46; 45; 69(1); 48). Also the nasal height is growing actively.(55).
2. The less changing dimensions are the width measurements of the cerebral part of cranium. Exception is the biauricular width that is growing in the same rate with facial width dimensions.
3. The orbital height is almost invariable during the childhood.

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TYMPANIC MEMBRANE AFTER ULTRASOUND-EVOKED MYRINGOTOMY

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Introduction

Ventilation of the middle ear by paracenthesis of the eardrum is an effective method in treatment of secretory processes in cavum tympani. However, myringotomy produced by conventional methods heals in term unsufficient for complete restoration of ventilation and drainage of middle ear. Paracenthesis by CO_2-laser and diathermy (Ruckley, *et al.*, 1988; Kent, *et al.*, 1987; Söderberg, *et al.*, 1984) show widespread destruction of the outer keratinized squamous epithelium and the vascular supply of membrana tympani (TM), leading to delayed healing period of the eardrum thus to stable ventilation and drainage of middle ear through TM up to the normalizing of the ventilating function of Eustachian tube. But thermal energy-inflicted methods are potentially hazardous due to high temperature and propagation of the action to intact parts of the organ. Therefore, with the view to eliminate excessive temperature damage to sensitive middle and inner ear structures the ultrasonic surgical equipment with special transducers for the myringotomy was developed in Tartu University to perform round perforations on the eardrum (Ani, *et al.*, 1991).

Aim of the present study was to investigate and compare organspecific alterations of the eardrum subject to myringotomy by ultrasonic microscalpel (USM) and by conventional paracenthesis-needle. The investigation was carried out using light microscopical (LM) technique.

Material and methods

The experimental design is shown in figure 1.

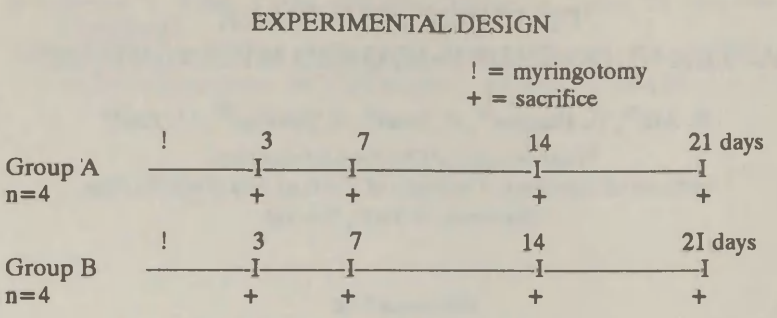

Fig.1. Outline of the experimental design

Eight healthy male, albino Wistar rats weighing about 250–300 g, with normal TM status were used. The material was divided into two groups of equal size:

Group A: In 4 animals myringotomy was performed with conventional myringotomy needle.

Group B: In 4 animals myringotomy was performed with USM. Parameters of the USM established — frequency 66 kHz, amplitude of the vibrating tip 15 μm, diameter of the tip 0.3 mm. First, paracenthesis with switched-off USM was performed as conventional technique and then by the rotating movements of the switched-on instrument the diameter of the round aperture in the eardrum was enlarged up to 1.5 mm.

For myringotomy the rats were subjected to anesthesia through inhalation of ether in a closed cage. Myringotomies were performed under visual control of operating microscope in both right and left TM in posterior upper quadrant of pars tensa. For LM investigations one rat from each group 3, 7, 14 and 21 days after myringotomy was subjected to anesthesia by ether inhalation, decapitated and both TM with adjacent tissues were removed. The TM was fixed in 2% glutaraldehyde in 0.1 N cacodylate buffer and after rinse in buffer postfixed in 1% OsO_4 in cacodylate buffer. After dehydration in increasing concentrations of ethanol the specimens were embedded in Epon. Semithin sections were cut on ultramicrotome, stained with toluidine blue and examined under a light microscope.

Results

In both groups the TM status - extent and localization of inflammation was characteristic. Paracenthesis of the eardrum caused typical inflammatory destructive and reparative changes in the epithelium and connective tissue of the TM: oedema of subepidermal layer, capillary dilatation, and inflammatory cellular reaction of submucosa, destruction of cells, increased mitotical activity of basal epidermocytes etc. In acute stage of inflammation lymphocytes and macrophages appeared in epidermis.

Conventional myringotomy induced cellular inflammation: infiltration of submucosa by neutrophils, lymphoid cells, plasma cells, monocytes, macrophages, lymphoblasts, plasmablasts and monoblasts. In days 3–7 epithelization of the scar occurred and perforation closed, whereas epidermal epithelium as histogenetically more active than mucosal epithelium covered the surface of wound as described also by Stenfors (1980) and TM was thickened. In day 14 as well as in day 21 TM histologically did not differ from normal eardrum. There was only minimal increase in number of lymphoid cells in day 14.

In day 3 by myringotomy with USM more expressed inflammation was seen: oedema, especially extended in submucosal connective tissue, dilatation of capillaries and precapillary arterioles in all layers of TM (some capillaries seems to spread into basal layers of epidermal epithelium), inflammatory cells spreading in submucosa and infiltrating of lamina propria. Lymphocytes between radiate and circular collagen bundles were migrated far beyond reactive zone. In days 7–14 parallel to closure of wound active inflammation occurred. The number of fibroblasts and fibrocytes increased. The closure and epithelization of the perforation was similar to the changes in the group A whereas thinning of TM in day 21 was not seen.

Discussion

Healing pattern of eardrum after myringotomy by ultrasonic instrument have not been investigated before.

Fact, that paracenthesis of the TM by surgical ultrasound caused only minimal reversible changes in hearing similar to these after conventional myringotomy (Ani, *et al.*, 1995), encouraged authors to introduce USM for performing round perforations on the eardrum for delayed ventilation of the middle ear cavity of rats. White rats were chosen for this study because their TM is quite similar to this of humans (Schmidt, *et al.*, 1991).

Inflammatory changes of the TM in control group coincides with data of Hambley, *et al.* (1988), who demonstrated comparatively on porcine skin that the width of epidermal destruction thus tissue damage by conventional scalpel is significantly less than by ultrasonic methods.

Since it is well known that action mode of surgical ultrasound differs from this of conventional surgical methods by biophysical effects like agitation, moderate rise of temperature, cavitation and microstreaming (Igarashi, 1976), leading to formation of bubbles in the cellular cytoplasm, blocking of the metabolic system, increased permeability of the cellular membranes and decrease of enzyme activity (Lundquist, *et al.*, 1978) in thin zone of adjacent tissues, our interest was focused on reaction of inflammatory elements, caused by above mentioned ultracellular damages.

We found on the TM after ultrasound-evoked myringotomy oedema, dilatation of vessels in all layers of TM, intense infiltration of submucosa and lamina propria by inflammatory cells, increased mitotical activity of basal epidermocytes. Appearing of macrophages and lymphocytes in epidermis of TM in animals is described already by Lim (1985) and may be associated to immune defence system of TM. These findings of extended inflammatory reaction are different to these after laser-evoked myringotomy which by Hukki (1990) are characterized by necrotic zone covered by carbonized tissue and surrounding wide zone of enzymatic inactivity.

On the contrary to our findings in day 3 when dilatation of capillaries and intense infiltration by acute inflammatory cells in the margins of perforation was registered, 3 days after thermal myringotomy coagulative necrosis without any inflammatory cells on the edges of the wound by Kent, *et al.* (1987) was mentioned. We found in our study intense vascularization in all layers of the TM in early stages of healing, indicating relative preserving of capillaries in surrounding structures by using USM compared to severely damaged blood vessels by applying diathermy and carbon dioxide laser (Söderberg, 1984). These differencies may be explained by small thermal effect of USM (60°C), according to Tranberg, *et al.* (1986) sufficient to cauterize vessels smaller than 0.5–1 mm, inducing significantly thinner coagulative zone than this by lasers or diathermy, which does not hinder healing of wound, leading to favorable epithelization and complete healing of TM.

We conclude that alterations in TM caused by ultrasound-evoked myringotomy were analogous to these caused by conventional method of paracenthesis but differed in longer period of wound healing. Compared to alternative methods of round perforations, dynamical properties of cellular reactions seem to have better prognosis for healing processes.

Summary

1. Inflammatory reaction after myringotomy by USM shows more acute and extended than conventional myringotomy.

2. By performing round perforation with diameter 1.5 mm on the TM the complete healing period is delayed up to 14 days, compared to myringotomy by conventional methods (3–7 days).

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ARCHAELOGICAL EVIDENCE OF URINARY TRACT STONE DISEASE IN ESTONIA

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Abstract

A human urinary bladder stone was found during archaelogical excavations of the former cemetery of St. Johns Church in Tartu in 1993. X-ray diffractometric analysis was performed and the exact chemical composition of the stone was established.

The bladder stone studied was discovered during archaelogical excavations of the former cemetery of St. Johns Church in 1993. The archaelogical excavations at the site were performed in connection with restoration works carried out in St. Johns Church. The excavations were conducted by T. Aus. He dated the grave containing the skeleton and the bladder stone to the 16th–17th centuries (Aus, 1993).

The skeleton itself was not sufficiently preserved. However, it was possible to state that it had belonged to a woman who had died at 40–60 years of age. The age and sex determinations are based on methodologies published by Ascadi and Nemeskeri (Ascadi *et al.*, 1970).

The calculus: The calculus measured 6.1×4.0×4.5 cm and weighed 22 gm. Its light brown surface is rough-barked. The shape of the stone is similar to a human urinary bladder. Even the orifice of urethra is formed (arrow in photo).

Stone analysis was performed by x-ray diffractometry (DRON 3M, St Petersburg). The bladder stone consists of basic calcium hydrogen phosphate Ca10(PO4)6(OH)2 and a mineral called apatite.

Discussion: Stone formation in the urinary tract has been known for many centuries. A urinary calculus from a giant reptile of the Upper Cretaceous period even has been described (Voight, 1960). The oldest human urinary tract stone was discovered in an old Egyptian grave and has been estimated to be 6,000 years old (Backman *et al.*, 1985). Even up to the last century, stone disease appears to have been almost exclusively due to bladder stone formation. Nowadays urinary bladder stones are not so common. In the industrialized societies of

during the 20th century and this disease is now rare. Bladder stones are still common in some less developed parts of the world. Investigations in Estonia show that only 6.3% of urinary stone patients suffer from urinary bladder stone disease (Annuk, 1991). Stone composition analyses from 1985 to 1990 show that stones consisting of apatite constitute approximately 18% of all urinary calculi (Annuk, 1995).

Photo 1. Human urinary bladder stone from archaelogical excavations

Other authors have found apatite stones to be more common, 51–69% of all stones (Leusmann, 1990; Cifuentes, 1980). There is also evidence of apatite stones from excavation materials of early Americans Indians (Beck, 1966).

J. K. Streitz and coauthors found a 1,500 years old bladder stone belonging to a Southwestern American mummy. Infrared spectroscopy revealed the calculus to be composed of calcium oxalate monohydrate (Streitz, 1981). Such a composition is common nowadays.

Conclusions: Our finding is not unique in the world but it is the first thoroughly analysed case found in Estonia and is evidence of the occurence of urinary tract stone disease centuries ago.

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DENTAL ENAMEL HYPOPLASIAS AS A TOOL OF INVESTIGATION OF POPULATION HEALTH STATUS

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Introduction

Anthropologists have long held a particular and justified fascination for teeth. Tooth size and external morphology has provided a wealth of information on dietary adaptations, evolutionary relationships within and among species, and other key areas of interest to anthropologists (Capasso and Goodman, 1992).

Studies of the health of population based on their skeletons should be undertaken to expand our knowledge of human condition and the types of stresses and selective agents that have holded human populations in the past and that have continuity for present populations. Thus, the recent developments in paleopathology have stressed indicators that are best studied with a populational perspective (Goodman *et al.*, 1984, 1988). Prominent among these have been nonspecific indicators of stress, such as enamel hypoplasias and other enamel defects of teeth, because they are common on prehistoric skeletons, are usually wellpreserved on teeth at all ages, can be studied in the field and laboratory with minimum eguipment and are easily recogniziable with relatively little training (Goodman *et al.*, 1984).

Enamel hypoplasia is a tooth structure anomaly, but it may also involve changes in tooth size, shape or colour. This anomaly is defined as a deficiency in thickness resulting from disruption in the matrix apposition stage of tooth enamel development (Goodman and Armelagos, 1985).

Hypoplasia appears on the enamel surface of the teeth as circumferential thin lines, grooves, bands or isolated pits, or large areas of irregular enamel (Goodman *et al.*, 1980, 1990).

Enamel hypoplasia has been noted on all teeth, permanent and deciduous (Lanphear, 1990), though, according to Goodman *et al.* (1980), the defects occur most frequently on the mandibular canine and the central maxillary incisor.

Classification of enamel development defects

Dental enamel hypoplasia is a class of development defects on enamel (DDE). As a general term, enamel hypoplasia refers to a deficiency in the amount or thickness of enamel (Suckling, 1989). These defects range in appearance from single and multiple pits or small furrows, to deep and wide troughs of decreased enamel thickness, and ultimately to entirely missing enamel. Enamel hypoplasia is a quantitative defect, as opposed to enamel opacity (or hypocalcification), the other major class of enamel development defects, which involves change in color and opasity of enamel, indicating differences in hardness or quality of enamel.

All enamel developmental defects results from disruptions in the process of amelogenesis. Enamel hypoplasia has long been held to be a disturbance to ameloblasts during matrix secretion, an inference that is strongly supported by the most recent experimental research (Suckling, 1989). Similary, enamel hypocalcification had long been held to be due to always due to a disruption to ameloblasts during maturation phase has recently been challenged by the experimental research of Suckling, who finds that hypocalcification can result from a disruption in matrix formation (Suckling, 1989).

Based on the pattern of defects within and among teeth, hypoplasias can be reliably diagnosed as resulting from one of three causal conditions: 1) hereditary anomalies, 2) localized traumas or 3) systemic metabolic stress (Suckling, 1989). Defects resulting from hereditary causes generaly affect all of the teeth in a set and are the most severe. Defects due to local trauma, local inflammation, and other non-systemic factors may also be relatively severe, but will influence only one tooth or a few adjacent teeth (Skinner and Hung, 1989). Finally, defects resulting from systemic metabolic stress are likely to be found on most or all teeth developing at the time of the stress, and the locations of the defects reflect the relative completeness of enamel crowns at the time of the disruption.

Individuals with hereditary defects are rare (less than 1 per cent) in most contemporary populations (Winter and Brook, 1975). It is likely that they would be even less frequent in prehistoric populations because individuals with hereditary defects are frequently affected with other congenital problems (Winter and Brook, 1975) and these individuals may have had little chance of survival.

Enamel hypocalcification is also visible on dental surfaces, where it usually appears as dull-white opacities or stained areas of reduced mineralization (Skinner and Goodman, 1992). Hypocalcifications were also more common in the deciduous dentition of other skeletal populations (Cook and Buikstra, 1979; Blakey and Armelagos, 1985).

In the vast majority of cases, defects found in archaeological ma-

terials fit a chronologic pattern and appear to be due to systemic metabolic stress (Goodman *et al.*, 1980, 1984; Rose *et al.*, 1978). Thus, they are frequently referred to as chronologic or linear enamel hypoplasias, reflecting the linear and chronologic nature of the defects caused by systemic stress at a specific time during tooth development (Goodman *et al.*, 1984).

The FDI classification of surface enamel developmental defects

The Federation Dentaire International (FDI) recently commissioned a working group to propose a system of classification of developmental defects of enamel suitable as an international epidemiological index. The subsequent descriptive classification divides enamel opasities by color (white/cream and yellow/brown; FDI types 1 and 2, respectively). Differences in border characteristics — diffuse versus demarcated opasities — are no means for systematically recording these characteristics. Because differences between diffuse and demarcated opacities may have epidemiological significance, they merit greater attention (Goodman and Rose, 1990).

Hypoplastic defects are classified as pits (type 3), horizontal grooves (type 4), vertical grooves (type 5), or altogether missing enamel (type 6). The FDI type 4 defect is most like what is typically referred to as chronologic or linear enamel hypoplasia (LEH) in the anthropological literature.

Choise of teeth

Teeth exibit differential susceptibility to defects, it is extremely important that the same tooth type be selected for study. For both the permanent and deciduous human teeth, the maxillary central incisor and the mandibular canine are generaly the most hypoplastic and frequently studied (Goodman, 1990). All studies of permanent and deciduos teeth include data on the maxillary central incisor (Goodman 1990). Lower canines, and to a slightly lesser degree upper canine, are also highly sysceptible to disruption and provide information on a longer period of development, hence they are useful second teeth for study. All anterior teeth are easily studied in living individuals (Goodman, 1989).

Conclusion

The study of enamel hypoplasias is maturing and gaining momentum. A great deal is now about the etiology of these defects, enough in fact that they may now be usefully applied to a number of epidemiological questions. Linear enamel hypoplasia is particularly useful in determining the chronology of stress during periods of tooth crown formation and in providing a biologically meaningful, retrospective assessment of stresses. Enamel is nearly unique among biological tissues in its ability to fossilize past physiological perturbations. On the other hand, a great deal of uncerntainty exists concerning the actual meaning and interpretation of these defects and how they might be best studied.

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METHODS AND PERSPECTIVES OF ODONTOGLYPHICAL INVESTIGATIONS

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Physical anthropology can be parted according to methods and objects of investigations into several fields. One of them is odontology which sometimes is also called dental anthropology. Its object is the teeth of humans and primates. Odontologists investigate the teeth in various aspects: dental genesis and its factors, evolutionary changes, teeth eruption, morphological peculiarities of teeth elements (crown and root), dental pathology etc.

Not long ago one of the most interesting and popular questions in odontology was how to apply the odontoscopic and odontometric methods by discussing and solving taxonomic problems. So was worked out the programme which includes above twenty odontological traits. Investigating spreading and frequencies of these traits among various racial groups and populations was found considerable differences between groups. So developed the separate section of dental anthropology — ethnic odontology which is in the close contacts with other sciences — craniology, paleoanthropology etc. But now the most of these taxonomic problems are analysed in details and very thoroughly and this direction of investigations is less popular.

Some years ago into this classical odontological programme were included several traits of dental masticatory surface microrelief: form of 1 eocone groove on 1st upper molar, relationship of entoconide grooves and 2nd lower molar, direction of 2 metaconide groove on 1st lower molar etc. These traits turned out to be very useful for ethnic odontology.

By analysing of dental masticatory surfaces microrelief was established that this ornament has some regularities. So by prof. A. Zubov was elaborated new odontoglyphical programme which includes about 100 traits of dental microrelief. This programme is so large because it is not known yet which significance has each trait. It is possible that later some of traits which will appear not useful will be eliminated from programme and odontoglyphical examination could be more simple.

Odontoglyphic (gr. *odus* — tooth, *glyphe* — carving) formed as

a new branch of odontology. It is a science about the microrelief of dental masticatory surfaces. This microrelief is very interesting for anthropologists because it is determined strongly genetically, it is constant and does not change during the life. (There is some analogy with dermatoglyphic which investigates the relief of finger skin.)

This unique ornament on dental masticatory surfaces (only premolars and molars!) is formed by enamel streams during the dental genesis. By erupting the teeth have finally formed their microrelief.

According to popular tritubercular theory of Kope and Osborn each odontomer differenciates into three cusps (or tubercles). These three cusps form protocone, eocone and metacone on upper molars and protoconide and metaconide on lower molars. Other cusps of molars develop from other structure — *cingulum*. All cusps can differenciate further into smaller elements — crests. Usually well differenciated cusp is formed from three principal crests which can also differenciate further in more smaller elements.

The amount of cusps on molars, their differentiation or reduction is very important trait in ethnic odontology.

The object of odontoglyphical studies are the grooves which separate the dental cusps (intertubercular grooves) and grooves which divide cusps in smaller elements. The intertubercular grooves have their names in international terminology (vestibular, lingual, mesial etc.) and are marked by Roman numerals. Other smaller grooves are marked by Arabian numerals and they also are strongly defined, for example 1st and 2nd grooves on each cusp divide it into three principal crests, grooves 3 and 4 divide middle crest into smaller elements etc.

The methodic of examination is comparatively simple the best way is to examine wax prints of teeth. On the wax prints the smaller details of dental microrelief are more visible than on natural teeth. It is used the binocular microscope (magnificence about 10 times) for the analysis. All data are registered using numbering of grooves and other coding signs. This unifying system of coding allows to compare data of various examinators.

The microrelief of dental surfaces has as some regularities as his own individuality. The amount of grooves, their shape, direction, the localisation of intersection points can vary and this is object of odontoglyphical studies.

The main traits which are registered on 1st and 2nd upper and lower molars:

— presence or absence of both grooves which divide each cusp into principal crests;

— variable intersection points where the intratubercular grooves enter intertubercular ones;

— direction of central crests on each cusp;

— shape variants of some intratubercular grooves;

— topographical correlation and relationship of some neighbouring grooves;

— terminal branching of grooves;

— presence or absence of variable accessory grooves, crests, pits etc.

For the statistical analysis the same mathematical methods can be used as by analysing of other discrete descriptive traits.

The odontoglyphical method has serious advantage — in the same way we can examine as modern population as paleomaterial (this method is applicable as for a living person as for skulls). On the other side there is one fault of this method — only young people till 12–14 year can be examined. Later it becomes impossible because the dental masticatory surface wears out and microrelief ornament is lost.

At the moment the modern Lithuanian population is examined according to this new programme. Only local inhabitants determinated by genealogical method are sampled (it means that all parents and grandparents of sampled persons lived in the same district). All material is divided in series after geographical and ethnological principles.

Prelimirary results and conclusions:

1) odontoglyphical type of modern Lithuanians is rather homogeneous. The similar results shows the clasical odontological research done by I. Balčiūnienė;

2) differences between chosen regions of country are minimal and statistically insignificant;

3) in comparison with data of other Caucasoid and Mongoloid populations (data from A. Zubov) the significant differences were discovered. They show large biological distances between populations according to this system of traits. Unfortunately this method at the moment is not widespread yet. There are only a few publications and we compared our data with distant groups;

4) we suppose that this system of traits is old and formed before divergence Lithuanians in Lower and Upper Lithuanians. For this reason we did not find significant differences between these two groups and most of the signs are distributed mosaically.

So this method can be successfully used together with others by solving of ethnogenetical problems. But ethnogenesis is not only possible field where can be used system of odontoglyphical traits. Other interesting question which is not investigated yet — bilaterality of odontoglyphical traits. Fluctuance asymmetry of dental microrelief could interest paleoanthropologists because it can be analysed as a stress marker of population. Also sexual dimorphism of these traits is not investigated yet. Another interesting question — odontometric analysis using odontoglyphical points because measuring of molar crowns sometimes is very problematical for intricately defined measuring points. So odontoglyphic is a new method and it has some perspectives.

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BODY DEVELOPMENT AND PHYSIQUE OF VISUALLY IMPAIRED CHILDREN

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The study of physique and body development of visually impaired children is a rather poorly investigated topic. Probably it is due to the relatively low number of such children. However, there is a remarkable exception, namely a good number of publications are devoted to the questions dealing with the onset of menarche.

It is known that as a consequence of visual trauma, persons concerned adapt peculiar movements throghout the course of their lives. So, it is expected that the physique of visually impaired children differs from that of sighted children.

Subject and method

To begin with we must put in two short comments on the definition of visually impaired in Hungary and the number of children under discussion.

We are speaking about visually impaired of visual achievement less than 33% of full vision. The visual loss of partially sighted is between 33 and 10%. Low vision is under 10% and the vision cannot be used for the education. These children are practically blind.

There are three institutes for visually impaired children in Hungary, two of them for the partially sighted and one for blind children. The number of visually impaired children was approximately 600 over the past 10 years, which is 0.06% of the one million primary school children. In some cases of partially sighted children the visual disorder can be corrected. Many of them are integrated into normal primary schools, possibly requiring the help of peripatetic teachers. The number of them is not known because in statistics they are included in the number of primary school children.

The distribution of studied cases is shown in Table 1. Children for control have been chosen on the basis of the random number

Table 1

The number of examined children and control

Group	Boys	Girls	Together	Age
Blind	94	95	189	6–16
Weak-sighted	128	119	247	7–15
Sum total	222	214	436	4–18
Control	1040	1050	2090	–

generator of an IBM 360 computer from the Nationwide Growth Study of Hungarian Children and Youth (Eiben and Panto 1988).

Within the scope of an anthropometrical program we have measured 14 body sizes including those 10 necessary for determination of anthropometric somatotype of the concerned children. In the course of data processing beyond the calculation of usual statistical parameters (Kaposi and Buday 1985) the proportion of body sizes has been determined by means of Ross and Wilson's unisex human phantom model (1970). The Siri's density (1956), the body fat and lean body mass have been determined as well.

Adolescence of girls is well characterized by the date of first menarche. Its median was calculated by status quo method and probit analysis.

The physique has been investigated by the Heath-Carter anthropometric somatotype method (Carter 1975). The values on the first component were corrected — according to the suggestion of Hebbelick *et al.* (1973) for children — and are multiplied by a correction factor which is the quotient of the unisex human phantom's body height and body height of the children in question. According to Borms *et al.* (1973) this correction increases the value of endomorphy 18–20% which means 0.5 increase in the endomorphic scale.

The somatotype dispersion index (SDI), introduced by Ross *et al.* (1977), was used to calculate the distances of the individual somatoplots from the average. The somatotype dispersion distance (SDD) was then used to calculate the distance between average somatoplots of the age groups. Changes in growth of body build are indicated by "migratin" of somatoplots. In the examined period of life the migration distance (MD) is the total vectorial distances of somatoplots (Parizkova and Carter 1976).

Results

From our results the growth of two body sizes, the median of menarche and some characteristics of the physique are presented.

The body weight and body height of boys are shown in the com-

parison of the percentiles of Nationwide Growth Study of Hungarian Children and Youth (figure 1). The height of partially sighted boys does not differ considerably from that of the 50th percentile of the sighted, while the body mass is somewhat greater for partially sighted (figure 1). The height of blind boys is shorter than that of the sighted, as a rule it is between the 50th and 25th percentiles. Their body mass is between the 25th and 75th percentiles. The height and body weight values of visually impaired girls are between similar limits.

Due to the motion-poor way of life a greater number of obese or at least overweight children is expected in the visually impaired. However, this assumption can not be fully regarded, since it is not justified by data of height for weight or by other (here not presented) calculations cincerning the lean body mass, density and energy protein index (Amador *et al.*, 1981).

The puberty of girls is well described by the median of menarche. The menarche median of blind and partially sighted girls together with other handicapped groups is shown in Table 2, in comparison with some other hungarian data. The smallest median even lower than that for blind girls, has been found for visually impaired girls. This result is in agreement with some other observations, But there is some other contradictory data as well.

The median of menarche of hearing impaired girls is higher than that of visually impaired girls but lower than these of who attend primary schools. The menarche median data for moron mentally handicapped girls, especially those for girls with Down syndrome, are higher and their reliability limits are wider also.

Table 2

Median age at menarche of handicapped and cotnrol girls

Visually handicapped	
Blind and practically blind	11.90 ± 0.27
Visually impaired	12.10 ± 0.48
Hearing impaired	
Deaf	12.50 ± 0.17
Hard of hearing	12.43 ± 0.65
and mentally retarded	12.67 ± 0.98
Mentally retarded	
Mild	12.96 ± 0.65
Moderately	13.34 ± 0.96
DOWN SYNDROME	13.45 ± 0.48
Control	
(Parkas, 1984)	12.72
(Pantó és Eiben, 1984)	13.09 ± 0.15

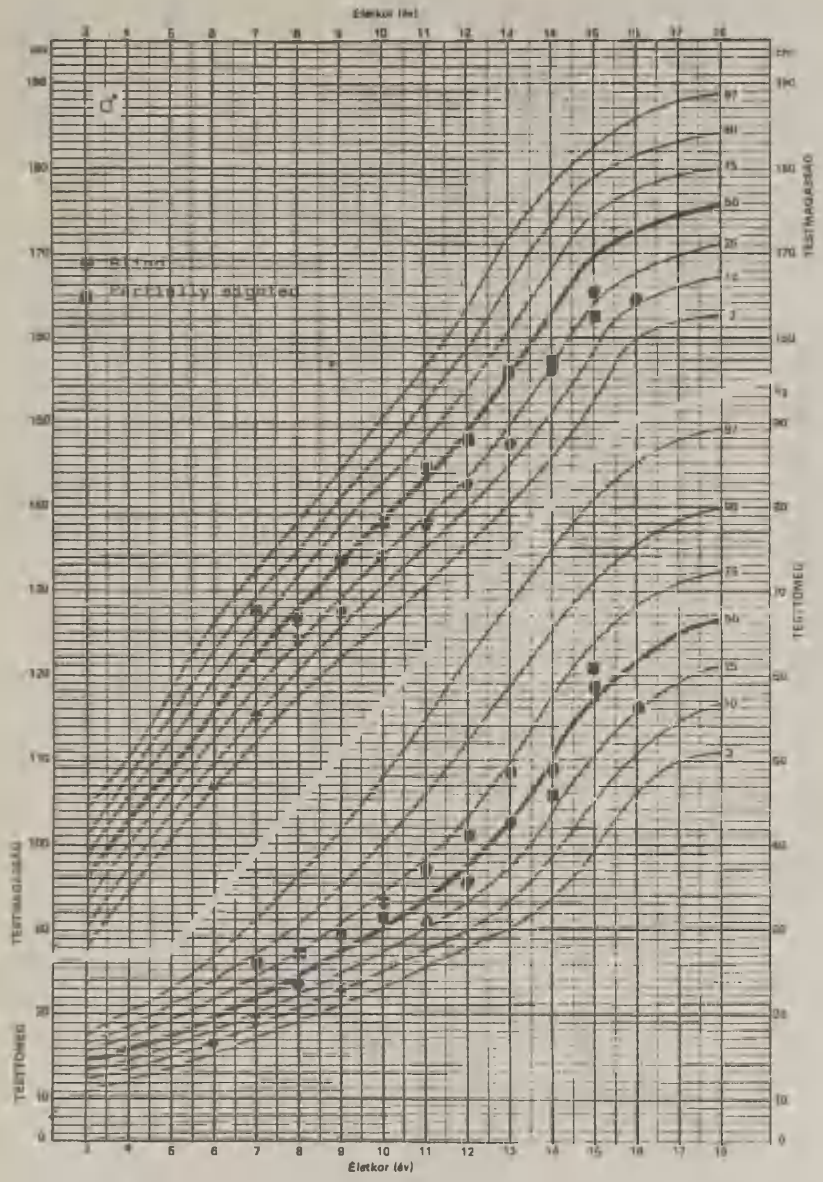

Figure 1. The body height and weight of boys in the percntiles of Nationwide Growth Study of Hungarian Children and Youth

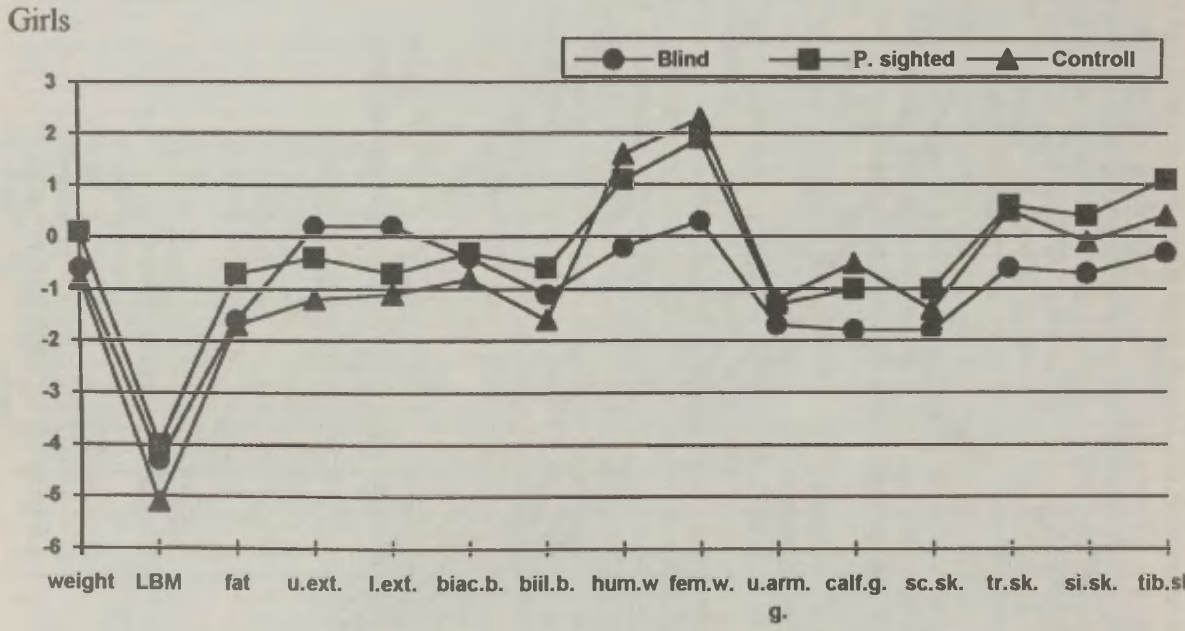

Figure 2. Proportionality profile of 8-year-old children

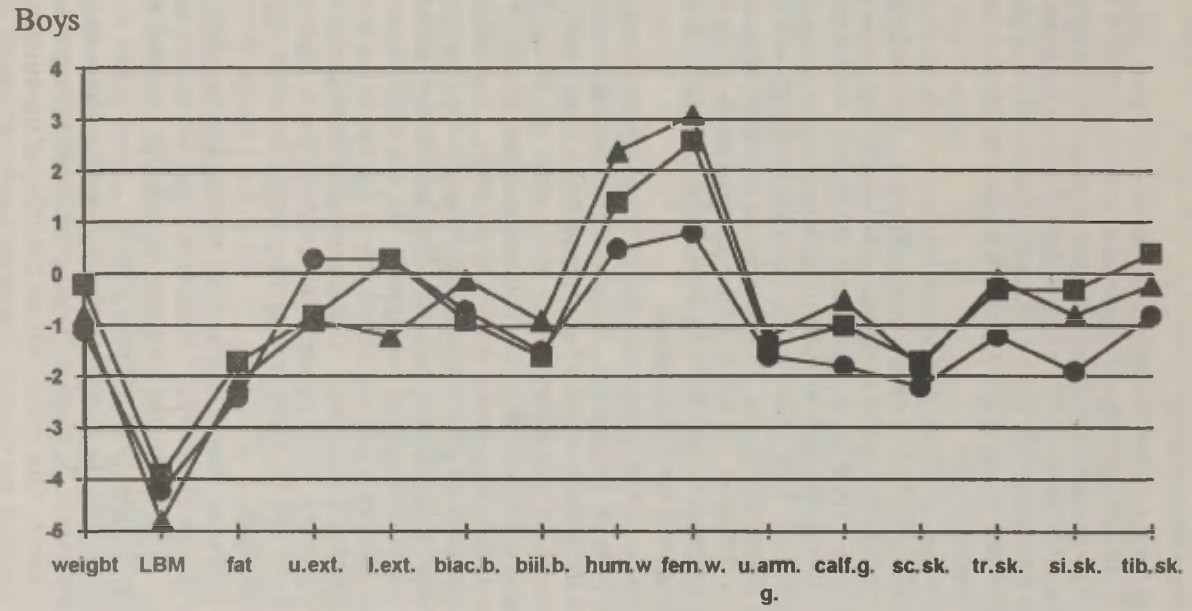

Figure 2. Proportionality profile of 8-year-old children

Henceforth, the proportional variations of some body sizes will be shown. At their evaluation one has to take into account, that — the investigation is of transverse type — the number of children is limited in each group — an intensive phase of growing is going on in the investigated interval of age.

It can be seen from the probability profile of 8-year-old children (figure 2), that the growth of body sizes is not too intensive at this age. The lean body mass makes an exception, it grows rapidly throughout childhood. The value of the bi-epicondylar width of the humerus and femur is proportionally high at this age. The measure of girths and skinfolds in the group of blind children grows somewhat more rapidly than in other groups.

At the age of 15 the differences between groups of visually impaired and sighted children are larger (figure 3). In visually impaired groups the skinfolds and consequently the body fat values are proportionally high. Their limbs grow more moderately than those of the sighted. The bi-epicondylar width of the humerus and femur decrease proportionally. This points to the fact that during growth the sizes of thick elbows and knees of these children becomes proportuionally thinner and thinner. Th values of the condylus width of the humerus and femur correlate well with the skeletal age, therefore it is of use to watch them with special attention.

The value of SDI is larger in groups of visually impaired children than in those of the sighted. Consequently the individual somatoplots for the visually impaired are spread over a larger area, so their physique can be very different even in the same age group. This observation is explained by the fact that our groups were selected by the severity of visual impairment and not by aetologie. Very different children, from the point of view of aetology, belong to the same group, but the physique is significantly influenced by the clinical picture describing the origin of the visual impairment. So, the physique of visually impaired children is influenced not only by the way of life but also by the aetiological background. This is proved by the fact that unusual somatotypes, first of all extremely low and extremely high values of endomorphy can be found among the visually impaired children at almost every age.

The migratory distances of average somatoplots belonging to certain age groups (Table 3) are somewhat larger for visually impaired children. Therefore, the physique of visually impaired children changes to a higher degree during growth.

It follows from the foregoing that special attention should be paid to the importance of physical training and sport among visually impaired children. One can report on a number of encouraging initiatives in this field, for example, a growing number of visually impaired children take part in the programs of the Special Olympic Games and

Table 3

Somatotype components and SDI of visually impaired and control

Age	Group	Boys Somatotypes				Girls Somatotypes			
		I	II	III	SDI	I	II	III	SDI
6	Blind	6.0	4.3	1.7	8.8	3.1	3.0	3.3	8.4
	Partially sighted	–	–	–	–	–	–	–	–
	Control	3.4	4.7	2.6	3.5	4.2	4.2	2.6	4.1
7	Blind	1.3	2.5	5.5	7.8	2.1	4.5	2.0	9.1
	Partially sighted	3.5	4.6	3.3	5.9	4.3	4.0	3.0	4.1
	Control	3.3	4.3	3.2	4.4	4.5	4.0	3.2	4.5
8	Blind	2.0	3.3	4.0	5.2	3.0	3.1	4.5	8.8
	Partially sighted	3.6	4.4	2.7	4.8	4.6	4.4	2.3	5.3
	Control	3.0	4.4	3.5	3.5	4.5	3.8	4.5	4.5
9	Blind	4.8	3.9	2.5	6.4	3.1	2.8	4.5	10.3
	Partially sighted	3.3	4.2	3.4	4.8	4.0	3.5	3.6	6.5
	Control	3.5	4.1	3.6	4.5	4.8	3.8	3.7	5.0
10	Blind	4.3	4.1	2.9	5.6	3.4	3.4	3.5	8.0
	Partially sighted	3.2	4.4	3.3	4.6	4.3	3.5	4.0	5.8
	Control	3.7	4.2	3.6	4.8	5.0	3.6	3.8	4.0
11	Blind	3.6	3.4	3.9	5.5	4.2	3.4	2.9	7.3
	Partially sighted	3.8	4.1	3.5	7.0	5.4	3.9	2.8	6.4
	Control	3.9	4.1	3.6	4.1	5.3	3.6	3.7	4.6
12	Blind	4.5	3.9	3.4	5.8	4.2	3.2	3.2	6.7
	Partially sighted	3.6	4.1	3.4	5.8	4.3	3.1	3.7	4.9
	Control	4.1	4.1	3.7	4.5	5.0	3.2	4.1	4.5
13	Blind	5.1	4.6	2.7	7.0	4.8	2.8	3.5	7.8
	Partially sighted	4.4	4.8	2.9	7.0	4.7	3.2	3.2	6.2
	Control	3.9	3.9	4.0	5.1	5.5	3.2	3.7	4.5
14	Blind	3.3	3.1	3.8	5.3	4.8	2.8	3.5	7.4
	Partially sighted	2.8	3.9	3.9	4.4	4.9	3.6	3.1	6.4
	Control	3.2	4.0	3.7	5.0	5.9	3.3	3.4	4.6
15	Blind	4.2	4.3	3.0	6.5	6.7	4.3	2.3	6.8
	Partially sighted	5.9	4.8	2.2	10.1	4.8	3.9	2.5	4.4
	Control	2.5	4.2	3.2	3.5	6.1	3.5	3.1	4.7

other sport events. The usual number of physical training lessons in schools is insufficient to improve the present situation. Recently, sporting of adult visually impaired people living under common conditions encountered still more serious difficulties.

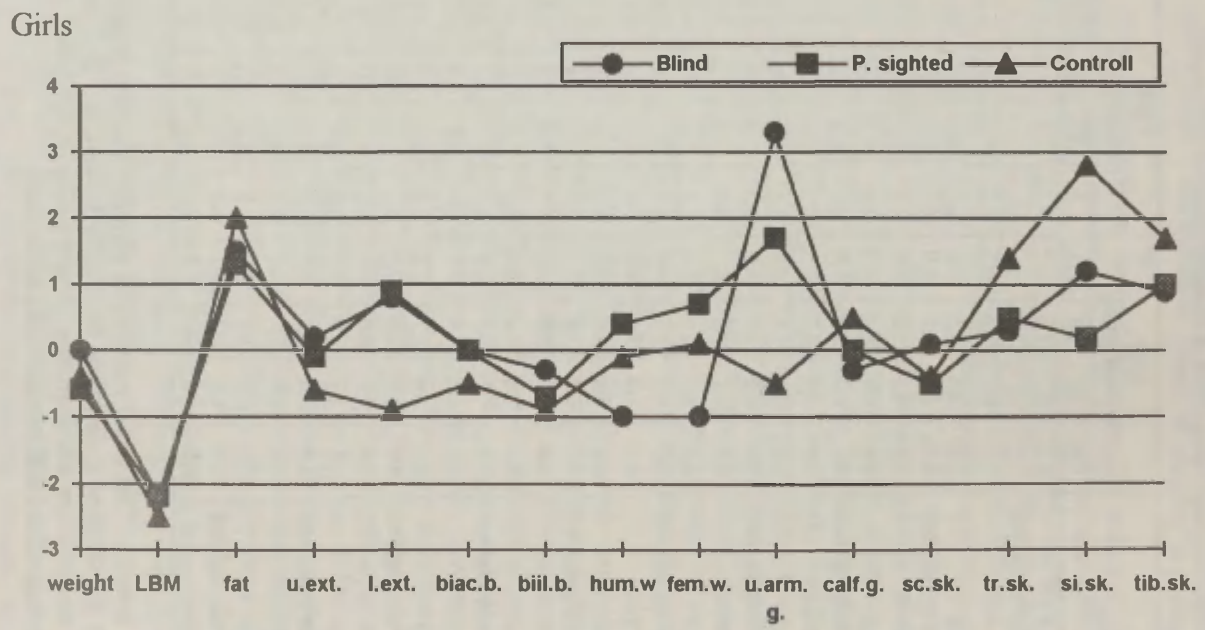

Figure 3. Proportionality profile of 15-year-old children

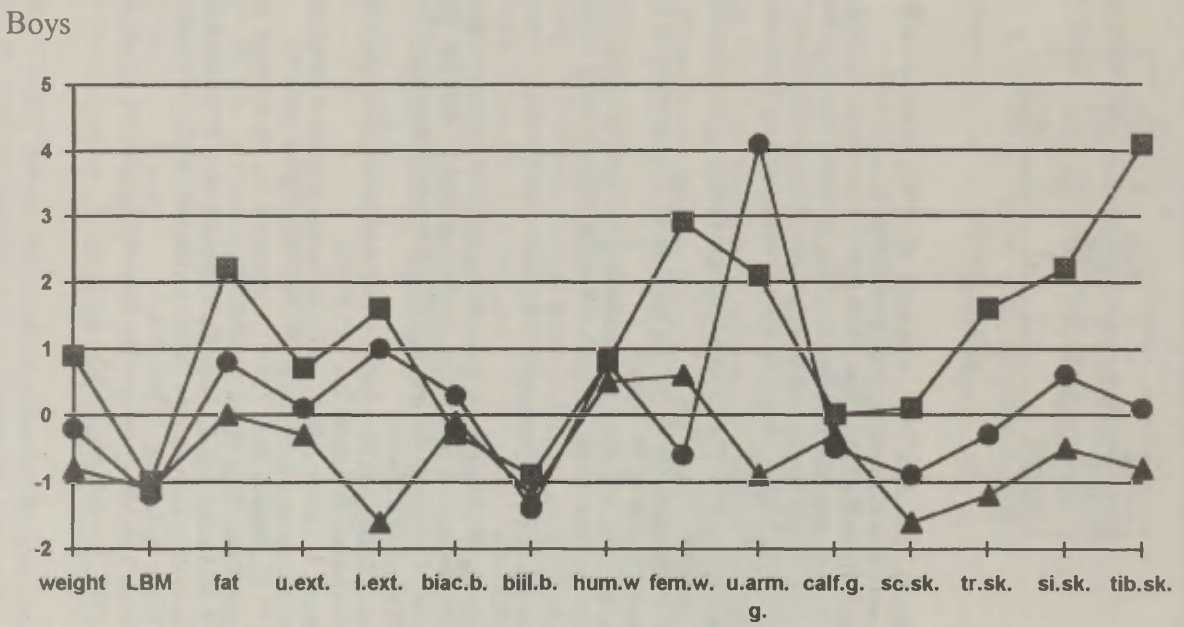

Figure 3. Proportionality profile of 15-year-old children

Table 4

Migratory Distance of visually impaired and control 7–15 years of age

Group	Boys	Girls
Blind	31.8	22.4
Partially sighted	21.5	19.5
Control	7.1	14.5

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NEUROMUSCULAR PERFORMANCE CHARACTERISTICS IN JUDOISTS AT VARIOUS AGE

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Introduction

Strength is the term generally used to describe the neuromuscular performance. Maximal muscle strength and power output play an important role to determine performance in many sports events, where the athletes often use explosive type of strength training. Neuromuscular performance can be measured by a variety of methods characterized as the isometric, iso-inertial and isokinetic testing modalities. For this study, strength is operationally defined as the ability to exert force on an instrument specially designed to measure isometric and isokinetic torque of the knee extensors. One of the most popular tests for measuring the explosive power output of the human leg extensor muscles are vertical jumps performed on the force platform (Bosco *et al.*, 1982, Aura, Viitasalo, 1989, Wilson *et al.*, 1993).

The purpose of the present study was to measure the relationship between the maximal isometric, isokinetic knee extension strength and the vertical jumping ability in young and adult judoists.

Material and methods

Subjects. 36 male judoists aged from 12 to 25 years participated in the present study. They were divided into three groups:

I group, aged 12–14 years,
II group, aged 15–16 years,
III group, aged 17–25 years.

Group data concerning age, body height and weight is presented in Table 1.

Isometric strength testing. An electromechanical dynamometric chair was used to measure maximal unilateral isometric force and various force-time and relaxation parameters of the leg extensor muscles. The subjects were seated with the knee and hip angles equal to 110°. The force produced by isometric voluntary contractions of the right

Height, body weight and the number of the judoists (n) in the groups (mean ± SE)

	GROUPS		
	I	II	III
Height (cm)	157.8 ± 2.9	170.5 ± 1.7	183.6 ± 2.7
Weight (kg)	43.3 ± 2.8	62.8 ± 2.5	83.3 ± 5.5
n	14	14	8

knee extensor muscles was measured with a strain gauge. An elastic strap was placed around the distal part of ankle above the malleoli and connected to the strain. The subjects were instructed to react to the light signal (ignition of the lamp) as quickly and as strongly as possible by extending the leg against a cuff fixed to a strain-gauge system, to maintain the maximal effort as long as the signal were on (2 s) and to relax the muscles suddenly after dissappeareance of the signal. The force-time curve and light signal were analysed by computer. The following data were calculated:

(1) maximal voluntary contraction (MVC);
(2) rate of force development (RFD) after 0.2 s from onset of the contraction;
(3) half-relaxation time (1/2 RT).

Isokinetic strength testing. Cybex dynamometer was used to measure maximal voluntary concentric strength of the knee extensor muscles of the right extremity. Subjects were positioned for seated knee joint testing with stabilization straps across the chest and a horizontal pad across the distal thigh. The tibiofemoral joint line was palpated and the axis of the dynamometer arm was aligned with the joint line. The sliding cuff of the lower extremity dynamometer arm was positioned just proximal to the malleoli. Starting position for testing was at 90° of knee flexion. The angular velocities used were 90, 180 and 270°/sec. Data were compiled and stored in a computer coupled to the dynamometer. The characteristics studied were:

(1) peak torque (PT);
(2) power output at peak torque (W).

Vertical jumping tests. The vertical jumping tests to record dynamic explosive strength characteristics of a lower extremity extensor muscles were performed on a force platform. The subject's hands were kept on the hips throughout the jumps.The three types of maximal vertical jumps were performed:

(1) from a squat position without countermovement (SJ);

(2) from an erect standing position with a preliminary countermovement (CMJ);
(3) after jumping down from a platform, height of which was 40 cm, called drop jump (DJ).

The vertical ground reaction force-time curve was analyzed by computer. The flight time gave the basis for calculation of the height of the body's center of gravity i.e. height of jump (H).

Statistics. Standard statistical methods were used for the calculation of mean, standard error of mean (SE) and linear coefficient of correlation (r). The differences between the mean values were tested for significance by using ANOVA test.

Results

Isometric dynamometry characteristics. The mean values of the isometric MVC, RFD and 1/2 RT obtained in the three groups of subjects are shown in Table 2.

Table 2

Mean values (mean ± SE) of the isometric dynamometry characteristics

	GROUPS		
	I	II	III
MVC (N)	426.9 ± 25.6	673.0 ± 33.7	747.3 ± 41.9
RFD (N/s)	1666.7 ± 115.1	2548.5 ± 120.2	2526.5 ± 185.9
1/2 RT (ms)	97.0 ± 11.0	86.0 ± 4.0	91.0 ± 12.0

The results demonstrated increase in maximal isometric strength characteristics of the knee extensor muscles with age. The group II and III had significantly greater mean values of MVC and RFD than group I. No significant differences were found in 1/2 RT values between the groups.

Isokinetic dynamometry characteristics. The mean values of the isokinetic knee extension peak torque and power output at three angular velocities are shown in Table 3.

As maximal isometric strength, the results of measurement demonstrated increase of isokinetic strength and power output of the knee extensor muscles with age. The group II and III had significantly greater PT and W. at all measured angular velocities than group I. At 90°/s , the significant differences between group II and III were found in W.

Table 3

Mean values (mean ± SE) of the isokinetic dynamometry characteristics

	GROUPS		
	I	II	III
90°/s			
PT (N·m)	82.5 ± 9.9	181.4 ± 15.4	256.4 ± 35.2
W (W)	108.6 ± 17.2	267.9 ± 24.6	383.4 ± 41.8
180°/s			
PT (N·m)	25.9 ± 5.1	66.1 ± 9.7	109.0 ± 17.0
W (W)	38.3 ± 8.6	129.0 ± 26.6	216.5 ± 48.5
270°/s			
PT (N·m)	12.8 ± 2.2	30.0 ± 2.5	37.4 ± 5.6
W (W)	22.4 ± 5.8	67.4 ± 7.4	89.4 ± 17.4

Vertical jumping height. The mean values of the H of the three types of vertical jumps are presented in Table 4.

Table 4

Mean values (mean ± SE) of the vertical jumping height

	GROUPS		
	I	II	III
SJ (m)	0.26 ± 0.01	0.31 ± 0.02	0.35 ± 0.01
CMJ (m)	0.28 ± 0.01	0.34 ± 0.02	0.37 ± 0.01
DJ (m)	0.28 ± 0.01	0.33 ± 0.01	0.38 ± 0.02

As shown in Table 4, group II and III had a significantly higher values of H in all three types of vertical jumps than group I. No significant difference between the group II and III were noted.

Correlations. The correlation coefficients were calculated for all subjects to assess the relationship of isometric and isokinetic strength and power characteristics with vertical jumping height. Isometric MVC correlated positively and significantly with RFD (r = 0.80), PT and W of isometric contraction (r ranged from 0.71–0.83 at various angular velocity), and H of three types of vertical jumps (r ranged from 0.61–0.67).

Discussion

The objects of general discussion are the isometric and dynamic muscular strength connections. The present research showed that the isometric and isokinetic strength of judoists are in positive correlative connections with each other. These results are compatible with the data presented by several authors (Knapik, 1980; Knapik *et al.*, 1983) who have established significant positive connections between isometric and isokinetic contractions of the human knee extensor muscles. Our studies indicated that both isometric as well as isokinetic strength correlated with the vertical jumping height of judoists. Positive correlation between vertical jumping ability, isokinetic and isometric strength of the knee extensor muscles established by several authors (Smith, 1961; Berger and Henderson, 1966; Genuario, Dolgener 1980). In conclusion, our data indicated that isometric and isokinetic torque measurements could both be used in human muscle strength testing.

The present research revealed that the studied muscular strength and power output parametres in judoists were in the age group 12–14 years considerably lower than in the age group of 15–16 years and the adult group. At the same time no significant changes could be observed between the age group of 15–16 years and the adult group. The latter confirms the standpoint that the functional improvement of the muscular system occurs after adolescence, expressed in considerable muscle strength and power output variables increase.

In the given case the subjects were judoists of good training condition, so this aspect has also be considered. Our data indicate that no statistically significant improvement took place in the voluntary muscle relaxation capability of the given subjects. This is in good agreement with the data according to which the muscle relaxation characteristics are relatively stable during heavy resistance or explosive type of strength training (Alen *et al.*, 1984; Häkkinen *et al.*, 1985). Our data point to the fact that co-ordination ability of muscle develops at a relatively earlier age than strength and power output of muscles (Nemoto *et al.*, 1990).

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EVALUATION OF GROWTH DISORDERS IN CHILDREN

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Introduction

Growth is a complex biological phenomenon and is a vital part of child's development (Goldbloom, 1992).

Growth monitoring with standard growth charts is advocated as an effective, simple and inexpensive way for assessment of normal physical growth and nutrition in children (Sabu, 1993).

Accurate measurements over time and comparisions with established standards are essential for the early recognition, diagnostic evaluation, and successful management of growth and nutritional problems in infants and children. Many of occult diseases may first manifest as growth failure which results in short stature (Winter, 1990).

Growth charts for growth monitoring were started in 1993 in Estonia based on standard deviation scores, cross-sectional measurements of children done by R. Silla and M. Teoste. The World Health Organisation's international growth reference uses cut offs based on standard deviation scores rather than centiles. European height and weight charts commonly extend from 3rd to the 97 centile, whereas in North America the extremes are usually the 5th and 95th centiles (Cole, 1994).

Materials and methods

1240 children aged 9–15 years were observed for growth and pubertal development. Questionnaires about growth data at birth, childs health and parents growth were filled in.

The measurement of height, weight were performed and pubertal development was graded according to Tanner (Tanner, 1976). Height was determined by two consecutive measurements.

Short stature has been defined as height and weight below the –2.5 standard deviations and tall stature as height above the +2.5 standard deviations.

In the group of children evaluated as short bone age was determined from a radiograph of the left wrist. Delay in bone age was determined by using the child's chronologic age at the time of bone age. Determination of upper/lower body segment ratio enabled to evaluate disproportionate shortening of the lower limbs in short children.

For each short child the chronologic age, bone age and predicted height standard deviation was recorded additionally.

Table 1

Sex and Age Distribution of Subjects

Age (years)	Girls	Boys
9	155	148
12	251	226
15	229	200
Total 1240		

Results

21 children of investigated children were classified as being short and 50 children as tall according to established standards (Table 3). 19 children were proportionally and 2 children were disproportionally short.

Table 2

Mean height in Children Aged 9, 12, 15 years

Age (years)	Girls	Boys
9	135.02 cm ± 5.97	137.8 cm ± 6.01
12	152,1 cm ± 7.62	151.7 cm ± 8.11
15	164.5 cm ± 7.57	170.0 cm ± 7.82

Among short children 12 boys and 9 girls.

18 children evaluated for short stature are normal stature variants. The slow growth patterns of these children reflect familial short stature or constitutional delay of growth. All 12 children evaluated as constitutionally short were boys.

In the group of constitutional short stature the puberty has delayed, the children with familial short stature enter the puberty at an appropriate age.

Chronic systemic disorders, endocrine abnormalities, skeletal dysplasias were excluded in group of children with constitutional delay of growth.

13% of short children had a pathological condition. Causes for pathological growth were two skeletal dysplasias and vitamin-D resistant rickets combined with I type diabetes.

45 children were with tall stature. Among them predominates familial tall stature. In 5 children exogenous adiposity was accompanied by inreased height in prepubertal period.

Table 3

Referrals for Growth Disorders

Diagnosis	Number of patients	Percentage
Short stature		
Normal height	1174	94.67
Constitutional growth delay	12	0.96
Familial short stature	6	0.48
Pathological growth	3	0.24
Short stature	21	1.69
Tall stature		
Familial tall stature	40	3.22
Exogenous adiposity	5	0.40
Tall stature	45	3.62

Target height standard deviation was consonant with parenteral height only in children with familial short stature.

Discussion

An evaluation of the patient's pattern of growth is the most helpful clue in the determination of growth disorders. A record of consecutive accurate heights over a considerable time span important information than isolated measurements (Lifshitz, 1992). The best growth data are obtainable from schools that measure children regulary once or twice a year. A serious growth problem may be overlooked for many years. The most simple way for growth monitoring is growth chart. Growth disorder may be the onliest or the first manifestation of certain diseases.

Most children evaluated for short stature are normal stature variants. Short stature especially among boys, may be pscychologically depressiv. Therefore evaluation of cause for short stature is important.

Children with constitutional growth delay have a delayed adolescent growth spurt because of the bone age delay consistent with height age. (Moore, 1993). They continue to growth after an average child has stopped growing and, therefore, may attain average adult height.

Children with genetic or familial short stature grow constant rates and enter puberty at an appropriate age. Their final height is consonant with parenteral height.

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ON CRANIOLOGY OF SOUTH-EAST ESTONIAN POPULATION IN XI–XVIII CC.

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The investigations of the Estonian paleopopulations and the distribution of the anthropological types in Estonia on the craniological material have been carried out by K. Mark (1956, 1962, 1965 u.o.). The detailed craniological studies have been completed also in the other Baltic states (Denisova 1975, 1977, 1990, Česnys 1990 u.a.).

Some new craniological materials from South-East Estonia have been added in the course of this survey (Tab. 1). The aim of this survey is to give a craniological characterization of South-East Estonians of XI–XVIII cc. A.D. on the background of the paleoanthropological material of the same period of time of Estonia, Latvia and partly also on the background of that of 1st millennium A.D. of Lithuania.

At first we observe the position of the South-East cranial samples among the samples all over Estonia (figure 1, Table 2).

At the central part on the figure two bigger clusters have joined (nr. 25, 6, 11, 24, 23, 9, 7, 13 and nr. 8, 21, 20, 18, 19, 16, 22, 17). These embrace a large part of East-Estonian cranial samples. The mesomorphic, mesocran samples of the 1st half of the 2nd millennium AD have been joined into the 1st cluster — Jõuga from North-East, Otepää and Siksali from South-East Estonia and Viski samples nearby Pecory. Some cranial samples of the later period as Iisaku, Kohtla-Järve (XVII–XVIII cc) and Kaberla (XV–XVII cc) also belong into the 1st cluster. Makita (XV–XVII cc) sample from South-East Estonia joins with that cluster from one side. Distinguishing features of these samples are a wider skull and wider face, a lower nasal bridge in comparison with the other samples of the cluster. Dolichocran North-Estonian Kaberla (XIII–XV cc) sample, which is an intermediate form between the meso- and dolichocran types, joins to the mesomorphic groupings of East-Estonia on the other side. Kaberla sample is characterised by a profiled face, by a narrow leptorhhin nose, but a comparatively wide face (136.3 mm).

The Central and East Estonian cranial samples of the later period (XV–XVIII cc) and also Välgi sample (XIII–XV cc) form the other cluster of the same mesocran cranial type. Here the clusters show

Table 1

The list of the craniological samples used

No	Territory, cemetery	Dating (cc)	Author
	I Estonia		
1.	Complex group (Martna, Haimre, Küti, Lahepera, Õvi)	XII–XIII	Mark, 1956
2.	Karja	XIII	Mark, 1956
3.	Tammiku	XII–XIII	Mark, 1965
4.	Pada	XII–XIII	Heapost
5.	Lindora	XI–XII	Heapost
6.	Siksali	XI–XVI	Heapost
7.	Jõuga	XI–XIV	Mark, 1956
8.	Välgi	XIII–XV	Mark, 1965
9.	Otepää	XIV	Mark, 1965
10.	Kaberla	XIII–XV	Mark, 1962
11.	Kaberla	XV–XVI	Mark, 1962
12.	Makita	XIII–XV	Heapost, 1994
13.	Makita	XV–XVII	Heapost, 1994
14.	Kuuste	XV–XVII	Heapost
15.	Kõrgepalu	XIV–XVII	Mark, 1965
16.	Koikküla	XVI–XVII	Mark, 1965
17.	Räpina	XVII	Mark, 1965
18.	Rõngu	XVIII	Mark, 1965
19.	Kabina	XVII	Mark, 1956
20.	Varbola	XVI–XVII	Mark, 1956
21.	Aimla	XVI–XVII	Mark, 1956
22.	Vaadu	XVII	Mark, 1965
23.	Iisaku	XVII–XVIII	Mark, 1965
24.	Kohtla-Järve	XVII–XVIII	Mark, 1956
25.	Viski (Pecory district)	XIV–XV	Mark, 1956
26.	Tsirgu	XVIII–XIX	Mark, 1965
27.	Ruhnu (Swedes)	XVII–XIX	Aleksejev, 1974
28.	Boat-axe culture	2700–2000 B.C.	Mark, 1956
29.	Comb-marked pottery culture	4000–3000 B.C.	Mark, 1956
	II Latvia		
30.	Lielupe basin (Zemgali)	V–VII	Licis, 1939
31.	Čunkäni-Drenģeri	VIII–XI	Denisova, 1990
32.	Lejasbitēni	VII–X	Denisova, 1975
33.	Kivti	VIII–IX	Denisova, 1975
34.	Odukalns	IX–XI	Aleksejev, 1969

Continued Table 1

No	Territory, cemetery	Dating (cc)	Author
35.	Complex group of Latgallians (Nukši, Kristapēni, Cibla, Zilupe, Oglenieki, Dignājas-Strutmali)	X–XII	Denisova, 1975
36.	Livonians (Daugava and Gauja)	X–XII	Denisova, 1975
37.	Lejasdopeles	XI–XII	Denisova, 1975
38.	Jaunpiebalga	XI–XIV	Denisova, 1977
39.	Sēlpils	XIII–XV	Denisova, 1977
40.	Vaidi	XIII–XVI	Denisova, 1977
41.	Uplanti	XIII–XIV	Denisova, 1977
42.	Jauniela	XIII–XIV	Denisova, 1977
43.	Mārtinsala	XIV–XV	Denisova, 1977
44.	Jkškile	XIV–XV	Denisova, 1977
45.	Reznes	XIII–XI B.C.	Denisova, 1975
46.	Kivutkalns	1300–1100 B.C.	Denisova, 1975
47.	Zvejnieki	5000–4000 B.C.	Denisova, 1975
48.	Zvejnieki (dolichocran type)	5000–4000 B.C.	Denisova, 1975
49.	Zvejnieki (dolicho-mesocran type)	5000-4000 B.C.	Denisova, 1975
50.	Zvejnieki	4000/3000 B.C.	Denisova, 1975
51.	Zvejnieki	3000/2000 B.C.	Denisova, 1975
	III Lithuania,		
52.	Versvai, Sagrenai, Eiguliai Lauksvydai, Seredžius, Veljuona, Vaitiekunai, Upyte (the burial ground culture of central Lithuania)	II–V	Česnys, 1990
53.	Zastaučiai, Daubai, Žaduvenai, Visdergiai, Akmjaniai, Noruišiai, Kairiai, Plaučiskiai, Ragin'enai, Dauienai, Berciunai, Pajuostis, Lepšiai (the barrow culture of Lithuania)	II–V	Česnys, 1990
54.	Delnica, Krikštonys, Pažarstis, Eitulionys, Šveicarai, Osova Karklinai, Jatviež-Mala, Žyva-Voda (mesocranic type of Jatvingians)	III–V	Çesnys, 1990
55.	Delnitsa, Krikštonys, Pazarstis, Eitulionys, Szwajcaria, Osova Karklinai, Jatviež-Mala, Žyva-Voda (dolichocranic type of Jatvingians)	III–V	Česnys, 1990

Continued Table 1

No	Territory, cemetery	Dating (cc)	Author
56.	Kanjūkai, Pakraugle, Zvirbliai, Riklikai, Lygalaukiai	III–V	Česnys, 1990
57.	Maudžiorai, Šaukenai	III–V	Česnys, 1990
58.	Griniunai, Kriemala (the west Aukžtaičiai)	V–VI	Česnys, 1990
59.	Jauneikiai	V–VII	Česnys, 1990
60.	Pašušvys	V–VIII	Česnys, 1990
	IV Volga district		
61.	Fatjanovo culture	2000–1400 B.C.	Denisova, 1975
62.	Balanovo (Balanovo culture)	Bronze Age	Akimova, 1947

clear differencies between the cranial series of the 1st half of the 2nd millennium and the later period that have been earlier described in detail by K. Mark (1965).

The length and the height of the skulls of that cluster are smaller than those of the first cluster of that type. Cranial width of the samples of Välgi, Aimla and Varbola are equal (142.5 mm) to those of East-Estonian ones of the earlier period of time (XIII–XV cc), the nasal bridge is also comparatively low on the background of the other samples and some facial flatness on the top level is observed (as with Vaadu and Räpina samples in South-East Estonia).

Makita (XIII–XV cc) and Kuuste (XV–XVII cc) cranial samples from South-East Estonia (nr. 12, 14) are near to the East-Estonian mesomorphic type. The dolicho-mesocran Kõrgepalu (nr. 15) sample with a narrow skull, a lower face and profiled face in comparison with the Makita and Kuuste, joins with them. That cluster is characterized by a comparatively low nasal bridge and chamaerrhin nose.

The South-Eastern Tsirgu (XVIII c) and West-Estonian sample of Swedes from Ruhnu Island (XVIII–XIX cc) join into the mesomorphic cranial samples of Central and East Estonia (nr. 26, 27). These mesomorphic, mesocranial samples are characterized by a low face height and a narrow nose, Ruhnu sample is characterized by a narrow face too.

Tammiku and Lindora (nr. 3, 5) samples join into a small cluster but in a quite high level. Tammiku sample is characterized by K. Mark (1965) and should belong to the dolichocran anthropological type which is represented by the skulls from the underground graves of the 1st half of the 2nd millennium. She has pointed out some intermediate features between mesocran and dolichocran types of Tammiku series. Lindora sample from South-Eastern mounds of XI c is characterized

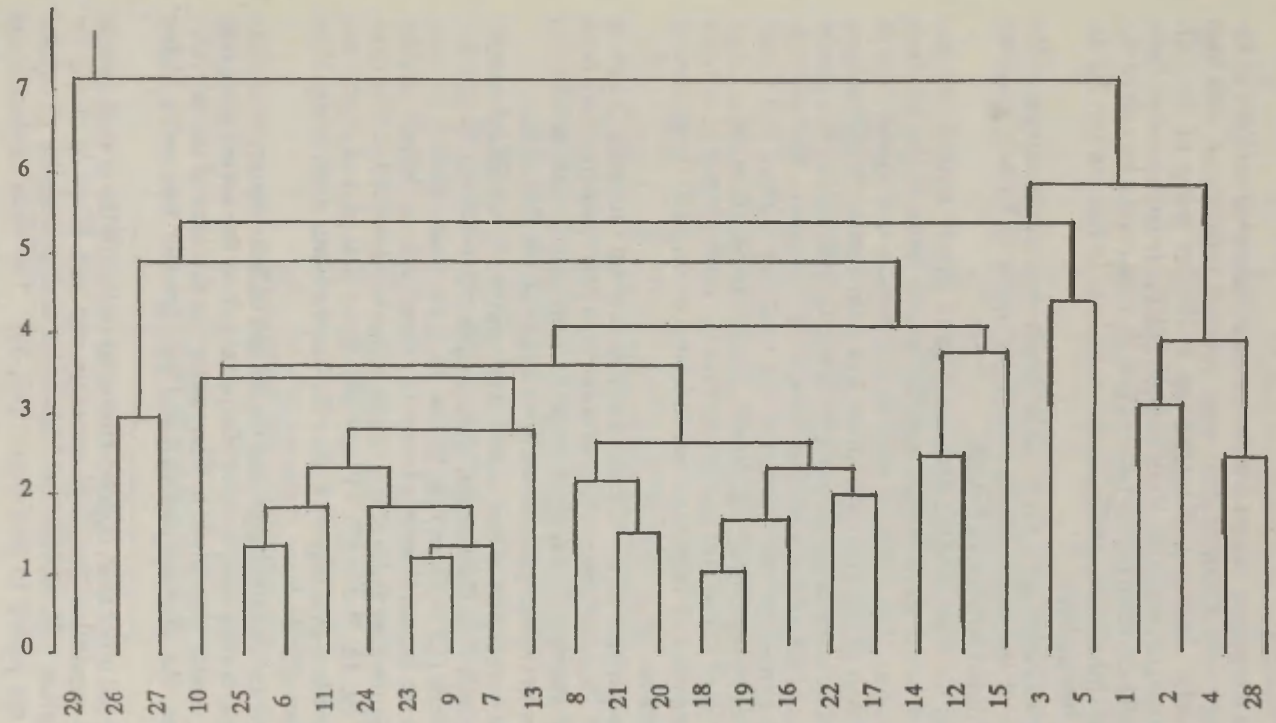

Figure 1. Comparison of Estonian cranial samples with the others using the method of cluster analysis. Dendrogram II. (the titles of the samples as in Table 1).

also by long, narrow and high skulls with narrow face. Closeness of these series to the dolichocran type has been assured also by the cluster analysis.

Into a separate cluster were combined the cranial samples of another type with a massive, very long and high, dolichocran, with high face skulls. The cranial samples as a complex group of the (XI-II c) underground skulls, Karja sample (XIII c) from Saaremaa, Pada (XII–XIII cc) from North-Estonia and also the cranial sample of the neolithic inhabitants of the Boat Axe Culture in Estonia (nr. 20, 21, 23, 15) belong here.

On the higher level the neolithic brachycran cranial sample of the carriers of the Comb Marked Pottery Culture of Estonia joins the other cranial samples of Estonia.

Next we shall observe with the help of cluster analyses the position of South-Eastern skull samples among these of the southern neighbours. The material used in comparison was mainly that of the 1st half of the 2nd millennium AD from Latvia. In this analysis some of Lithuanian cranial samples of the 1st millennium AD, cranial samples of mesolithic-neolithic cemetery of Zvejnieki, late neolithic cranial samples of the carriers of the Boat Axe Culture and Comb Marked Pottery Culture of Estonia, cranial sample of the Bronze Age cemetery of Kivutkalns and in addition the neolithic cranial samples of the carriers of Fatjanovo and Balanovo culture have been used in comparison.

Comparison of the cranial samples is given on figure 2 and in Table 3. One can observe that all cranial samples compared have been divided mainly into two big clusters. Mesomorphic, meso-dolichocran skulls with various variants are assembled into the first cluster.

The kernel part of that cluster is constituted by the Siksali sample from South-East Estonia and Viski, Selpils (XIII–XV cc), Ikskile and Martinsala (XIV–XV cc) (nr. 26, 44, 39, 6, 43) from Latvia. The other part of the kernel cluster is formed by samples from Otepää, Makita from South-East Estonia and Jõuga, Lejasdopeles and Jauniela from Latvia (9, 12, 7, 37, 42). The skulls of the first part of cluster are distinguished by a slightly higher skull and a lower nasal bridge than the others (Table 3).

Kivti and Jaunpiebalga from the 1st half of 2nd millennium and late neolithic cranial sample from Zvejnieki join to the kernel groupings of the cluster (38, 33, 51). They share the features of the previous samples, but they are distinguished by a broader face and a higher skull.

On the other side, dolicho-mesocran variant of the cranial sample of the mesolithic Zvejnieki cemetery and also III–V cc of the 1st millennium AD. North-East Lithuanian cranial samples (Kanjūkai u.o.) are joined to that cluster (49, 56). The main distinguishing

Table 2

Average measures of the Estonian cranial samples on the dendrogram I by clusters (or cluster parts)

Martin's No of traits	Numbers of samples												
	9, 7, 23,24	6, 11 25	13	10	8, 20 21	16,18 19	17,22	12,14	15	26,27	3,5	1,2, 4,28	29
1	184.3	186.3	186.2	186.3	182.5	181.8	181.0	186.0	183.3	182.9	185.5	193.3	179.8
8	142.6	142.2	146.0	137.7	142.5	138.7	142.2	141.3	137.3	141.9	133.3	135.8	146.0
17	137.8	136.2	136.2	137.5	133.4	133.4	133.4	137.7	133.0	129.1	138.0	140.2	134.0
9	97.8	100.1	98.2	101.8	98.3	96.4	95.9	97.7	94.9	98.7	95.2	96.8	95.0
45	134.4	135.4	136.3	136.3	131.8	132.1	133.8	134.6	133.9	132.3	126.6	133.4	137.0
48	69.3	71.9	72.1	71.7	67.9	68.4	70.3	70.0	69.1	71.5	69.7	73.8	69.8
54:55	50.6	48.4	48.0	45.0	48.7	50.3	48.5	51.3	51.8	46.1	51.8	46.9	46.2
SS:SC	47.3	48.7	42.6	50.2	40.8	45.1	46.1	38.2	37.0	53.1	48.2	50.2	38.6
77	138.4	137.4	139.2	135.3	140.1	138.3	141.2	140.8	134.3	137.9	136.1	136.2	144.4
–Zm'	127.9	128.9	127.0	125.9	131.2	126.3	128.2	129.8	130.3	122.6	124.5	126.2	134.0
75(1)	30.8	29.5	28.5	28.7	26.9	30.0	31.5	27.4	–	29.9	26.2	29.1	–
8:1	77.4	76.4	78.4	73.7	77.6	76.2	78.6	76.0	74.9	77.7	71.8	70.3	81.2

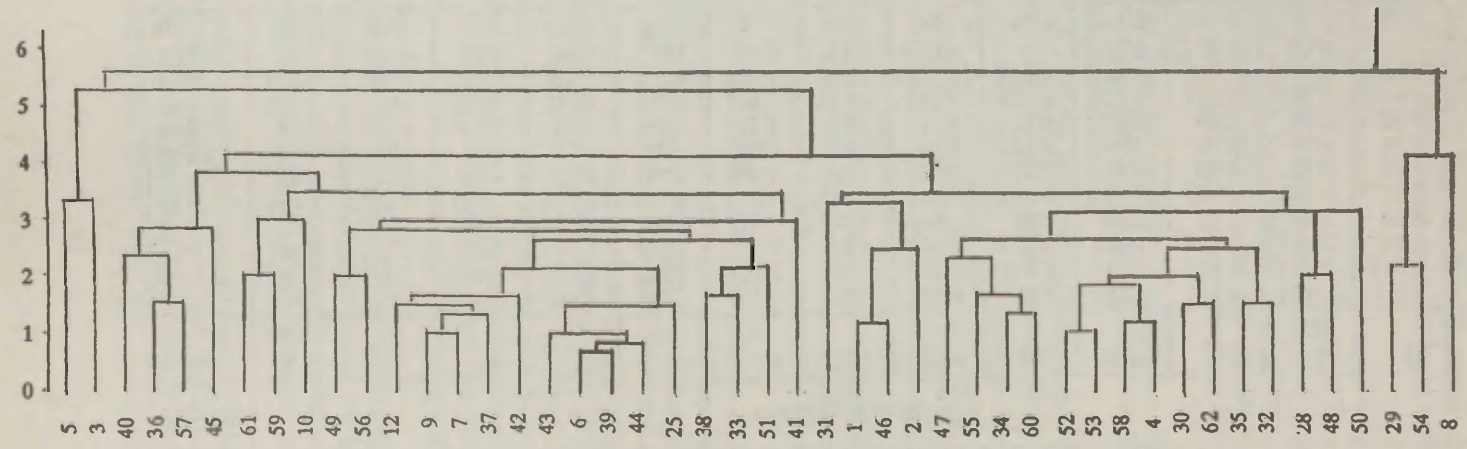

Figure 2. Comparison of Estonian cranial samples with the others using the method of cluster analysis. Dendrogram II. (the titles of the samples as in Table 1).

Table 3

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

Martin's No of traits	Numbers of samples																	
	7,9,12 37,42	6,25,39 43,44	33,38 51	49,56	41	10,59, 61	36,40 45,57	4,52 53,58	30,62	32,35	34,55 60	47	28,48	50	1,2, 46	31	29,54	8
1	186.8	186.8	186.3	184.2	189.0	188.5	184.9	191.4	195.3	194.0	190.8	187.6	193.7	190.4	192.8	196.1	180.0	181.0
8	141.3	142.7	140.8	137.9	141.6	136.8	138.1	137.9	136.6	140.1	138.8	136.5	134.4	138.1	136.1	139.3	145.2	144.8
17	137.7	135.5	137.3	139.0	133.5	136.1	134.4	139.4	138.2	141.0	139.2	140.2	141.2	144.7	139.8	135.2	136.1	132.0
9	98.1	99.3	98.6	97.1	100.9	101.4	95.8	96.9	97.8	99.7	97.8	96.8	97.0	99.3	96.3	98.9	96.1	98.8
45	133.5	134.9	138.5	135.4	138.8	133.0	130.4	133.1	133.5	135.8	136.8	136.9	137.6	139.1	130.3	130.6	136.3	132.0
48	69.1	71.3	69.2	68.7	69.7	71.3	69.9	71.6	72.0	72.8	70.6	70.4	74.9	71.3	72.4	73.8	70.1	67.0
54:55	50.9	48.8	48.0	51.4	51.2	48.0	46.9	48.6	48.0	49.9	51.6	47.9	47.2	46.9	45.2	49.2	47.4	47.5
SS:SC	44.8	49.7	42.4	50.9	52.1	49.5	49.5	48.1	55.0	48.0	45.5	51.8	49.7	53.2	53.7	47.7	42.9	41.2
77	137.8	138.7	142.6	140.2	140.9	134.9	137.7	137.6	138.6	136.7	138.4	139.8	134.0	138.2	136.5	134.3	142.7	140.1
–Zm'	126.9	128.4	125.7	124.0	127.6	124.8	125.5	123.1	123.2	126.1	119.2	125.5	–	122.0	125.9	122.2	127.1	133.0
75(1)	29.3	29.3	28.3	27.9	27.6	28.3	26.9	30.4	33.0	32.3	29.7	31.7	32.8	32.3	28.5	–	–	23.0
8:1	75.7	76.4	75.5	74.5	74.9	72.5	74.9	72.1	70.0	72.3	72.8	72.8	69.5	72.6	70.6	71.2	80.6	78.6

feature with those is the narrow face. The nose of all these central clusters is mesorrhin, tend towards chamaerrhin (as Otepää, Viski, Lejasdopeles). The chamaerrhin nose, as in Makita, occurs with the skulls of Uplanti (XIII–XIV cc) and of Kanjukai (III–V cc). Two smaller clusters (10, 59, 61 and 45, 57, 36, 40) are added to that dolicho-mesocran cranial samples cluster. Both samples'series are dolichocran, with long but narrow skull and face. Samples of Kaberla, Jauneikjai and the carriers of Balanovo culture belong to the 1st of these small clusters. The other one combines Latvian samples on the lower reaches of Daugava — complex group of Livonians (X–XII cc), Reznes (XIII–XI BC), Vaidas from Eastern Latvia and the early burial ground culture of Zemaičiai (III–V cc). The Livonians and the peoples of Zemaičiai are specially characterized by the narrow head and face, also the mesorhhin nose.

The very long, moderately wide or narrow, high, dolichocran or hyperdolichocran skulls are assembled into the big cluster on the dendrogram (figure 2). Here belongs the cranial sample of Pada (XII–XIII cc) from North Estonia, which closely resembles that of West Aukstaitija (V–VI cc; Upper Lithuanians, as Griniunai, Kriemala), and of the burial ground culture (II–IV cc AD) and the barrow culture of Central Lithuania (nr. 4, 58, 53, 52).

Similar to Pada skulls are those of Zemgallians of Lielupe basin (V–VII cc) and of the neolithic tribes of Fatjanovo culture, but also the skulls of Latgallians of Lejasbiteni (VII–X cc) and of the complex group (X–XII cc) of Latgallians (nr. 30, 62, 32, 35). The latter have wider and higher skulls.

The Odukalns sample (IX–XI cc) from Latvia, the sample of the borderline between the East and West Aukstaitija (V–VII cc), the sample of dolichocran variant of Jatvingians (II–V cc) and the mesolithic cranial sample of Zvejnieki join into the kernel cluster (nr. 34, 60, 55, 47).

The next ones to join with the latter are the cranial sample of the carriers of the Boat Axe Culture and the dolichocran variant of the mesolithic Zvejnieki sample (which are characterized by a narrow hyperdolichocran skull, with a little wider and higher face. The early neolithic sample of Zvejnieki joins with them, too (nr. 28, 48, 50).

The complex sample of the underground graves of XIII c of Estonia, Karja sample (XII–XIII cc) from Saaremaa Island and the Bronze Age sample of Kivutkalns (nr. 1, 2, 46) form a separate cluster in the general dolichocran cluster. Special features of that cluster are the narrow face and skull. The narrow-faced Cukani-Drengeri sample joins them too (nr. 38).

The cranial samples of Tammiku and Lindora (nr. 16 and 25) occupy the intermediate position of the dolicho- and mesocran samples.

A small cluster (nr. 29, 54, 8) joins finally on a higher level. Here

belong the cranial sample of the carriers of Comb-Marked Pottery Culture from Estonia, the mesocranic variant of the II–V cc Jatvingians and the Välgi sample. Here belong the mesomorphic, mesobrachycran, moderately wide-faced type of skulls, with certain facial flatness on the top level. Among them, the Välgi sample is characterized by a lower face and skull. The nasal bridge of the skulls of that cluster is relatively low, the shape of the nose is on the border of mesorhhin-leptorrhin. The face is characterized by a certain flatness.

The cluster analysis once more assures the existence of two anthropological types in the earlier Estonian populations. But separate features of both main types can be found at the same time in one or another series of the two types. According to the complex of features some series stays inbetween the two anthropological types.

The majority of the observed East-Estonian cranial samples belong to the mesomorphic anthropological type, that has been joined into two kernel clusters in figure 1. South-East Estonian cranial samples are closer to the mesocranic type of North-Eastern ones than to the dolichocranic type. Representatives of another anthropological type also occur here. Just as we cannot treat the forming of Estonian population separately, we cannot investigate South-East Estonian population on its own. We have to consider the development of the Baltic region as well as that of the northern part of East Europe and the general formation of Fenno-Ugric original tribes.

Anthropological similarities of South-East Estonian paleopopulation with several neighbouring populations have earlier been observed (Mark 1956, 1965; Heapost, 1993, 1994).

Anthropological similarity of cranial samples of South-East Estonia (XII–XV cc) with those from Pskov, Pecory and Novgorod districts, also from Volga-Kama districts, as well as with the cranial samples from Finland, Karelia and with the Latvian samples, having been compared on the basis of Penrose's distance method and the factor analysis, have been pointed out earlier (Heapost, 1993, 1994).

The results of the present work also show that anthropologically close to the South-East Estonian population in medieval times were the inhabitants of the lower reaches of Daugava, of the left shore of the river in Lejasdopeles, also people from the districts of Saldus, Tervete, in Vidzeme and in East Latvia. Close to medieval South-East population have been the inhabitants of the neolithic time but also those of the mesolithic time living near to the present Estonian-Latvian border — in Zvejnieki.

Close to the dolichocran type of the populations of the 1st half of 2nd millennium AD in Estonia (particularly in West and North Estonia, as in Pada) lived in Latvia on the right shore of Daugava River in Lejasbiteni (VII–X cc), in Latgallia (complex group of the X–XII cc and IX–XI cc in Odukalns), but also on the present Lithuanian

territory on the borderland of the Aukstaitija and Zemaičiai in V–VI cc, in the West Aukstaitija in V–VI cc, on the territory of barrow culture of Zemaičiai and North Lithuania of the II–V cc.

Related to that dolichocran form of populations one can find among the local populations in neolithic time, as the carriers of Boat Axe Culture in Estonia and among the mesolithic inhabitants, owners of the grave of Zvejnieki. Close variants to these earlier tribes one can find on the territory of burial ground culture of Central Lithuania in II–V cc, In Zemgallia in Latvia the inhabitants of VIII–XI cc. That anthropological type is represented also by the carriers of the Fatjanovo culture in Volga districts, by the Kivutkalns population of the Bronze Age.

Features or complexes of features characteristic of the two main types occur in the form of one or another feature among several cranial series observed here. So, Kaberla sample of the XIII–XV cc is dolichocranic, but according to a certain complex of features used in the analysis it joins with the mesomorphic series of East Estonia. In comparison with the neighbouring populations Kaberla is close to the Zemaityans of Lithuania (III–V cc of the 2nd millennium), but also to the tribes of Late Neolithic Balanovo culture from the Volga district.

Livonians have been proved to be related to the III–V cc tribes of Zemaičiai, Lithuania (Maudzoriai, Shaukenai samples), also to the inhabitants of XIII–XVI cc Vaidi, and the Bronze Age population of Reznes (Latvia). This whole cluster joins the group of mesomorphic cranial series on one side. On the other side the whole grouping of dolichocranic samples joins with this cluster. So it is evident that the cranial series of the "Livonian cluster" occupies the place inbetween these two main clusters — the mesocranic and the dolichocranic ones.

People anthropologically close to the tribes of Estonian Comb Ware Culture have lived among the Jatvingians of the II–V cc Lithuania. In general features the XIII–XV cc. Välgi population (East Estonia) has also belonged into this type.

Generally speaking, we may say that the anthropological types spread in Estonia were common to a wide territory. Forms similar to the I–II millennia cranial series of Estonia can be traced back to the local Bronze Age, the Neolithic and the Mesolithic.

In the present work the cluster analysis has been used, based on the average linkage method. The Estonian cranial samples have been compared on the ground of 9 traits (Martin's nr. 1, 8, 9, 17, 45, 48, 54:55, SS:SC, 77). In the comparison of Estonian samples with those of the southern neighbours 7 traits were used (nr. 1, 8, 9, 45, 48, 54:55). The results are shown in figure 1 and 2. The average values of the traits of the clusters or of the parts of the clusters are given on Table 2 and 3.

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KNEE EXTENSION RANGE OF MOTION IN TRUNK FORWARD FLEXION

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Abstract

The knee extension range of motion was evaluated in trunk forward flexion among the 38 female students. A specially constructed instrument for measurement the knee extension range of motion in knee joint was used. The influence of knee joint range of motion in trunk forward flexion was determined by modified sit-and-reach test eliminating the knee extension range of motion in knee joint. The test scores of trunk forward flexion obtained by modified sit-and-reach test were less than sit-and-reach test scores about 2 cm. The correlation coefficient between the range of motion of knee extension and the difference of the two tests was 0.45 $p < 0.01$. Received information will be useful to take account in enhance or rehabilitation procedure of flexibility.

Introduction

The trunk forward flexion, measured by sit- and-reach test is often administered under the assumption that it gives a composite accounting of hip, spine and hamstring flexibility (Wells, 1952, Shephard, 1990). The hamstring flexibility is usually measured by supine straight-leg raise test and is often associated with reflecting the ROM in hip and knee joint. However, it does not allow for determining the separate influences. The method of Suni (1994) for the determination of the knee extension in supine position when the hip and knee of the limb to be measured are flexed to 90û is not free from the hip flexion influence to knee articulation. Since several muscles and tendons of the lower extremities cross the knee joint, special attention must be turned to it. Unfortunately, few authors (Kirby 1981, Suni 1994) have reported the measurement methods for knee extension. In order to enhance the trunk forward flexibility it is important to point out in what extent the extension ROM in knee joint influences on it. Sharpe *et al.* (1994) report that the sit-and-reach test score

with ankle dorsiflexion is significantly less than with plantar flexion. No documentation exists, however, how the ROM of the knee joint extension influences measurements of sit-and-reach test scores. The aim of this investigation was to evaluate the knee extension range of motion (ROM) in trunk forward flexion among the 38 female students at the age of 18–22.

Methods

Subjects. Thirty eigth students (age = 20.44 ± 2.41 years, weight = 61.61 ± 7.53 kg and height = 171.21 ± 5.57 cm) were the volunteers of the investigation. Informed consent was obtained from each subject.

Knee extension. The special instrument was constructed to measure the knee extension. The construction of the instrument allowed to record the range of motion in linear scale with specification of 1 mm fixed to the measurement plate. Measurement plate was placed into the special box attached to the edge of the measurement table on the equal level. The subject in measurement procedure was in sitting position, feet extended and heels on the measurement plate. The knee extension range of motion was recorded by up raised measurement plate distance released from the pressure after the maximally up lifted heels.

Reliability of measurement. To estimate the reliability of the knee extension measurement procedure intraobserver and interobserver testing was arranged. Analytic equation by Malina *et. al.* (1973) was used to estimate the technical error of measurements (in mm).There were calculated intertester error 1.46 (averages and standard deviations of two measurement sessions: 30.60 ± 1.67, 29.93 ± 1.73) and correlation coefficient between two sessions $r = 0.95$ ($p < 0.001$). The corresponding result for intratester intrassay error was 1.26 and $r = 0.96$ ($p < 0.001$). Intratester interassay error 1.85 was determined by 2 measurement sessions with one-week interval (averages and standard deviations of two sessions: 31.26 ± 1.96, 32.66 ± 1.76, $r = 0.95$ ($p < 0.001$).

Sit-and-reach. The subject placed the soles of both feet against the testing box with a height of 0.3 m. The zero point of measurement was taken from the edge of the box. The linear measurement to the nearest half centimetre was obtained by having the subject reach and hold for two seconds with feet together and knees fully extending.

Modified sit-and-reach test. The measurement procedure was similar to sit-and-reach test procedure, but the knee joint extension ROM was previously eliminated by the special thickness plates fitted under the heels. Stabilizing straps were placed around the thighs prevent associated motions.

Procedure. All measurements were taken in the same conditions: temperature, time, warm up exercises including two initial practice attempts for each measurement procedure. No external forces were used in any measurements. Body height and mass were recorded prior to testing flexibility.

Statistics. The appropriate procedures in the Statgraphics program were used. Pearson product moment correlation between test scores were established. The < 0.05 levels were selected as the criteria of statistical significance.

Results

The obtained results are presented in Table 1. Modified sit-and-reach test scores were less than in sit-and-reach test scores about 2 cm. The correlation coefficient between the ROM of the knee extension and the difference of the two tests was 0.45 $p < 0.01$.

Table 1

	Sit-and-reach test (cm)	Modified Sit-and-reach test	Differences	Extension ROM of the knee (mm)
X	15.1	13.0	2.0	36.7
SD	7.4	7.5	1.2	15.6
SE	1.2	1.2	0.2	2.5

Discussion

It was assumed that ROM of knee extension, established by this method, characterises hamstring flexibility more exactly. This method is free from the external assistance as it usually occurs in the straight leg raise test. Additionally, the external forces are difficult to determine and besides, they are not employed in the sit and reach test.

On the basis of determining the ROM of knee joint in trunk forward flexion received information will be useful to take account in enhance or rehabilitation procedure of flexibility. Furthermore, health fitness instructors should be aware that knee extension ROM limits the sit and reach .

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COMPONENTS OF POSTURE

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Abstracrt

Joint mobility and muscle isometric endurance characteristics were evaluated in posture of 17 students at the age of 18–23 years. Spinal angles at L5–S1 and T1–T2 level were used to estimate spinal curvature. The obtained values were compared with posture screening instruments described by Liemohn and Sharpe (1992). The constructed multiple regression models by stepwise variable selection procedure evaluated the hip extension ROM, trunk lateral flexion to right and sacrum angle as most important components in posture. The obtained results allowed to conclude that for a good posture preference should be given to joint mobility, than to the muscles isometric endurance.

Introduction

Postural alignment is developed in individuals as a consequence of their circulatory, respiratory, neurological, and musculoskeletal capabilities. Chances in any of these systems to compensate for external stresses may result in an alternation of the orientation of body segments, and require additional muscle activity to counteract the force of gravity (Opila, *et al.*, 1988). Experimental data by Woodhull, *et al.*, (1985) on alignment of the human body in standing position among young students and dancers presented a different picture from the traditional alignment.

Anatomical differences among individuals are typically accounted for using anthropometric data, particularly data on limb lengths and functional capabilities such as reach. However it has long been known, that individual differences of joint mobility exist and that these can account for individual differences in posture. Kendall, (1967, 1971) have described how abnormalities in muscle function (leading to stretched or shortened muscles) cause characteristic postural abnormalities through the effects on the joint associated with their action.

The importance of the flexibility for the maintenance of good posture have been noted by Borms (1984). During *et al.*, (1985) stated that a harmonious postural situation might be defined as a condition in which the constituent parts are not deformed beyond their normal ranges and in which their instantaneous shape is governed by rules of mutual dependency. They found significant differences in the mean recordings of the relations between parameters of the pelvis and lumbar spine system in groups of healthy volunteers and patients with a spondylolysis. There are at least two possible explanations of abnormally high postural loading of the lumbosacral joint in patients with spondylolysis: the upper sacral surface was steeper than in the normal group by an average of 12.9 degrees, and the position of the line of gravity deviated from the regression equation on an average of 16.4 mm which may be related to a less favourable position of the sustaining structure with regard to the line of transmission of forces. Swärd *et al.*, (1990) indicated that a small inclination, defined as the sacro-horisontal angle, correlated significantly with back pain in top athletes. Linear relationship between sacral tilt and lumbar angle between standing and sitting postures has been shown in healthy adults (Bridger *et al.*, 1989). This suggests that anterior pelvic tilting, which increases sacral tilt, is related to increased lumbar lordosis in a linear fashion. Toppenberg and Bullock's (1986) findings have showed that measurements of joint mobility can be systematically related to measurements of spinal curvature. A number of muscles length indices were found to correlate with spinal angle.

On the base of literature review it is not clear as the right posture is more attributable to the joint mobility or to the muscle endurance.

The aim of this study was to evaluate the most important components of posture in 17 student at the age of 18–23 years enyoed in short course of posture with duration three months.

Methods

Subjects. Seventeen students (age = 21.35 ± 2.37 years, weight = 60.73 ± 7.5 kg and height = 170.47 ± 6.62 cm) were the volunteers of the investigation. Informed consent was obtained from each subject.

Estimation of posture. Posture rating chart presented by Liemohn and Sharpe (1992) was used as postural screening instruments. The posture score sheet included estimation of head, shoulders, spine, hips, ankles, neck, upper back, trunk, abdomen and lower back from 0–10 points. The additionally whole body posture was estimated as the average of these screenings.

Measurements of spinal angles. The method described in Bridger

et al., (1989) was used. The interspaces of L5–S1 and T1–T2 were marked and inclinometer was placed along the line of vertebrae in standing position. The vertically hanging inclinometer needle thus provided a reference for the inclination of the back. The L5–S1 angle was used as an estimate of pelvic tilt and T1–T2 as angle upper spine. Surface spinal inclinometer has been shown to be a reproducible method of measuring spinal posture which correlates well with angular measurements taken from radiographs (Adams *et al.*, 1986).

Spine and hip forward flexion. The subject was asked to hold his arms behind the head. The gravity goniometer was fastened to one side of the chest (midaxillary line) at nipple height and needle placed to zero. The subject was asked in standing position at first to bend forward with straight vertebral column (the first point).The needle of the gravity goniometer was fixed and the reading recorded. It allowed the determination of the ROM of flexion in hip joint. Then the subject performed maximum trunk forward flexion and the reading was recorded (the second point). The difference between the readings of the two points was calculated and observed as a characteristic for estimating back forward flexibility. The same procedure was performed in sitting position, the leg extended forward and straight back and legs forming the angle of 90û. The reliability and accuracy of goniometer measurement has been proved by several authors (Boone *et al.*, 1978, Hubley-Kozey, 1991)

Knee extension. The special instrument was constructed to measure the knee extension. The construction of the instrument allowed to record the range of motion in linear scale with specification of 1 mm fixed to the measurement plate. Measurement plate was placed into the special box attached to the edge of the measurement table on the equal level. The subject in measurement procedure was in sitting position, feet extended and heels on the measurement plate. The knee extension range of motion was recorded by up raised measurement plate distance released from the pressure after the maximally up lifted heels. To estimate the reliability of the knee extension measurement procedure intraobserver and interobserver testing was arranged previously (see art. Knee extension range of motion in trunk forward flexion).

Hip extension and side-bending of the trunk

Sit-and-reach. The subject placed the soles of both feet against the testing box with a height of 0.3 m. The zero point of measurement was taken from the edge of the box. The linear measurement to the nearest half centimetre was obtained by having the subject reach and hold for two seconds with feet together and knees fully extending.

Isometric muscular strength. Isometric abdominal muscular endurance was measured following the guidelines described by Hyyti-

ainen *et al.*, (1991). Isometric trunk extensor endurance was recorded by the method Jorgenson and Nicolaisen (1986). In the both tests unsupported upper body was kept until exhaustion .

Statistics. The appropriate procedure in the Statgraphics program were used. Pearson product — moment correlations between test scores were established and regression model was constructed by stepwise selection for posture rating. The $p < 0.05$ level were selected as the criteria of statistical significance.

Results

Mean values of joint mobility, muscles strength and posture screenings in female students are presented in Table 1. The correlation coefficient between whole body posture rating and observed body segments were higher with should $r = 0.78$, spine $r = 0.70$, hip $r = 0.64$, and lower back 0.54 ($p < 0.05$) screenings' points.

The sacrum angle to the vertical line correlated with mean values of hip extension and spine muscles isometric endurance at the significance level $p < 0.06$ accordingly $r = -0.47$ and $r = -0.46$. The angle of upper spine at T1–T2 level of vertebral column was correlated with trunk lateral flexion ROM to the right $r = -0.58$ ($p < 0.05$). From the ROM of the different joints had more important relations between hip flexion in sitting position and head erect gravity line posses directly through center $r = 0.50$ ($p < 0.05$). Knee extension ROM correlated with ROM in hip extension $r = 0.56$ ($p < 0.05$).

Spine and abdomen muscle isometric endurance were both significantly related to spine flexion in sitting position characterized by the differences between total trunk forward flexion and hip flexion, respectively –0.49 and –0.54. No statistically significant relations between sit — and — reach test and posture rating screenings were found.

The stepwise multiple regression equation was conducted with whole body posture rating (y) being predicted by ROM of hip extension in right joint (x_1), ROM of trunk lateral flexion to right (x_2), sacrum angle to vertical line (x_3), and spine flexion in standing position (x_4).

$$y = 40.9 + 0.36x_1 + 0.58x_2 + 0.52x_3 - 0.18x_4$$

SE of equation = 2.83 and MAE = 2.08. Significant level for all independent variables in equation was $p < 0.01$. The multiple correlation coefficient $R = 0.68$. Regression equation for posture rating prediction indicated to essential role of the extension ROM of hip joints and lateral flexion ROM of trunk.

Table 1

Mean values of flexion, muscles, strength and posture screenings female in students at age of 18–23 years

	X	SD
Standing position		
hip flexion	87.82°	14.27
trunk forward flexion	138.47°	16.56
trunk lateral flexion to right	57.82°	7.42
trunk lateral flexion to left	57.23°	8.59
spine flexion	50.64°	16.63
spine extension	64.35°	12.88
Sitting position		
hip flexion	31.58°	12.02
trunk forward flexion	65.35°	13.77
spine flexion	33.71°	6.33
Hip extension	35.41°	5.10
hip extension in right joint	34.94°	5.60
hip extension in left joint	35.88°	5.30
Knee extension (mm)	36.64	19.01
Sit-and-reach (cm)	13.64	9.12
Sacro vertical angle L5-S1	18.76°	5.04
Angle of upper back T1-T2	14.59°	6.13
abdomen muscles	70.47 [s]	54.31
spine muscles	121.12 [s]	51.36
Posture screenings		
head	9.59	0.87
shoulder	7.06	1.34
spine	7.88	1.73
hip	8.29	1.57
ankle	9.12	0.99
neck	9.00	1.00
upperback	9.47	0.62
lower back	8.71	1.72
trunk	9.59	1.23

Discussion

The purpose of this study was to determine which components — flexibility or muscle endurance are most important to reflect the right posture. The results of investigation of observed group indicated that most alterations of the posture were occurred in shoulder, spine, hips and lower back displacements. More essential inclination from the right alignment was followed in shoulder level. Reason of it may

be from the habit to carry the load by one hand. It confirmed the mean value of the trunk lateral flexion to right that was slightly higher than to left. The ROM of the trunk lateral flexion depends on the angle of upper back on the T1–T2 level ($r = -0.58$). Increased angle related to the thoracic kyphoses reduces the trunk lateral flexion. Mean sacral angle 18.76 ± 5.04 in observed group differed slightly from results obtained by Bridger *et al.*, (1989) in 25 female subjects at the age of 22.4 ± 5.2 years (14.8). They reported that there is a relationship between lumbar angle and sacra angle. This suggests that anterial pelvic tilting, which increases the sacral tilt, is related to increase lumbar lordosis in linear fashion. Correlation coefficient between sacral angle with ROM of hip extension — 0.47 and with spine muscles isometric endurance — 0.46 indicated to the opportunity to act the displacement of sacrum angle and accordingly to prevent the undue lumbar lordosis by extensibility in hip joint and spine muscles isometric endurance. The ROM of the hip extension was correlated with the ROM of the knee extension 0.56 ($p < 0.05$). An explanation to it according to the Kendall *et al.*, (1971) may be that hip extension with the knee extended is limited by the illiopsoas muscles. The hip flexion ROM relation ($r = 0.50$ $p < 0.05$) to head screening points. The correlation coefficient ($r = 0.50$ $p < 0.05$) between the ROM of hip flexion and head screening points is difficulty interpretative and needs futher investigation. An indirect approach to it may be via the statement of Bridger *et al.*, (1989) that the correlation with thoracic kyphosis and hip flexion range is caused by the correlation of both of these variables with a third variable — lumbar lordosis. From this point of view should be explained the above mentioned relation.

Increased spine and abdomen muscles isometric endurance reduces the spinal flexion. In spite of it there were not found direct influences of them to the values of posture screening points. These results confirmed the findings obtained by Richardson *et al.*, (1990), who reported that spinal stability may not be optimally affected by strengthening abdominal musculature, particularly rectus abdominis.

The constructed multiple regression models by stepwise variable selection procedure evaluated the hip extension ROM, trunk lateral flexion to right and sacrum angle as most important components in posture. Considering that the independent variable of lateral trunk flexion to right in regression model was evaluated more than other variables, then for a good posture is essential to enhance the it. The obtained results allowed to conclude that for a good posture preference should be given to joint mobility, than to the muscles isometric endurance.

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SPLEEN CELL AND TISSUE KINETICS IN RATS AFTER IMMOBILIZATION

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In case of physical load and intoxication, we observed alternative — destructive and reparative morpho — adaptive changes in the rat's spleen (Hussar, Lepp, 1984: Meerson, Pshennikova, 1988: Hussar *et al.*, 1993). The intensity of these changes depends on the intensity of the action and duration of the tissue — specific sensibility. But even with the greatest loads the lymphatic tissue retains its characteristic regenerative ability (Policard 1963; Natvig *et al.*, 1976; Jäger, 1988). Changes in the spleen of immobilized experimental animals have not yet been thoroughly investigated.

In the present paper we studied the histological alterations in the spleen of immobilized rats in situ and in the organ culture in vivo. As is known, the tissue and organ cultures enable us to better investigate the cytoconstruction of the organ and its changes. Under culture conditions the calls and tissues unfold their organ — specific morphogenetic potentialities.

14 white male Wistar rats (200–220 g) were investigated. They were divided into two groups: 1) rats moving in the usual way (7) and 2) immobilized rats (7). The rats were immobilized in isolated cages with fixed limbs. Only the head, protruding out of the cage, remained mobile. The organ culture was taken in vivo per laparotomy, the spleen was fixed and the medial quarter was ligated (was separated from the innervation and circulation). Per thermocautery a coagulatory cut of 1.0 mm. was incised on the anterior edge of the spleen. Then the cut was closed.

The phagocytic activity of the macrophages was investigated with 10% lithium carmine injected acccording to Ribbert's scheme — 2.0 ml to a rat a day for three successive days. The experimental animals were dissected on the seventh day of the experiment 4 hours after the last injection. The material was fixed after Maksimov in the Zenker formol. The histological preparations of 7 mkm thickness were colored according to standard histological methods: the macrophages were investigated in preparations colored with hemalaun. The mitoses were counted in Feulgen histochemical coloring.

In immobilized rats the white pulp of the spleen becomes atrophied, the aggregates of follocles disappear, only the polymorphic single follicles remain. The number of lymphocytes in the periphery of the follicles (the periarterial and mantle zona) has decreased from 385 ±34 in normal conditions to 272 ± 29 to the standard unit of 12,800 mkm of the field of vision. The number of destructive lymphocytes increases from 9% to 45%. Mitotic cell division slows down considerably. The number of polynuclear splenocytes resembling gigantocytes of a foreign body increases as well. These changes are similar to those attending parenchymatous changes in partial resection of the spleen (Harlova, 1975). In the periphery of the organ erythrocytic focuses appear. They are especially well developed in the region of thermic damage. Here the lymphoid nodules have completely perished and red pulp with numerous macrophages is clearly visible. Histomorphologically we can best distinguish the so — called perisinusoidal fusiform Marshall — type macrophages (Carr, 1973). In the lesion focuses typical cell inflammation has taken place (infiltration of round cells with macrophages and polyblasts and some fibroblastoid cells; in the periphery of the focus neutrophils and eosinophils abound).

In the organ culture there is no remarkable difference in the histological picture of the spleen of the moving and the immobilized rats. In both experiments a week's cultivation in vivo shows ischemic strong destructive changes in the spleen. Characteristic of the situation is a subcapsular profusely hemorrhagic stripe of destruction, about 0,5–1,0 mm in width, which partially extends to the central areas of the organ; total demolition of follicles, destruction of lymphocytes and an abrupt fall in proliferation activity. The number of macrophages has risen. In the white pulp there appear vast colonies of perishing lymphocytes. Periarterial (T-)lymphocytes are damaged to a lesser extent; single cells, capable of mitotic activity, have survived. In the region of thermic cauterization (thermo-coagulation) the crater is filled with inflammatory cells — lymphocytes, plasmocytes, macrophages, etc.

Summary

One-week immobilization of the rat causes extensive destructive morpho — adaptive changes in the spleen (perishing of the follicles or nodules, massive demolition of lymphocytes, etc.) which is particulary noticeable in the inflammation focus after thermic damage. There are no differences in the organ culture in vivo between the immobilized and the moving rats. Perhaps in isolated tissues the effect of immobilization is not manifested. The extensive subcapsular destruction of the spleen obviously reflects the dysadaptive (risky) part of this

organ caused by morphogenesis or some other factors. In all series the mitotic activity of the cells and thus the strong regenerative ability characteristic of the lymphoid tissue has been preserved.

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THE USE OF REVASCULARIZED ILEUM FRAGMENTS FOR REPAIRING THE CERVICAL OESOPHAGUS

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Tranplantation of the organs as an immunological and clinical problem has been studied throughly. The morphology of posttransplantation tissue has been studied less. In the present the histoadaptive (destructive and reparative) changes were observed in the autografts of revascularized ileum fragments transplanted to the cervical oesophagus. Histoadaptive and regeneration capability of the ectodermal epithelium of oesophagus and endodermal epithelium of ileum was estimated, also, subepithelial inflammation, mainly in the connection zone between the transplanted portion and receiver tissues (reactive zone). A tubular section of ileum (5...8 cm of length) was removed 10...40 cm away from the ileocaecal angle, and taken to the cervical region. The artery and vain of the ileum were joined with *a. thyroidea* and *v. jugularis* (revascularization of the transplant). Then both ends of the transplanted fragment were joined with the oesophagus (complete replacement of the oesophagus section with ileum).

The material for histological studies was taken from the bordeline between the oesophagus and transplanted ileum section, also from the middle part of the transplanted section (2 cm long and 1 cm wide pieces) on 1st to 372nd day after the operation. The material was fixed using the Maksimov's method;paraffin slices with the thickness 7...10 mm were coloured with haematoxyline and eosine, with ferrum haematoxyline according to Heidenhain, with azane and alciane blue according to van Gieson. The mitosis (%) was counted on the immersion magnifications coloured according to Feulgen.

The replacing of the cervical oesophagus with an ileum fragment produced stenosis with dilated inflammatory areas in the region of anastomosis. Histologically some degree of atrophy of the ileum mucous membrane was notised. The mucous membrane becomes thinner, and the villi shorten and dilate; the crypts become lower. In

the chronicle experiments especially in the central parts of the transplanted segment the columnar epithelium and mitotic activity of the cells are restored, the same is with the number of plasma cells in propria and submucosa. Intensive lymphocytial infiltration and eosinofilia continue — "graft versus hostreaction" (Kirpatovski, Lysenko, 1988; Lysenko, Kirpatovski, 1979; Jäger, 1988). The process is more intensive in the site of anastomosis, i.e. in the site of detachment contact of the transplanted section. In this site a 0.1...0.3 mm wide and up to 0.1 mm deep sulcus is formed (rapid lowering and enlargement of villi, atypism of crypts, partial replacing of propria and epithelium collumnar cells by goblet cells, inflammatory lymphocytary infiltration of propria and epithelium, high fagocytosic activity of macrophages) are noticed.

The numerous epithelial cells are destroyed and replaced with hypertrophic or atrophic polymorphic cells with pycnotized nucleuses. The epithelis enter focally into the underlying propria where the crypts resemble round/oval end parts of cardiac gland of the oesophagus.

The intensive infiltration of lymphocaits and plasma cells reaches through the epithelis to the surface of the transplanted segment.

The results of our experiments coincide with the data found in literature where the auto-transplantation of revascularized ileum fragment to replace the damaged oesophagus has proved to be perspective and fully justified (Buckspan *et al.*, 1986; Katsaros, Tan, 1982; Smith *et al.*, 1988; Smith *et al.*, 1989).

Although the histological studies showed that finally the transplanted segment will be destroyed due to the defence reaction, the replacement therapy has proved to be necessary.

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PALEOPATHOLOGY OF LITHUANIAN FIRST MILLENNIUM AD SKELETAL SAMPLES

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Introduction

Paleopathology, as the meeting ground for several disciplines, is of consideration both for medicine, as it elucidates the variability of physiologic and pathologic reactions without iatrogenic intervention to various pathogens on the level of individual and population, and for historical sciences, being a valuable source of information about peculiarities of life conditions in the past. The discipline meets specific problems related to the character of the object of studies)burial rituals, diagenetic effects, thoroughness of excavation and subsequent processing) and unspecific character of many of reactions. That's why the term "osteoarchaeological syndrome" was created. Finally, many problems are related to the interpretation of data. Reliable conclusions about health status of paleopopulation could me made only after evaluation of complete cultural and biological context (demography, as well as indexes of physical development). Thus no wonder that till now descriptive publications on paleopathology prevail, and deficit of epidemiological, especially analytical studies is stressed (Ortner, 1991; Wood *et al.*, 1992).

In Lithuania, as well as in Baltic countries in general, not much regular paleopathological investigations were performed. Review of older collections can be found in V. Derums (1978) works. But, as during last decades very representative paleoosteological samples were collected, especially in Lithuania, such investigations gain new quality. This paper is an attempt to discuss paleopathological finds in Lithuanian First Millennium AD paleoosteological materials, taking into account above mentioned considerations.

Materials and methods

Skeletons of various state of preservation of 958 individuals (subadults — 178, females — 315, males — 433, sex undetermined — 32) were investigated visually, in some cases — radiologically and under magnification.

Results and discussion

During epidemiological investigations by other authors (Angel, 1974; Grimm, 1980; Kunter, 1981; Lovejoy and Heiple, 1981; Knowles, 1983), definite sexual and interpopulational differences were established, enabling to make conclusions about life style differences. Analysis of our materials (Table 1) revealed marked sexual differences in occurrence of traumas — preference of male skeletons (both for blunt and sharp instrument skull vault wounds and face traumas $p < 0.001$; radius — $p < 0.05$). Majority of these traumas are related to direct violence: from 27 male skull lesions, 20 (74.07%) were noted on the left side of skull vault and face (for comparison, on the midline — 4, on the right side — 3). Fractures of the arm also were found more frequently on the left side (although $p > 0.05$). Comparing with Lithuanian Medieval data, rural population of later period suffered much less skull traumas (for 14–17 c.c. males, their frequency 1.92%, $p < 0.01$), but lesions of postcranial skeleton were of similar character. No significant differences were found comparing with Danish Iron Age and Viking period data (Bennike, 1985); no cases of decapitation typical for Viking were found. Besides, five cases of probable trephinations in our 1st millennium samples were identified.

Infectious diseases were among the principal causes of mortality in the past (Sheth *et al.*, 1994). Regretfully, majority of acute diseases leave no traces on the skeleton, and paleopathologists are dealing mostly with vestiges of subacute and chronic inflammations; besides, these changes often have no pathognomic character (Ortner and Putschar, 1985). Thus inflammatory lesions (periostitis; osteomyelitis) are considered as one of unspecific markers of stress, experienced by the individual (chronic intoxication, septicemia, scurvy, posttraumatic reactions could be among their causes). Periosteal lesions in investigated samples (Table 2) most often were found on tibias and fibulas. In majority of cases, these were characterised as not pronounced symmetric thickening of diaphysis with uneven surface, this way pointing to systemic character of lesions. Among other cases, acute periostitis in both orbital regions of 3–4 year old child, two cases

Table 1

Incidence of traces of traumas in Lithuanina 1st-millennium skeletal materials

Region	Subadults			Females			Males		
	N	M	%	N	M	%	N	M	%
Skull vault:									
blunt instrument	80	1	1.25	231	0	–	294	11	3.74
sharp instrument	79	0	–	231	1	0.43	291	16	5.50
Face	65	0	–	179	0	–	245	11	4.49
Clavicle (r/l)	9/9	0/0	–	26/22	0/0	–	45/41	1/2	2.22/4.88
Scapula (r/l)	8/8	0/0	–	21/16	0/0	–	35/33	0/0	–
Humerus (r/l)	15/16	0/0	–	106/102	0/0	–	178/168	0/1	0.00/0.60
Radius (r/l)	14/15	0/0	–	100/88	0/0	–	155/155	1/4	0.65/2.58
Ulna (r/l)	14/13	0/0	–	95/83	0/1	0.00/1.20	152/151	3/4	1.97/2.65
Os coxae (r/l)	9/9	0/0	–	88/81	0/0	–	107/103	0/0	–
Femur (r/l)	19/17	0/0	–	144/145	0/0	–	211/218	2/0	0.95/0.00
Tibia (r/l)	19/18	0/0	–	117/116	0/0	–	186/175	1/0	0.54/0.00
Fibula (r/l)	18/13	0/0	–	28/25	0/0	–	48/42	0/0	–

N — number of observations; M — number of pathologies; % — frequencies in percent. For bones of extremities, data of right and left sides (r/l) are presented separately.

of generalised chronic periostitis (Marie-Bamberger syndrome) and three cases of osteomyelitis of tibia were noted. Comparing with later periods, frequencies of periosteal lesions in Medieval town populations were substantially higher (for Vilnius females — 23.08 + 8.43%, males — 25.00 + 5.64%, $p < 0.05$).

Skeletal tuberculosis is one of few infectious diseases that leave specific changes on the skeleton. As TBC was one of the main causes of mortality in the past (even in 1900 it was the third cause of deaths — Stini 1990), paleopathology pays a special attention to this disease (Buikstra, 1976; Steinbock, 1976; Kelley and El-Najjar, 1980; Ortner and Putschar, 1985). In our skeletal materials, 3 definite and one probable case of skeletal TBC were identified. One mature male had specific focus in the region of lumbar 4–5 — sacral 1–2 vertebrae, one young adult female with marked kyphosis — destruction of bodies of 7–12 thoracic vertebrae with consequent vertebral block, and one young male with specific lesions on the bodies of thoracic 12 — lumbar 1–2 vertebrae. One young male, only skull vault of which is preserved, had 3 small perforations with slight perifocal reaction on right parietal and 1 — on frontal bone. Some authors (Hackett, 1976) consider such changes as specific for skeletal tuberculosis. Thus there are no doubts that at least in the 1st millennium population of present day Lithuania suffered from TBC. Epidemiological conclusions yet cannot be drawn, as for Medieval materials (when tuberculosis, especially for town inhabitants, was really serious problem), as materials are incomplete due to various reasons. For Danish materials, earliest case comes from Neolithic, and one more case from early Roman period is also known (Bennike, 1985).

Traces of other specific inflammations (syphilis, lepra) were not found in examined samples.

Degenerative lesions of vertebral column (spondylosis deformans, osteochondrosis, Schmorl's nodes) are very often found in skeletal materials. Detailed studies (Jankauskas, 1992) revealed close relation of the former two with individual age and the same pattern as in later periods. Conclusion was made, that these changes are poor markers of occupational stress. For synovial joints, males show greater prevalence of osteoarthrosis, and right arm joints are slightly more involved (although $p > 0.05$), than the left side ones (Table 3).

Contrary, osteochondritis dissecans had marked preference for females: such condition was identified in 7 of them. Cubital, hip and knee joints were involved most often.

One case of rheumatoid arthritis was identified for a female of 45–50 years: symmetrical lesions (porosity and deformations) of radiocarpeal, metacarpophalangeal, interphalangeal, talocrural and tarsal joints. Other synovial joints and vertebral column without marked pathology. This is the oldest and at this moment single one case of

Table 2

Incidence of periosteal lesions in Lithuanian 1st millennium skeletal samples

Region	Subadults			Females			Males		
	N	M	%	N	M	%	N	M	%
Radius (r/l)	14/15	0/0	–	100/88	0/0	–	155/155	1/2	0.65/1.29
Ulna (r/l)	14/13	0/0	–	95/83	0/0	–	152/151	0/0	–
Femur (r/l)	19/17	0/0	–	144/145	0/1	0.00/0.69	211/218	2/2	0.95/0.92
Tibia (r/l)	19/18	0/0	–	117/116	8/7	6.84/6.03	186/175	11/11	5.91/6.29
Fibula (r/l)	18/13	0/0	–	28/25	1/1	3.57/4.00	48/42	3/3	6/25/7.14

Table 3

Incidence of all forms of osteoarthrosis (lipping, pitting, eburnation — Merbs 1983) in Lithuanina 1st millennium skeletal materials*

Joint	Females			Males		
	N	M	%	N	M	%
Art. humeri (r/l)	13/10	0/0	–	33/31	4/3	12.12/9.68
Art. cubiti (r/l)	74/63	1/0	1.35/0.00	118/112	8/6	6.78/5.36
Art. radiocarpea (r/l)**	11/9	1/2	9.09/22.22	38/32	14/8	36.84/25.00
Art. coxae (r/l)	74/72	0/1	0.00/1.39	99/92	5/5	5.05/5.43
Art. genus (r/l)	95/96	3/3	3.16/3.13	154/153	12/11	7.79/7.19
Art. talocruralis (r/l)	81/85	3/2	3.70/2.35	121/117	4/3	3.31/2.56

* Both articular surfaces present

**only cases with pathology plus cases when carpal bones are present

such disease found in our skeletal materials. It is interesting to note also that this female had also healed trephination hole in her skull vault.

Other form of chronic inflammatory diseases with connective tissue, synchondrosis and synovial joint involvement — seronegative spondyloarthopathies (Arriaza, 1993). In materials investigated 10 cases of sacroiliac ankylosis (all males, age between 30 and 50 years) were identified; these and some other data suggest one of forms of ankylosing spondylitis.

Four cases of clinical otosclerosis (stapes footplate fixation) were noted (0.51%), incidence of this disease being similar to it's epidemiology nowadays. On the contrast, strikingly high frequency of auditory exostoses, sometimes almost completely blocking external auditory meatus (3 females — 1.25%, 16 males — 6.25%, and one 12–14 year subadult) was established (Sakalinskas and Jankauskas, 1991). This disease can be provoked by irritation, usually of cold water, especially when genetic predisposition exists (Mann, 1986).

From tumours, only four cases of osteomas of skull vault were noted. Considering skeletal anomalies, malformations of vertebral column (vertebral blocks, spondylolysis) and dental eruption anomalies were noted.

Considering skeletal metabolism impairments, two cases of osteoporosis are worth of attention: symmetrical senile atrophy of parietal bones of an old male, probable post paralytic atrophy with marked osteoporosis of left leg bones in adult female, and deformation of right femur, suggestive of Paget's disease, in another senile female.

Finally, one case of young female was also found to be remarkable, as her pelvic bones contained bones of full term foetus. Il means that she died at the end of her pregnancy.

Discussion and conclusions

Review of paleopathology of Lithuanian 1st millennium AD materials elucidated some of peculiarities of their life and subsistence strategies, that were reflected on their skeletons. Differences in traumatism levels and lesions of the joints are evidences of differences in their life style and different physical activities between sexes. Incidence of some unspecific markers of stress show early contacts with various pathogens and organism response to them. Tuberculosis was present between our 1st millennium inhabitants; this is of no wonder, taking into account close contact between humans and domesticated animals at that period. Presence of otosclerosis, rheumatoid arthritis and ankulosing spondylitis prove long history of these diseases. On the

other hand, this study is one more demonstration, that paleopathological finds cannot be examined isolated, but all cultural context, demographic, population genetic and physical development indexes should be taken into account. Only in such a context paleopathological investigations gain a full sense.

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ABOUT THE PHYSICAL DEVELOPMENT OF THE RECRUITS FROM TARTU REGION

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The newly independent Estonian Republic needs data concerning the physical development of its youth (Aul, 1982; Thetloff, 1987). Traditionally in Estonia one of the main subject for this kind of research have been the recruits (Aul, 1964).

In this work data about 518 young men (18–19 years of age) from Tartu and its surroundings is published. Their physical development was examined a year before their draft. The attention of this research is concentrated to the analysis of their stature, weight and arterial blood pressure.

Basic data together with the so called Kaup index (weight/(stature)^2) is can be seen in Table 1. The mean stature of the group under study is 180,32 $\pm$ 6.91 cm and the weight 68,89 $\pm$ 10.03 kgs. Stature is a typically stabile variable, with coefficient of variation — 3.83%, having minimal value 160 cm, maximum value 206 cm.

Weight posesses a noticeable variability with its minimal value 44 kg and maximum of 129 kg. There are individuals three times exceeding the weight of their comrades by generation. The coefficient of variation of weight is traditionally big — 12.03%.

The mean systolic blood pressure is 127.42 $\pm$ 15.33 mm/Hg, diastolic blood pressure is 79.91 $\pm$ 8.37 mm/Hg with a characteristically big variation (Table 1). The group includes therapeutic patient.

In the next table (Table 2) the correlation matrix between the variables is shown. We see that the stature and weight are statistically noticeably connected ($r = 0.453$, $p < 0.0001$)). Stature is also connected especially with systolic blood pressure ($r = 0.159$, $p < 0.001$). The weight on the other hand is strongly connected with both systolic ($r = 0.396$, $p < 0.0001$) as diastolic blood pressure ($r = 0.270$, $p < 0.0001$).

Research on the structure of human body show, that bodily variables compose a system well correlating between each other, with the leading variables being body weight and stature (Kaarma, 1981). Accordingly weight and stature are the best characteristics of bodily

Table 1

Basic statistics of variables

Variable	n	$\bar{x}$	min	max	σ	v	St. skewenss	St. kurtiosis
Stature (cm)	516	180.32	160	206	6.91	3.83	–0.72	2.01
Height (kg)	18	68.89	44	129	10.03	14.56	8.34	13.02
Systolic blood pressure	503	127.42	90	190	15.33	12.03	8.43	6.38
Diastolic blood pressure	501	79.91	60	120	0.37	10.48	–1.14	10.61
Kaup index	516	21.18	15.22	40.26	0.12	13.14	12.99	23.63

Table 2

Correlation matrix

Variable	Stature	Weight	Systolic blood pressure	Diastolic blood pressure
Weight	0.452*			
Systolic blood pressure	0.157*	0.394*		
Diastolic blood pressure	0.086	0.270*	0.504*	
Kaup index	–0.071	0.854*	0.346*	0.250*

* $p < 0.001$

differences among the studied. The remaining main question is: by which way the studied people can be classified?

According to our experience which is confirmed by the results of other researchers, one of the possibilities could be the use of the classification of stature-weight, where the both variables are divided into equal value categories (when five: very big; big; medium; small; very small. When three: medium; bigger than medium and smaller than medium.) These categories are based on the σ values in the boundaries of $\pm$ 2.5 σ. As a result a 5 $\times$ 5 or 3 $\times$ 3 classification is formed, where the physical development of the individuals under study can be evaluated by the data from all other analogical research materials but also with data based on σ classification.

There is a second possibility-the relationship between stature and

weight depicted as a regression model: Weight = –49,768 + 0,658 (Stature) (R^2 = 20.52, $p < 0.01$).

When the regression is depicted graphically (Figure 1), the additional lines could be used to divide the stature-weight data of the individuals.

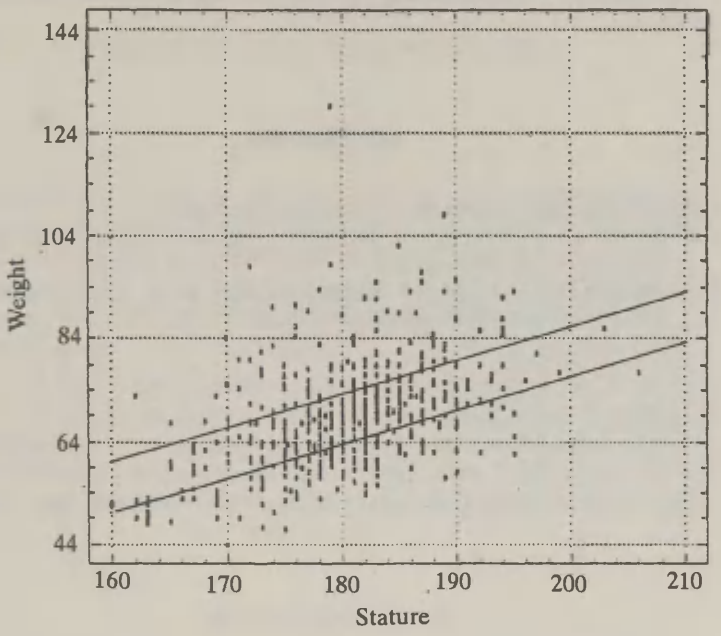

Figure 1. Plot of weight and stature with lines to regression lines

The set of points has been divided into three parts by two parallel lines

$$y = a_1 + bx \text{ and } y = a_2 + bx,$$
$$\text{where } a_1 = a + \sigma/2,\ a_2 = a - \sigma/2,$$

a and b are the regression parameters (for modelling the weight by height) and σ the standard deviation of weight by given height. It is necessary every class can be subclassified into 3 classes by the height, as well, using e.g., lines $x = 4\,\bar{x} - \sigma/2$ and $x = \bar{x} + \sigma/2$.

When indexes (for example Kaup index) are used for evaluating the stature and weight of boys, the classes should be based on stature and Kaup index (as 5 × 5 or 3 × 3 classes).

The above mentioned methods for evaluating stature and weight should be used also to connect other functional variables (data) with body buildup. In our case the bigger values of Kaup index correlated with higher (Kaup index > 27) systolic blood pressure ($p < 0.05$).

As our previous research (Kaarma, 1981) has shown that weight and height determine the major part of the variability of all the other measurements, then further periodical analysis of the weight and height of recruits are significant for evaluating changes in the body as a whole.

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THE ROLE OF PELVIC MEASUREMENTS IN WOMEN'S WHOLE BODY STRUCTURE

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Introduction

Despite the important role of pelvic measurements in obstetric practice no theoretical conception has been offered about the relations of the pelvic system with the whole body structure.

Some authors have tried to establish norms of outer pelvic measurements for different women and studied the relation between outer and inner pelvic characteristics (Davõdov, 1967; Cherepanov, 1971).

At the Department of Obstetrics and Gynaecology of Tartu University anthropological questions in obstetrics have been investigated for many years. The results have been published in the publications of Tartu University in Russian (Kaarma, 1980, 1981, 1983, 1991). This is the first time our study about pelvic problems is presented in English.

Material and methods

The first contingent investigated consisted of 670 young Estonian women students of Tartu University (aged 18–22 years) who had not born children yet. All of them were healthy and had a normal menstrual function. The anthropometrical measuring program included 33 body measurements and 4 outer pelvic measurements.

The second material for investigation was the dead bodies of 48 women aged 40–70 years. They were measured at the Department of Pathology of the Tartu University Hospital.

First, external measurements were made, such as body height and weight, 14 classical anthropometrical measurements, outer pelvic measurements. Secondly, in the course of dissection, we measured *Conjugata vera obstetrica*, diameter transversa of pelvic inlet, and measures which characterized the thickness of pelvic bone from various sides — thickness of symphysis, thickness of sacrum base, diameter iliotrochanterica (i.e. the diameter between the most lateral point on

linea terminalis and trochanter majus). All the measurements were carried out by the author alone.

The data collected were processed at the Computing Center of Tartu University by means of the statistical data processing package "Stella" created in Tartu University (Tiit, 1975) with Prof. E. Tiit acting as a consultant.

Results

The variables of the one-dimensional empirical distribution of anthropometric characteristics are given in Table 1. The most stable measurement was body height (v = 3.40), the extent of variability 32.6 cm. most widely varied body weight (v = 12.47) with the extent of variability 59.7 kg. The variability of all the other measurements, including the outer pelvic measurements, was within the range between the two abovementioned characteristics (see Table 1).

Linear correlation analysis showed that body height and weight had the greatest number of high correlations with the other measurements. Height had the highest correlations with longitudinal parameters (sitting height r = 0.737°, upper limb length r = 0.747°, lower limb length r = 0.828°) and the least correlations with circumferences (r = 0.2°–0.3°). The correlations between height and breadth-depth measures, between height and routine diameters (*D. spinarum* r = 0.409°, *D. cristarum* r = 0.523°, *D. trochanterica* r = 0.510° and *Conj. externa* r = 0.501°) had the medial position.

Body weight had the highest correlations with circumferences (r = 0.6°–0.8°) and the least with longitudinal measures (r = 0.2°–0.5°). The intermediate group of correlations was formed again by breadth-depth and pelvic measurements (*D. spinarum* r = 0.418°, *D. cristarum* r = 0.513°, *D. trochanterica* 0.669°, *Conj. externa* 0.662thickness, is in correlation with both height (r = 0.416°) and weight (r = 0.659°).

As a result it may be supposed that the anthropometrical organization of the whole body is formed as a system of well intercorrelated body measurements where the leading role belongs to body weight and height.

This hypothesis was statistically checked in the following way: first the linear influence of body weight and height was eliminated from all the other anthropometric characteristics and then the correlation structure of the latter was investigated (Kelder, 1977). The results revealed a surprisingly changed picture. The system of correlations had disintegrated, most of them (70%) were statistically insignificant.

The leading role of body weight and height was also proved by factor analysis. It appeared that almost 50% of the total variability of

Table 1

Mean values and characteristics of variability of women's basic anthropometric measurements

No	Variable	$\bar{x}$	min	max	R_v = max-min	$\frac{Rv \times 100}{x}$	σ	v
1	height (cm)	164.17	147.50	180.10	32.50	19.7	5.59	3.40
2	weight (kg)	61.104	39.900	96.600	56.700	92.79	7.624	12.47
3	abdomen length	35.20	21.20	42..80	21.60	61.35	2.81	7.98
4	trunk length	49.59	38.00	57.60	19.60	39.52	2.39	4.82
5	upper limb length	73.31	54.70	90.90	36.2	49.37	3.32	4.52
6	lower limb length	88.59	74.90	115.75	40.85	46.11	4.31	4.86
7	biacromial breadth	35.37	30.00	40.00	10.00	28.27	1.66	4.69
8	chest breadth	24.68	19.00	34.50	15.5	62.80	1.44	5.83
9	chest depth	16.14	11.60	25.00	13.4	83.02	1.24	7.68
10	head circumference	55.30	51.50	60.00	8.5	15.37	1.46	2.64
11	chest circumference	83.66	70.00	105.50	35.5	42.43	4.61	5.51
12	waist circumference	69.14	56.50	92.50	36.0	52.06	5.00	7.23
13	abdominal circumference	73.64	56.00	102.00	46.0	62.46	5.98	8.12
14	thigh circumference	56.94	35.00	87.00	52.0	91.32	4.43	7.78
15	calf circumference	35.66	23.50	42.00	18.5	51.87	2.35	6.59
16	lower leg circumference	22.28	19.20	35.00	15.8	70.71	1.43	6.41
17	arm circumference	26.15	20.00	34.50	14.5	55.44	2.19	8.37
18	forearm circumference	23.37	13.50	28.50	15.0	64.18	1.45	6.20
19	wrist circumference	15.49	13.50	18.00	4.50	29.05	0.78	5.03
20	*D. spinarum*	25.54	20.50	30.00	9.50	37.19	1.52	5.95
21	*D. cristarum*	28.07	22.50	33.50	11.00	39.18	1.39	4.95
22	*D. trochanterica*	31.69	28.00	38.00	10.00	31.55	1.51	4.76
23	*Conj. externa*	19.93	15.00	25.00	10.00	50.17	1.02	5.11

the whole set of characteristics measured could be described by weight and height, and that there were no other body measurements that could be regarded as important enough to give a reliable description of the general build of a woman's body. The remaining factors described local peculiarities only.

If body weight and height are the leading characteristics, then a two-dimensional height-weight classification may be presented as a body build model. For this purpose a statistical model of weight-height classes was worked out (each characteristic being divided into 5 equal classes within the range of $\pm$ 2.5; 25 classes in total), for which the significance of the differences between the averages of the remaining investigated characteristics was established with the help of the Scheffe-test (Kelder, 1978). This model makes it possible to carry out comparative studies of the changes taking place in the body structure of women belonging to one and the same height class when their body weight increases or decreases. Our investigations proved that in all the height classes an increase in body weight would lead to a one-directional increase in the breadth and depth measurements as well as in the circumferences of the chest, the waist and the pelvis. It is noteworthy that virtually equal changes occurred in the breadth and depth of the waist (soft tissues) and in those of the pelvis and the chest (involving both soft and bone tissues). An increase in the circumference measurements was accompanied by an increase in the wrist circumference which, as it is well known, characterizes the thickness of limb bones. The changes were one-directional in short, medium-height as well as in tall women.

For more detailed investigation into the proportions of the woman's body we established 124 indices. The changes in the indices characterizing each height-weight class were studied in the same way as the separate body characteristics. It was found that changes in body weight and height also involved regular changes in body proportions. The principal regularity of body proportions consists in the fact that the indices formed from the breadth-depth measurements, circumferences and body length change to a greater degree than the measurements characterizing one and the same dimension.

Outer pelvic measurements in their indices formed with body height or trunk changed considerably in body height-weight classes, but changes were small in such indices which were formed from outer pelvic measurements themselves. Indices which were formed from wrist circumference and from *Conjugata externa* or *D. trochanterica* practically did not change.

In the examination of 48 women's dead-body anthrometrical materials intercorrelations between outer and inner pelvic measurements, thickness of pelvic bones and other body measurements (14 body measurements and 9 pelvic measurements) were calculated. As the age

of this contingent differed widely (40–70), the influence of aging was eliminated from the linear correlation matrix and it was shown that interrelations between single measurements did not change notably.

Consequently, in the following statistical analysis we need not take into consideration the differences caused by the different age of the women's dead bodies. Next we present all statistically reliable connections.

Body height was similarly correlated with the outer pelvic measures as well as with *Conj. vera obstetrica* (r = 0.33°–0.38°). Body weight and circumferences were correlated with *D. trochanterica* and *Conj. externa* as well as with pelvic bone thickness (r = 0.49°-0.55°). Some general anthropometric measurements which characterize body bone structure were also statistically sufficiently related with pelvic bone thickness (r = 0.3°–0.5°). For example, a very interesting variable was abdomen height which was correlated with *D. cristarum* (r = 0.586°), *Conj. externa* (r = 0.833°), with the thickness of sacrum base (r = 0.802°) and with the thickness of symphysis (r = 0.547°).

Outer routine pelvic measurements were also intercorrelated with the inner pelvis and pelvic bone characteristics:

D. spinarum r = 0.288° diameter transversa of pelvic inlet

D. cristarum { r = 0.303° *Conj. vera obstetrica*; r = 0.374° diam. transversa of pelvic inlet; r = 0.318° thickness of sacrum base

D. trochanterica { r = 0.330° diam. transversa of pelvic inlet; r = 0.450° *d. iliotrochanterica*

Conj. externa was not significantly correlated with *Conj. vera*, but is correlated with the pelvic bone characteristics:

Conj. externa { r = 0.357° *d. iliotrochanterica*; r = 0.527° thickness of sacrum base; r = 0.452° thickness of symphysis

Statistically reliable connections could also be noticed between the inner pelvic measurements and pelvic bone characteristics themselves:

Conj. vera r = 0.450° *d. transversa* of pelvic inlet

d. iliotrochanterica r = 0.366° thickness of sacrum base

thickness of symphysis r = 0.386° thickness of sacrum base.

Thanks to the existence of many reliable correlations between the general anthropometric characteristics and special pelvic measures, it was possible to prognosticate with the help of linear regression analysis

statistically significantly the inner pelvic measurements and the pelvic bone characteristics.

So we could demonstrate that with the help of such argument variables as body height and all four routine outer pelvic measurements it is possible to prognosticate *d. transversa* of pelvic inlet (R = 0.4949°), thickness of sacrum base (R = 0.6256°), thickness of symphysis (R = 0.6136°) and *d. iliotrochanterica* (R = 0.5857°).

By adding to the abovementioned argument characteristics also body weight, we might improve the prognosis of *d. iliotrochanterica* (R = 0.6302°).

The prognosis of inner pelvic measurements may be greatly improved by forming a complex of argument characteristics from body height, outer pelvic measurements and from the 11 supplementary indices which we formed from the other general body variables which were measured simultaneously with the pelvic measurements on the women' s dead bodies. A combination of the abovementioned argument anthropometric variables gives a relatively good prognosis for Conjugata vera (R = 0.8457°) and for the *d. transversa* of pelvic inlet (R = 0.8184°).

Discussion

The history of pelvic examinations has lasted about 100 years already. First, main attention was paid to possibly precise measurings of outer and inner pelvic measurements both on the anatomical material and at clinical investigations (Runge, 1988; Arhangelski, 1935; Kalganova, 1935).

Since woman's pelvis was studied in an isolated manner, without taking into consideration any other body measurements, then only the arithmetical mean values of all parameters measured could be used for establishing the norms of pelvic measurements for all the variable woman contingents (Kalganova, 1978).

Only a few researchers were against the standardization of isolated pelvic characteristics as norms for all women and required that the constitutional characteristics of different women should also be taken into account.

Corresponding investigations proved the existence of positive correlations between pelvic measures and body height (Davydov, 1967; Solth, 1960). But these studies were in minority and no systemical anthropological examinations in this field followed.

Positive results were not achieved in such investigations either, where an attempt was made to find intercorrelations between the outer and the inner pelvic mesaurements. Here again isolated pelvic data

were used without considering any other measurements (Chereparov, 1971).

Our studies demonstrated that the outer pelvic measurements also belong to the body build general system, and therefore it is not right to interpret these measures in isolation. The outer pelvic measurements have a role of stability in women's proportions, and therefore their variability and intercorrelations with the other measurements correspond to their function of supporting the body.

On our material it was also possible to demonstrate statistically significant intercorrelations between many outer and inner pelvic measurements, and other body measurements. It may be concluded that inner pelvic measurements and pelvic bone characteristics also belong to the women's whole body structure. These findings lead us to the conclusion that the correlations between outer and inner pelvic measurements are not realized in a direct way but may be realized only in the multiple systemic variability of many body measurements.

In our opinion it is not possible to create a theoretical conception of the pelvis without taking into account the whole body build.

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THE STRUCTURE OF THE SLIDING TENDON

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Introduction

The frequency of pathological alterations of the shoulder joint increases with aging (Reichelt, 1981; McKendry *et al.*, 1982; Refior *et al.*, 1987). In about 30% of population older than 40 years pathological changes of the shoulder joint are found. Nowadays lesions of the shoulder region occur even in younger persons due to the rising amount of sporting activities.

Beside subluxation and luxation of the shoulder joint, partial or complete ruptures of the liding tendons are observed (*m. supraspinatus, caput longum m. bicipitis brachii*). Ruptures of the sliding tendons could be related to the position and function (Ploetz, 1936; Tillmann, 1986) of the tendon; to the pattern of vascularisation (Lindblom, 1939; Utoff, 1976; Rathbun and Macnab, 1970; Macnab, 1981; Keyl, 1989) or to the specific structure of the sliding tendon (Pauwels, 1960; Altmann, 1964; Tillmann *et al.*, 1991; Tillmann and Kolts, 1993; Kolts *et al.*, 1994).

In the present study the fine structure of the m. biceps brachii long tendon of ambryos was examined. The results are compared with the structure of the biceps tendon of the adults.

Materials and methods

For histological and ultrastructural investigations 14 m. biceps brachii long head tendons were used (6 male embryos, ages 2–5 months and 8 female embryos, ages 3–8 months). The intraarticular segments of the tendon were fixed in phosphate-buffered paraformaldehyde (4%) for 6 hours and embedded in paraplast and glycolmethacrylate. The sections were stained with toluidine blue (0.1%) at pH 5.0 in 0.1M acetate buffer. For ultrastructural examination the tissue samples were fixed in 3.5% glutaraldehyde and processed according to routine methods.

Results

Histological observations

The histological appearance of the tendon was similar to those of adults and varied within the intra- and extraarticular parts (Tillmann, 1993; Kolts, 1994). In the extraarticular, distal segment slender tenocytes were embedded between parallel bundles of collagen fibres. In the intraarticular, proximal segment the bundles of collagen fibres were arranged more irregulary, the peritendineum internum was more voluminous than in the distal segment. Collagen fibres and intratendineous loose connective tissue (peritendineum internum) was orientated diagonally towards the sliding surface. The cells varied from slender tenocytes to ovoid, chondrocyte-like cells, lying between the collagen bundels and numerously in the peritendineum internum.

On the surface adjacent to the humerus, most cells were of ovoid shape; the central region contained both — typical tenocytes and chondrocyte-like cells. Adjacent to the capsule, slender tenocytes were the dominating cells.

Ultrastructural observations

In the extraarticular segment and to the capsule adjacent part of the intraarticular segment typical tenocytes with numerous slender processes were found. the sliding area contained mainly ovoid cells without processes, with the felt-like pericellulare matrix. It was clearly visiable in the tendons of the older embryos; in the younger material the felt-like matrix was in the stage of formation, surronding partially the chondrocyte-like cells.

Discussion

Similar to those of adults, the long biceps tendon of embryos shows structural differences between the extra- and intra-articular segments. The variations of adults are thought to be caused of biomechanical conditions — the structure varies in the traction and sliding zones of the tendon; on the sliding surface the tissue shows features of fibrous cartilage (Tillmann, 1993; Kolts *et al.*, 1994).

The ultrastructural observation of chondrocyte-like cells with surrounding felt-like matrix in the sliding tendon of the embryonal period is similar to the findings in the flexor digitorum muscle of the rabbit (Merrilees and Flint, 1980) and investigation of human long head biceps tendons (Kolts, 1994). In immunohistochemical preparations of

human tendons incubated with antibodies against laminin and collagen IV the chondrocyte-like ovoid cells showed a halo of immunopositive material. The reaction correlated with the age — the younger material was strongly immunopositive, the reaction was reduced with the age (Kolts, 1993, 1994). In the tendons of embryonal period the biochemical structure of this felt-like matrix is unknown.

Summary

According to the theory of Pauwels (1960) of "Kausale Histogenese" the occurrence of fibrous cartilage within the sliding tendon can be explained by biomechanical differences in distal (tension) and proximal (pressure) parts of the tendon. The existance of the elements of fibrous cartilage-like tissue in the embryonal period shows that the adaptation processes caused by biomechanical factors seems to have genetical basis.

The clinical significance of the investigation is, that the chondrocyte-like cells with the felt-like pericellular matrix are located in that region, where mineralisation and degenerative changes most frequently occur. The lost of pericellular matrix, is in correlation with ageing and beginning of degenerative changes in the tendons.

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THE PHENOCLINE OF PRIMARY HYPOLACTASIA IN FINNO-UGRIAN POPULATION

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The differences of the adults' organisms reaction on whole milk using are investigated actively both by physicians and anthropologists. All healthy children under 3–5 years had a high lactase activity, which splits the lactose, containing in milk. By growth, the genetically caused difference of enzyme activity occurs. Lactase activity level, conserving in later years, lays out between 2 and 21 years old (in Caucasoids and Euroamericans mainly between 14 and 18) (Schrimshaw *et al.*, 1988).

Lactose intolerance has an autosome-recessive heredity (Bayless *et al.*, 1969; Sahi, 1974). The lactase activity determined loci named LAC; the dominant (lactase persistence) allele — LAC*P; the recessive (lactase restriction) one — LAC*R (Flatz, 1987). Lactose intolerance symptoms are mainly determined by the lactase genotype; the contribution of other genetic factors is insignificant (Metneki *et al.*, 1991).

The frequency of primary (genetically attributed) hypolactasia differs in different ethnic groups. In Ural (Finno-Ugrian) peoples demonstrate possibly a highest in the world range in hypolactasia frequency (Tamm, 1991).

Object and method

The analysis of lactase activity was carried out by two indirect methods with blood-glucose (Gilat *et al.*, 1971) and urine-galactose (Lember, 1990) concentration peak rise after lactose load. The equivalence of these two hypolactasia diagnostic methods was showed by M. Lember, A. Tamm (1989). Hypolactasia diagnostic criterions was unified with the Institute of General and Molecular Pathology (University of Tartu, Estonia).

The blood group (ABD system) was defined in adults in the expeditions by standard antiserums. The data of medical documentation (birth cases) was used also. The Chi-square criteria comparison ($p = 0.95$) confirms the possibility of these data merging.

Finger prints (distal phalanx) was studied by H. Cummins and Ch. Midlo (1943) method. Patterns were classified into arches, loops and whrols.

The ethno-territorial samples' sizes are shown in Table 1. The age of the investigated on hypolactasia persons was 17–55; the anthropometric data of 18–33 years old. No significant intersexual differences nor in primary hypolactasia frequencies, nor in ABD phenotype distribution was founded.

Table 1

The ethno-territorial samples' sizes

Ethnic group	Primary hypo-lactasia	Blood group (ABD)	Body length		Finger-prints	
			M	F	M	F
Komi-permiaks	112	638	99	93	41	53
Komi (izhems)	56	80	34	47	35	33
Mansi	38	110	40	72	33	53
Khanty	76	44	32	69	–	–
Russians	49	3635	175	200	96	148

Results

The data on primary hypolactasia distribution and LAC*R (lactase restriction) gene distribution in Ural and Siberian populations was shown in Table 2. The data on body length, the frequency of phenotype B (ABO system) and the intensity of finger dermatoglyphic patterns are shown in Table 3.

Table 2

The frequency of hypolactasia and LAC*R gene concentration in the investigated samples (adults)

Ethnic group	Hypolactasia		LAC*R gene freq.
	Obs, freq.	% freq.	
Komi-permiaks	56	50	0.7071
Komi-izhems (Ob reg.)	35	63	0.7937
Mansi (Sosva gr.)	27	71	0.8426
Khanty (Northern gr.)	62	82	0.9055
Russians of Ural	25	51	0.7141

Table 3

The comparison of LAC*R gene frequencies, body length, q gene frequencies, B : A blood group phenotype rations, dermatoglyphic Furugata Index in Finno-Ugrian (Uralic) populations

Ethnic group	LAC*R gene freq.	Body length		Blood group freq.		Furugata Index (females)
		M	F	q gene	B:A index	
Russians	0.7000	172.0	161.3	0.148	0.51	40.2
Finns	0.4123[1]	–	–	0.108	0.32[2]	26.2[3]
Estonians	0.5292[4]	175.5[9]	–	0.175	0.73[5]	37.7[6]
Komi-permiaks	0.7211	168.3	158.4	0.200	1.00	45.8
Komi (izhems)	0.7937	165.7	155.4	0.214	1.22	51.2
Mari	0.9000[7]	166.7[10]	–	0.246	1.45[5]	55.4[6]
Mansi	0.8426	159.8	150.6	0.273	1.60	65.7
Khanty	0.9055	159.5	149.9	0.281	2.24	135.0[6]

REFERENCES: 1 — Jussila *et al.*, 1970; 2 — Kajanoja, 1972; 3 — Heet, Dolinova, 1990; 4 — Tammur *et al.*, 1982; 5 — Heapost, 1978; 6 — Heet, 1983; 7 — Tamm *et al.*, 1987; 8 — Tamm, 1991; 9 — Deriabin, Purunjan, 1990; 10 — Kajanoja, 1979.

Discussion

On the territory of Europe it was two gradients of LAC*R gene frequencies disclosed: from North-West to South-East, and from North-West to North-East of the continent (Sahi, 1991). In our publication only the second, "Northern" cline is studying.

We believe, that the diversity of LAC*R gene frequency in Finno-Ugrian populations is connected with the expression of the anthropological traits of Ural group. In the investigated populations of Europe, Ural and Western Siberia the increasing of LAC*R gene concentration (Table 3) is connected with the reducing of mean body length, increasing of q gene and B phenotype (ABO system; it is especially visible by B : A phenotypes comparison). In parallel with the increasing of LAC*R gene in the populations, the intensity of distal phalanx dermatoglyphic patterns (Furugata Index: W/L*100) increase also.

These data confirms, that the clinal diversity of LAC*R gene concentration in population (phenotypically shown in biochemical activity of adults' intestinal lactase decreasing) may serve as additional argument on the anthropological unity of Finno-Ugrians.

Paying attention on the coincidence of clinal diversity of LAC*R and q genes. The rise concentration of B phenotype (q gene) of ABO system is a common particularity of Arctic indigenous populations (Laughlin, 1966). Another specific trait of Arctic and Subarctic

peoples is using of high concent of fats with food (Draper, 1980). It was disclosed the dependence between the fatty food using, B and O groups secretority and alkaline phosphatase content. It was marked, that the content of alcaline phosphatases (both serum and intestinal) is higher in persons with O and B phenotypes, than with A one (Beckman, Zoschke, 1969).

It is possible, that in ancient Uralians, who lives in Sub-Arctic climate, the increasing concentration of the alcaline phosphatases (in correlation with the increasing of B phenotype) and genetically determined age decreasing of intestinal lactase activity were connected with the special nutritional regime with the high using of fats and the absence of milk products in adult rations. Such type of nutrition we definite now as "arctic-type".

In our days the rise concentration of LAC*R and q genes (B phenotype) in Finno-Ugrian peoples may be estimated as the additional marker of their common "Sub-Arctic" origin.

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INFLUENCE OF TRAINING LOAD ON THE FUNCTIONAL STATE OF *LOCOMOTIVE APPARATUS* IN GYMNASTS

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Modern sports gymnastics at competitive level consists of difficult aerobatic exercises, which are usually connected with the impact loads (jumps, dismounts, landings) on the locomotive apparatus (*LA*) of gymnasts. (Chenegip, 1987; Zaikin, 1987; Fjodorova, 1991). The growing rivalry on international level evokes the constant development of complicacy of programmes and thus forces trainers and sportsmen to raise training loads. Nowadays 10–13-years-old children are training 6–7 hours per day and their training loads exceed the range of intensity which earlier characterized adult competitive gymnastics. Thereby the share of impact loads in the whole training load remains relatively high during different periods of training process (Fjodorova, 1991; Trestzyova, 1981).

As the above-given proves, the LA of gymnasts must constantly bear the influence of intensive impact loads. If the training loads exceed the functional qualities of *LA*, the serious pathological changes may become evident (Carek, Fumich, 1991; Vain, 1981; Nikitjuk, 1980;Cotta, Sommer, 1986).

Researchers (Cotta, Sommer, 1986; Ehricht, 1978; Schneider, 1991; Tsivyan, Burukhin, 1988) showed that under the influence of recurrent impact loads the disturbances in the functional condition of connective tissues in lumber area of spinal column become evident. The hinder part of the intervertebral disk in the spinal column will suffer from compression and deformation. Many authors (Tsivjan, Burukhin, 1988; Naylor, 1962; Raichenstein, 1975; Zatsiorski, Sazonov, 1985) have established that if the functional condition of connective structures of spinal column is satisfying, the influence of compressive forces will cause pressure inside of *nucleous pulpous*. Due to the hydrostatic qualities of *nucleous pulpous* the pressure will be divided equally on the surface of intervertebral disk, thus pushing the vertebraes apart. This process results in a reserve for deformation, which was measured on a special stand in lying and standing positions ($\triangle$[mm] before and after the training (Vain, 1981). If the load surpasses the adaptional qualities of intervertebral structures,

the pressure inside of dies will decrease. The *nuclous pulpous* flattens and deformates and as a result of this the vertebraes approach, usually causing the deformations of intervertebral disk. In that case the normal amortizational functions of spinal column will be destroyed (Tsivyan, Burukhin, 1988; Raichenstein, 1975; Naylor, 1962; Ehricht, 1978).

This process results in the decrease of difference in height $\triangle l$ (Vain, 1981, 1986).

Our investigations established that the difference in height (if compared with the data obtained before and after the training load) decreased as well: ($\triangle l_D = \triangle l_B + \triangle l_A$ (Kums, 1994).

The aim of our investigation was to study the reaction of connective tissues in the gymnasts' *LA* to training loads of different character and intensity. We presumed that intensive training loads cause negative changes in the functional condition of *LA*.

Materials and methods

The research was carried out on the basis of Tallinn's Specialised Gymnastic School. 16 highly qualified female competitive gymnasts from age 9 to 14 took part in the research.

Through 5 years (1986–1990) the data of training loads had been periodically registred: capacity Q (elements), intensity I (relative unit of measurement, Afonin, 1976), percent of impact load in the whole capacity of training — U % and anthropometrical indices: height (with Martin's metal anthropometer) with ± 0.5mm accuracy and weight with ± 0.1 kg accuracy.

Before and immediately after $\triangle l_A$ the training the change in gymnast's height was measured on a special stand in lying and standing positions $\triangle l$(mm) = l lying — l standing. The arithmetical mean ($\triangle l_B$ and $\triangle l_A$ respectively) of height differences and the arithmetical mean $\triangle l_M$ per gymnast during the whole day.

On the ground of the arithmetical mean $\triangle l_M$ in height differences we got the general estimate on the fumctional condition of *LA* per day, on the ground of height differences ($\triangle l_B$ and $\triangle l_A$) dynamics we explored the shifts which took place in the functional condition of connective tissues in *LA* under the influence of training load.

The received results we treated statistically.

Results and discussion

The analysis was carried out on the ground of data obatained within a period 1986 to 1990. The data was divided into three groups

according to the capacity and intensity of training using a method for evaluation of training loads in gymnasts (Trestzyova, 1981).

The I group (n = 44) is characterized by relatively high training load: 437 ± 63 elements with intensity 0.67 ± 0.32 rel. units, the percent of impact load was 73.68 ± 8.09. The mean age of subjects was 11.82 ± 1.88 yrs, weight 31.95 ± 5.40 kg, height 1373.32 ± 8.64 mm.

The II group (n = 203) is characterized by relatively mean training load: 247 ± 73 elements with intensity 0.25 ± 0.14 rel. units and the percent of impact load was 66.45 ± 17.17. The mean age of subjects was 12.87 ± 1.69 yrs, weight 34.90 ± 5.48 kg, height 1429.99 ± 81.77 mm.

The III group (n = 79) is caracterized by relatively low training load: 126 ± 46 elements with intensity 0.06 ± 0.03 rel. units, the percent of subjects was 12.58 ± 1.68 yrs, weight 33.20 ± 6.19 kg, height 1415.73 ± 91.28 mm.

There were significant differences ($p < 0.001$) between the groups in the capacity and intensity of training loads. Differences between the groups in the indices of arithmetical means in height differences ($\triangle l_M$) were non-significant:

I group 16.17 ± 6.48 mm.

II group 16.83 ± 5.38 mm.

III group 17.59 ± 4.71 mm.

This fact evidences that the level of functional connective tissues of *LA* is similar throughout the day in all three groups. The similar level of *LA*'s functionality in the groups remains stable even immediately before the training load — there were no significant differences in height differences between the groups.

I group 16.16 ± 6.78 mm.

II group 16.89 ± 6.19 mm.

III group 16.27 ± 6.62 mm.

The significant differences ($p < 0.05$) became evident only in the differences of height $\triangle l$ after the training load between III and I group and between III and II group. The differences in height between I and II group were non-significant.

Comparison of indices of arithmetical means $\triangle l$ (mm) inside the groups showed that the differences in height in I and II group were non-significant:

I $\triangle l_B$ 16.16 ± 6.78 mm.

$\triangle l_A$ 16.48 ± 7.71 mm.

II $\triangle l_B$ 16.89 ± 6.19 mm.

$\triangle l_A$ 17.18 ± 6.50 mm.

(See Table 1.)

Table 1

Main data obtained in 1986–1990

	I high	II medium	III low	p		
				1–2	1–3	2–3
Age (yrs)	11.82± 1.88	12.82± 1.69	12.58± 1.68	<0.001	<0.05	NS
Height (mm)	1373.32±80.64	1429.99±81.77	1415.73±91.28	<0.001	<0.01	NS
Weight (kg)	31.95± 5.40	34.90± 5.48	33.20± 6.19	NS	<0.05	NS
l (mm)	0.45± 6.56	0.25± 6.57	3.14± 6.33	NS	<0.05	<0.001
Q (elem.)	437±63	247±73	126±46	<0.001	<0.001	<0.001
I (rel.unit)	0.67± 0.32	0.25± 0.14	0.06± 0.03	<0.001	<0.001	<0.001
U %	73.68± 8.09	66.45±17.17	62.70±25.50	<0.001	<0.001	NS
Δl_M	16.17± 6.48	16.83± 5.38	17.57± 4.71	NS	NS	NS
Δl_B	16.16± 6.78	16.89± 6.19	16.27± 6.62	NS	NS	NS
	NS	NS	$p < 0.05$			
Δl_A	16.48± 7.71	17.18± 6.50	19.34± 5.31	NS	<0.05	<0.01

In these groups the zero-type reaction to the load was found, the reaction of *LA* to the training load at high and average level was unsatisfying. No positive shifts were found in its functional condition after training.

In this case we must conclude that the amortisation function if *LA* was seriously disturbed.

In the III group the differences in height (Δl_B and Δl_A) were significant ($p < 0.05$): Δl_B 16.27 ± 6.62 mm; Δl_A 19.34 ± 5.31 mm, and the positive type of reaction to the training load was found.

Correlation analysis made evident that there is connection between the height differences before and after the training load (Δl_M) and the capacity (–0.43) and intensity (–0.48) of the training load ($n = 92$, $p < 0.001$). It means that the main negative effect of the training load on the functional condition of connective structures of *LA* becomes evident by increasing the intensity and condition of training load.

The above given data affirm that the training loads at different level has different effect on the functional state of *LA* of gymnasts if their functional condition was similar before the training load.

We can assume that relatively low level of training load don't cause negative shifts in the functional state of *LA*. Relatively high and even mean intensity and condition of training load influences depressively the *LA* of gymnasts thus causing degeneration in functional state of connecting tissues of spinal column. This fact was evidenced by the zero-type reaction to the training load.

Obtained information should be taken into account in planning training loads for competitive gymnasts.

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A LONGITUDINAL STUDY OF RELATIONSHIPS BETWEEN SEXUAL MATURATION AND GROWTH IN GIRLS

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Results of several studies evidence the dependence of growth pattern on sexual maturation in children of both genders (Tanner, 1962; Hägg, 1980; Kahl *et al.*, 1988; Malina, Bouchard, 1991, Österback, 1991). Some of these studies evidence the value of longitudinal approach in order to verify the results of cross-sectional studies (Tanner, Whitehouse, 1976, Kemper *et al.*, 1983, Österback, 1991). Material on growth pattern as well as sexual maturing in Estonian children and adolescents is provided by Silla and Teoste (1989). The material does not contain a detailed analysis of relationships between growth and sexual maturation.

The aim of this paper is to use the results of a 3-year follow up study for analysis of relationships between growth pattern and sexual maturation in Estonian girls.

Methods

34 girls (11 to 12 years old at the beginning of the study) were investigated three times during three successive years. Growth was evaluated by height, weight, biacromial and bicristal breadths. The skeletal age was assessed by X-ray photograph of the left wrist (Greulich, Pyle, 1959). Skinfold was measured at biceps, triceps, and scapula. Sexual maturation stages were determined by Tanner (1961). According to a pronounced variability in sexual maturing, described in girls by Marshall and Tanner (1969), various maturation criteria gave evaluations by which two or even three stages were overlapped. Therefore only three groups of girls were distinguished: (1) maturation stage 0–1 (mean evaluation < 1), (2) stage 1–3 (mean evaluation > 1 and < 3), (3) stage 3–4 (mean evaluation > 3).

For a cross-sectional comparison results were added up according to sexual maturation stage in each observation. Longitudinal analysis

was performed by comparison of five groups: girls remaining in stage 0–1 during a year, girls who were transferred from stage 0–1 to stage 1–3 for the next year, girls who remained in stage 1–3 during a year, girls who were transferred from stage 1–3 to stage 3–4 during the next year, and girls who remained in stage 3–4 during a year.

Results

Cross-sectional comparison indicated significant difference ($P < 0,05$) in height between stages 0–1 and 1–3, but not between stages 1–3 and 3–4 (Table 1). The weight increased significantly from stage to stage.

Table 1

Cross-sectional comparison of girls of various maturation groups (mean ± S.E.)

	Sexual maturation group		
	0–1 (n = 28)	1–3 (n = 25)	3–4 (n = 42)
Chronological age (years)	12.0 ± 0.3	12.7 ± 0.2 *	13.2 ± 0.1
Skeletal age (years)	11.9 ± 0.4	12.6 ± 0.5 *	13.5 ± 0.4
Height (cm)	153.5 ± 1.2 *	* 160.9 ± 1.2	163.6 ± 0.8 *
Weight (kg)	39.5 ± 0.9	47.0 ± 1.0	51.8 ± 0.6
Biacromial breadth (cm)	31.9 ± 0.4	32.3 ± 0.9	32.9 ± 0.5
Bicristal breadth (cm)	23.1 ± 0.8	24.9 ± 0.4	25.8 ± 0.6
% of postmenarcheal girls	4	86	93

In the group of skeletal age 12 to 14 years the height and weight were bigger as well as the mean evaluation of maturation, compared to the group of skeletal age 10 to 12 (Table 2). Menarche appeared in girls of this group. No significant differences were detected in other measures, including chronological age.

Girls who remained for a year in stage 0–1 had higher chronological and skeletal age than those girls who revealed transition from stage 1–3 to stage 3–4, or remained for a year in stage 3–4 (Table 3). The highest increase in height appeared in those girls who transferred from stage 0–1 to stage 1–3. The gain in weight was the most pronounced in

Table 2

Cross-sectional comparison of girls of different skeletal age (mean ± S.E.)

	Skeletal age (years)	
	10–12 (n = 27)	12–14 (n = 38)
Calendar age (year)	11.8 ± 0.2	12.3 ± 0.2
Height (cm)	154 ± 1.6 ——	* — 160 ± 1.5
Weight (kg)	40.7 ± 1.6 ——	* — 47.4 ± 1.4
Biacromial breadth (cm)	32.6 ± 0.6	34.0 ± 0.4
Bicristal breadth (cm)	23.6 ± 0.5	24.7 ± 0.2
Sexual maturation stage	1.4±0.5 ——	* — 2.6 ± 0.3
% of postmenarcheal girls	13	58

girls who remained in stage 1–3 for a year. In this group the increase in bicristal breadth was the highest. The biacromial breadth increased similarly in all groups.

Skinfold measures gave a variable picture, indicating on multicausal changes (sexual maturation, nutrition etc.).

Discussion

By the results of Silla and Teoste (1989), in Estonian girls the peak height velocity appears at the age of 11–12 years, while the mean age of maturation stage 1 is by breast 9.8±1.4 years and by axillary hairs 12.0 1.7 years (maturation stage 3 is by breast at age 12.79±1.2 and by axillary hair at age 14.3±1.8). It is referred by Malina and Bouchard (1991) that the peak height velocity correlates well with breast and pubic hair stage 1. Both cross-sectional comparison and longitudinal follow-up analysis of our results demonstrated that the highest increase in height takes place in transition from maturation stage 0–1 to stage 1–3.Thus, in Estonian girls the time of peak height velocity is at the end of stage 1.

The peak weight velocity appears in girls less than a year later than peak weight velocity (Malina, Bouchard, 1991). By our results the increased weight gain continues longer than the accelerated height increase and is typical for girls transferring from stage 0–1 to stage 1–3, for girls remaining in stage 1–3 for a year, and for girls transferring from stage 1–3 to stage 3–4. Despite the increased weight gain, our results did not confirm the results of Young *et al.*, (1998) showing increased fat mass and fat percent with sexual maturing in girls.

Table 3

Longitudinal comparision of annual changes (mean ± S.E.)

	Stage 0–1 persisted (n = 7)	Transition from stage 0–1 to stage 1–3 (n = 14)	Stage 1–3 persisted (n = 11)	Transition from stage 1–3 to stage 3–4 (n = 11)	Stage 3–4 persisted (n = 18)
Chronological age at the first year	11.6±0.20	11.9±0.23	12.0±0.13	12.6±0.28	12.9±0.17
Skeletal age at the first year	11.9±0.40	11.7±0.22	12.6±0.21	13.2±0.23	13.4±0.22
Annual height increase (cm)	4.9±0.34	6.9±0.48	5.6±0.65	4.6±0.37	2.9±0.41
Annual weight gain (kg)	2.9±0.36	5.2±0.40	6.1±0.82	4.6±0.70	3.5±0.59
Annual increase of biacromial breadth (cm)	1.6±0.25	1.9±0.28	1.2±0.36	1.8±0.53	1.1±0.27
Annual increase of bicristal breadth (cm)	1.0±0.29	0.9±0.15	2.1±0.41	0.9±0.28	1.0±0.22
% of postmenarcheal after a year	0	29	91	82	100

Therefore, the weight gain with advanced puberty is not necessarily caused by accumulation of subcutaneous fat. Fairly significant may be changes in the skeleton,indicated by a pronounced increase in bicristal breadth in maturation stage 1–3.

The obtained results showed that advanced skeletal age associates with increase both in height and weight, as well as with advanced sexual maturation, confirming the results of previous studies (for review see Malina, Bouchard, 1991).

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REWIEW OF STUDENTS ANTHROPOMETRY IN TALLINN PEDAGOGICAL UNIVERSITY

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About 20 years ago regular anthropometric measurements of students started in TPU.

The aim of the investigation have been:

1) To study morfological and physiological development of our students in dynamics and in comparison with previous data about Estonians anthropology and also with other nations;

2) To study students body construction and their nutritional status;

3) To give our students a chance to compare themselves with contemoraries and study everybody's physical ability and specific features of the body bilding.

The subjects of investigation were principally estonian girl-students aged mostly 18–24 years. In 1976–1990 altogether 2527 persons were examined. For comparison a group of russian girl-students (in 1984–1985; 90 persons) and also a group of young men (in 1989–1990; 104 persons) were measured.

Methods of investigation. Scores of classical anthropometric measurements (Martin, 1928) were performed. In each case 22–48 anthropometric characteristics were measured and 17–28 indices were calculated in different groups. Collected data were computed and data-bases for estonian and russian girls and also for young men were formed. In 1976 the profile graphic method by J. Aul (1974) modified by S. Tamm was taken into use. In 1988–1990 the height-weight relations by means of different formulares and methods were studied (Lausvee, 1991a, 1991b).

Results

During recent 15 years the mean body height of our girl-students has risen from 165.6 ± 5.2 to 167 ± 8.4 cm. The mean height, being more various, has increased from 61.8 ± 7.5 to 63.4 ± 8.7 kg. Dynamics of other parametres wasn't so clean.

Acomparison of the anthropometric characteristics of estonian students measured by H. Tiik in 1962–1963 (1965) revealed that in the course of some 25 recent years our girls have grown up by 4.4 cm on the average and young men by 4.5 cm. The formers weight has simultaneously increased by 1.2 kg and the latters' one — 2.4 kg. The same fact appeared comparing our data with the investigation of J. Aul (1982).

Accumulated results accord with own collegues (Aul, 1982; Heapost, 1969; Kaarma, 1981; Anthropological atlas, 1977) about the Estonians' tallness compared with other people:

Investigated by Estonian girls	Height (cm)	Weight (kg)
Aul (1974)	162.3 ± 5.4	60.0 ± 6.9
Tiik (1965)	163.3 ± 5.0	61.8 ± 7.0
Kaarma (1981)	164.2 ± 5.6	61.1 ± 7.7
Tamm, Lausvee (1982)	165.6 ± 5.2	61.8 ± 8.1
Lausvee (1991)	167.7 ± 5.5	63.9 ± 8.3
Anthropological atlas:		
Armenian girls (1977)	155.6 ± 4.9	56.4 ± 8.6
Lithuanian girls (1977)	165.1 ± 4.9	61.1 ± 6.5
Russian girls (1977)	159.5 ± 5.2	63.3 ± 8.8
Russian girls in Tallinn (1986)	163.9 ± 5.1	60.3 ± 9.0

The body construction of our girls judging by following indices, has become weaker — the fullbodiedness and sturdiness appear diminish, most of all in 1986–1987. Their physical ability (vital capacity and hand dynamometry) had it's low level in 1984–1985.

Anthropometric Characteristics	Results of J. Aul (studied 1963–1966)	Our results (studied 1976–1990)
The Rohrer index	1.42	1.37–1.33 $P < 0.01$
The Quetelet index	2.34	2.28–2.22 $P < 0.01$
The Piqnet index	16.60	18.15–20.49 $P < 0.01$
Strength of right hand pressure	29.8 ± 0.5 kg	27.0–21.4–30.3–32.6±4.9–6.4
Strength of left hand pressure	26.7 ± 0.5 kg	24.0–18.2–27.4–29.1±6.1–4.7
Vital capacity	3.7 ± 0 cm^3	3.2–2.2–3.4±0.5

There is a tendency of shoulder girdle weaking and growing of pelvic girdle measurements among our girl-students.

	Chest diameter	Thigh circumference
By J. Aul	25.82 ± 1.42 cm	54.60 ± 0 cm
H. Tiik		57.39 ± 4.20 cm
Our data	24.95 ± 1.55 cm	58.94 ± 4.50 cm

In recent 6–8 years the relative bicristal breath has increased (from 55.8% to 56.6%) and biacromial breadth has diminished (from 21.7% to 21.2%). All the changes are statistically significant.

The values and fitness of different criteria of optimal height-weight relations were examined to reveal the most suitable and simpliest ones for our subjects (Lausvee, 1991a). There is no ideal formula or index for normal weight that might be equally good for all (Kaarma, 1981). The main criterion for overweight by prof. J. Aul (1982) is Rohrer index (over 1.69). Comparison of several formulars on our material has shown that Rohrer index is good enough for persons whose standing height is between 160 and 175 cm. It a person is taller a light owerweight isn't expressed by this formula.

Improved Broca index is also considered to be good for normal weight calculating (Saava, 1987), but it assumes quite accurate determination of the type of body construction.

Lately the body mass index (MBI) is appreciated in similar investigation (Mustajoki, Konerva, Rissanen, 1991). According to both formulas own students height-weight relations in 1988–1990 were following:

Optimal height-weight relation	Girls-students (mean age 20.2±1.6)		BMI	Young men (mean age 20.8±1.6)		BMI
	N	%		N	%	
Slight underwight						
Slight overweight	152	64	19.5–2.5	71	70	22–26
Underweight 15% and more	17	7	18–19	7	7	19–21
Overweight 15% and more	13	6	< 18	8	8	< 19
	33	14	26–28	11	11	27–28
	22	9	> 28	4	4	28
	237 cases — 100%			101 cases — 100%		

Health education knowledge about optimal nutrition and fitness are necessary mainly for persons whose body mass index is 18 or 25. In future we hope to introduce fundamentals of anthropology into health education program in TPU, to make students aware of their body composition peculiarities in connection with their state of health.

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PHYSICAL WORKING CAPACITY OF PREGNANTS

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To determine the pregnant's aerobic working capacity mostly indirect methods are used. The results of investigations (Hare, Karn, 1929; Erkkola, 1984; Lotgering *et al.*, 1991) show that the physical working capacity (PWC) does not subject to great changes. The typical training adaption will take place. Such conclusion is based on the response of the heart rate to submaximal work (Gorski, 1985; Sady *et al.*, 1989, 1990). According to the data Dahlström and Ihrman (1960) the PWC of pregnants practically does not change during pregnancy. However, Erkkola (1976) and Clapp *et al.*, (1990) state that pregnancy brings about a certain decline of PWC. According to the data of Erkkola (1976) the PWC may decline somewhat at the beginning of pregnancy the result of which is thought to be the depression of pregnancy, fatigue and vomiting. The investigation of Clapp *et al.*, (1990) shows that by the 20th week of pregnancy the PWC declines to 57% from the maximal oxygen consumption and by the 32nd week of pregnancy to 47%. Lotgering *et al.*, (1991) finds that pregnancy does not influence PWC till the 3rd trimester, but from that on PWC lessens to 4%.

Thus we can see that the opinion concerning the PWC of pregnants are different and due to this the aim of the present research was to investigate the changes of PWC of pregnants during pregnancy and to compare it to the data of nonpregnants.

Material and methods

80 healthy women of primipregnancy and 25 nonpregnants were investigated. The physical working capacity was determined on the 13th, 20th, 28th and 36th week of pregnancy. Physical load was got in the form of 5 minute walk on treadmill. The power level of the first physical loads was 0.75 W per 1 kg weight, the second 1.25 W. The heart rate and arterial blood pressure were registrated in every minutes by walking. PWC150 was calculated according to the heart rate of the last minutes of both loads using Karpman's (1974) method.

1. experimental group with relatively high PWC (PWC > 100 W), n = 42

2. experimental group with relatively low PWC (PWC < 100 W), n = 38

25 healthy nonpregnant women were also investigated in order to get background data.

1. control group with relatively high PWC, n = 12

2. control group with relatively low PWC, n = 13.

Results

The results of the PWC_{150} of pregnants and nonpregnants are given in the Figure 1.

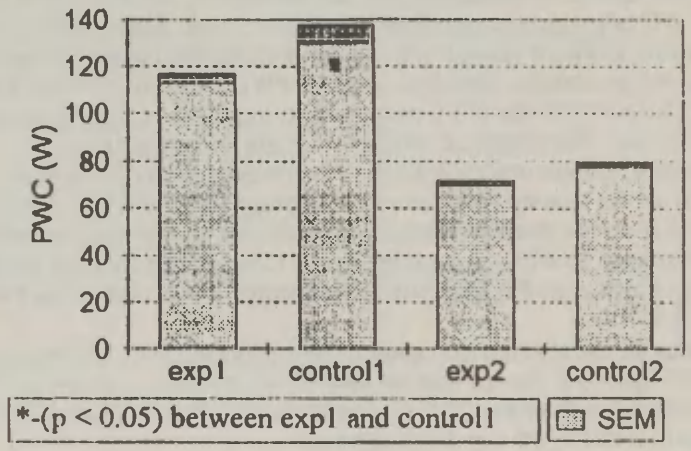

Figure 1. Physical working capacity of pregnants and nonpregnants.

The PWC150 of the I control group was 130 ± 7.8 W, of the II control group 77.5 ± 2.0 W. These data of the I and II experimental group were correspondingly 113 ± 3.7 and 70 ± 1.9 W. From this data result that the physical working capacity of pregnants on the 13th week of pregnancy was significantly lower than of nonpregnants ($p < 0.05$).

If to follow the changes of the PWC during pregnancy we can say that the PWC of the I experimental group declines till 28th week of pregnancy ($p < 0.001$) (Figure 2.). There were no changes in the PWC of the II experimental group during pregnancy (Figure 3).

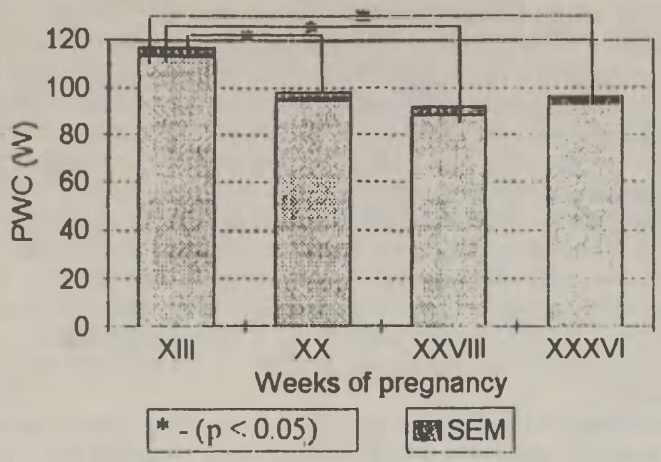

Figure 2. The dynamics of physical working capacity of pregnants with relatively high PWC.

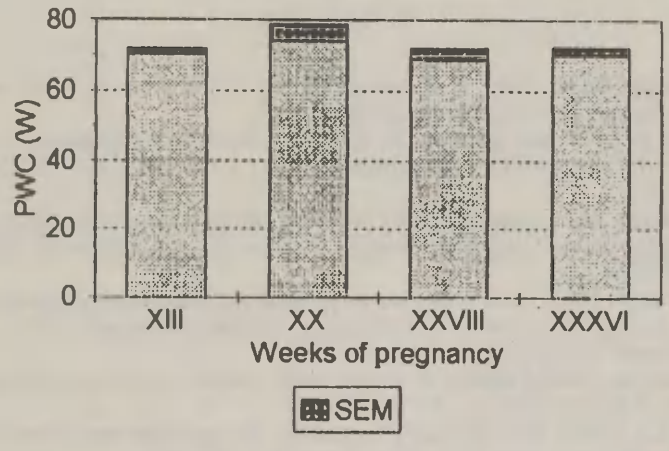

Figure 3. The dynamics of physical working capacity of pregnants with relatively low PWC.

Discussion

The PWC_{150} test that was carried out characterizes the cardiovascular state and physical working capacity. The results showed

that PWC, measured on the 13th week of pregnancy was lower than nonpregnant's PWC. This result coincide with the data of Sandström (1974), who assert, that depression of pregnancy, fatigue and difficulties of adaptating the pregnancy can cause the decline of physical working capacity. The PWC continue to decline during pregnancy of these women who had higher starting point at the beginning of the pregnancy. Following the investigation of Clapp *et al.*, (1990) the PWC declines to 57% on the 20th week of pregnancy and to the 47% on the 32th week of pregnancy from the maximal oxygen consumption. The woman with relatively low starting point of the level of the physical working capacity at the beginning of pregnancy has relatively stable level of PWC during pregnancy. Probably physically weaker women have so low starting point of PWC that it's further decline is impossible.

In conclusion one can say that physical working capacity of pregnants which is determined by PWC_{150} test depends on the starting point of physical working capacity. With the development of pregnancy the PWC declines of pregnants, who have relatively high PWC_{150}, but it is stable of women who have relatively low level of PWC_{150}.

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HEIGHT, WEIGHT AND SOMATOTYPE OF CHILD PSYCHIATRIC PATIENTS IN TARTU IN 1994

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Abstract

The physical development and somatotype of one hundred children treated in theTartu University Psychiatric Clinic during 1994 were investigated. All they were treated because of the neurotic disorders of the childhood. Thirty eight of the studied children had disharmony between the development of height and weight. In height distribution there were 51.6 percent of small, 32.6 percent of middle and only 15.8 percent of tall persons. The weight distribution showed that 65.3 percent were slight weight, 19 percent with averige weight and 15.8 with heavy weight. In children with neurotic disorders ectomorphic somatotype was the most frequent.

Key Words: height, weight, somatotype, child psychiatric patients.

In everyday clinical psychiatry the investigation of patients has been first and foremost limited and aimed at sampling symptoms and forming basis for constructing the diagnostic hypotheses, which may be corrected according to the new information. To interpret the clinical findings we joined the interrogation of the child, the interviews with parents, the kindergarten nursemaids and the school teachers' observations on the behavioral style of the child in different situations and especially deviations from the usual pattern of the average child's behavior.

This approach has been introduced into modern psychiatry by the usage of the diagnostic criteria of the DSM–III–R, DSM–IV and ICD–10 version and this has been and still is the shortest way to the contemporary diagnosis.

But the physician in our days does not forget the integrative model of diseases, in which the biological, psychological as well as social aspects of the disease are interwoven, for the better understanding of the nature of the disease and the relationships of the different aspects in the real patient (Aul, 1982). Evaluation of the child and adolescent

physical development, its retardation and acceleration can contribute to the better understanding of the case.

Unfortunately these aspects have not been satisfactorily taken into consideration in clinical practice. To fulfill this gap our investigation has been carried out. In the beginning of the last century Italian scientist Maria Montessori noted, that the children's physical and mental development and also work fitness was interfaced with the morpho-functional structures (Aul, 1982). In modern medicine that has been called principle of psychosomatic medicine. The development of the child is determined by genotype as well as by environment and social factors. As it is demonstrated in the works of E. Kretschmer, W. H. Sheldon, W. L. Linford Rees (Rees, 1976) there was also big role of the constitution in the philosophy of the causation of disease. The physique and their development evaluation gives us opportunity to understand better the etiology, the course and the outcome of the illness. The evaluation of physical development enables to find out the weak period in the physical development of the child.

The purpose of the present paper has been as follows:

1) to investigate the structure of the age and sex of the children with neurotic disorders in the most frequent disorders of the childhood in the psychiatric clinical population,

2) to find out the specific features of the growth development in group of children with neurotic disorders and to compare the results to the normal schoolchildren.

3) to find out the body weight progress in the mentally disturbed children and to compare this to the normal peers.

4) to investigate the mentally disturbed children's somatotype in boys and girls

5) to find out indices of differences of mentally disturbed children's sexual dimorphism.

Material and method

The study group consisted of one hundred children treated in the Tartu University Psychiatric Clinic in Department of Child and Adolescent Psychiatry in the year 1994. Altogether fifty seven boys and forty three girls. The age range was from 4 to 18 years (mean age 12.4 years, standard deviation 3.3 years). All these children had been diagnosed by the doctors of the Department of Child and Adolescent Psychiatry as having neurotic disorders according to the criteria of ICD–10 version.

All investigated children had been inspected and measured at he doctor's office. The measuring has been carried out according to the

instructions of Martin (Martin, 1957) by the help of measuring instruments manufactured in the Technological Center of the University of Tartu. The results had been immediately fixed on the observation sheet. The height (according to Martin number 71) and the weight has been put on record. In addition the eight points of the body dimensions were taken according to the Heath-Carter somatotype method. The three components of somatotype rating are defined briefly: Endomorph (or first component) is a rating on a continuum of relative fatness of a physique, mesomorph (or second component) is a rating on a continuum of musculoskeletal robustness relative to stature, ectomorph (or third component) is a rating on a continuum of relative linearity or "stretched–outness" of a physique. According to the preponderant component the investigated children had been divided into endomorph, mesomorph and ectomorph type of human physique.

Personal computer 486D X and the statistical program Systat for Windows were used for statistical analysis.

1. Demographic data

Table 1

The Age and sex structure of the investigated children

No	The Age of group	Total	Boys	Girls
1.	4–6	5	4	1
2.	7–11	39	25	14
3.	12–14	38	22	16
4.	15 and more	18	6	12
Total		100	57	43

Our data shows that frequency of morbidity among the children were heterogeneous. Only 5 percent of investigated persons were in the age group of 4–6 years children, 39 percent of cases were in the age group of 7–11 years, also in the age group of 12–14 years were 38 percent of cases and only 18 percent of cases were in age group of 15–18 years. On the ground of our data the morbidity preference has been in younger schoolage and in early adolescence.

We analyzed also the prevalence by the sex. In the group of preschool age the ratio has been 4:1 to the advantage of boys, also in age of 7–11 years the ratio is 1.79:1 and in the age of early adolescence ratio is 1.4:1, but in the adolescence the ratio changed vice versa to the advantage of girls 2:1, as it still is in adult age. We can tell, in the preschool age the ratio between both sexes has been to the advantage

of boys and this ratio decreases with age and in the adolescence the ratio is first in benefit to girls.

The Height

The height has been one of the relevant anthropological markers. The development of the height has been and still is the favorite characteristic in anthropology, the ground on which we may also evaluate other body measurements, the habitus, the proportions among parts of the body, the changes of the population in connection with the age, the influence of the environment factors and the other factors' influence. Thus it is of special interest and indicates the development of the person and the height deviations may be also the sign of the health disorders. J.Aul has classified according to the height all ages of the school children to the five classes from the age of 7–18 years. Using the height assessment's table of J. Aul (1978) we have determined the evaluation score for every person in schoolage. In the table there are data of 95 cases. The rest of 5 cases were much younger and we could not utilize the J. Aul's assessment table, therefore in this part of analyze they were excluded.

Table 2

The assessment of the standing height in erect position according to the J. Aul (1978) assessment scale

No.	The height assessment	No of cases	% of cases
1.	Unusually small	2	2.11
2.	Very small	16	16.84
3.	Small	31	32.63
4.	Average	31	32.63
5.	Tall	10	10.53
6.	Very tall	4	4.21
7.	Out of the ordinary tall	1	1.05
Total		95	100

Thus we can say that the distribution of the patients has been fully asymmetric. Into the categories unusually small, very small and small belong 51.6 percent of studied patients. Into the middle group belong only 32.6 percent of the investigated patients. Quite a different matter has been the shoulder of the tall and the very tall and unusually tall-only 15.7 percent. We may state that the part of patients with the small height in the cohort with neurotic disorders has been tree times greater than the sum of tall. The middle height patients group has been twice greater than the group of the tall height.

The Weight

Weight has been considered as the index of the plumpness. It gives together with height synopsis of the development character of the body (the habitus) and of the level of development. The body mass assessment table of the J. Aul for Estonian schoolchildren has been for us assessment scale for individual the person's data. The results have been given in the table 3.

Table 3

The distribution of the children with neurotic disorders according to the J. Aul (1978) weight assessment scale

No	The weight assessment	No of patients	Percent of patients
1.	Excess light	2	2.11
2.	Very light	19	20.00
3.	Light	41	43.16
4.	Average	18	18.95
5.	Heavy	9	9.47
6.	Very heavy	2	2.11
7.	Excess heavy	4	4.21

It becomes evident that weight is distributed fully unproportionally. The children with the excess light weight, the very light weight and the light weight include 65.3 percent of the investigated patients, the group of the average weight includes 19 percent and the group of the heavy weight, the very heavy weight and the excess heavy weight includes 15.8 percent of the investigated patients. We may conclude that the group of the light weight's sum surpass the group of the average weight three times and the group of the heavy weight, the very heavy weight + the excess heavy weight more than four times. By our material there is clear preponderance of the cohort of children with neurotic disorders the patients with excess slight weight, very slight weight and slight weight.

The Relationships between the Height and Weight

After J. Aul (Aul, 1982) the most important index in the evaluating of the relationships between height and weight is the ratio between height and weight where height and weight are adequate, weight may be bigger or smaller as expected. J. Aul uses the method of correlation coefficient. For the boys this index has been in the ranges 0.674 ± 0.020 to 0.855 ± 0.007 depending on the age of the tested

group and for the girls from 0.537 ± 0.021 to 0.795 ± 0.010. In the group examined by us the correlation coefficient has been 0.87 ($p < 0.05$). However these cannot answer exact to the question, how much there has been the patients who's height and weight have been in accordance. To determine the harmony between the height and the weight we had been put in pairs the estimated value of the height and the body weight according to the J. Aul assessment scale values. In this way it has become evident that on the 38 cases there has not been harmony among the estimated value of height and weight (19 boys and 19 girls). In the principle of dominating component we analyzed all these cases. It turned out that in 26 cases the estimated value of height preponderated the estimated value of weight. It has been get to clear that the development of height has been anticipated the development of the weight. Situation of the this sort has been in the cases of 14 boys and 12 girls. Over twofold less where the estimated value of weight in preponderance to the height. Only in 12 cases the estimated value of the weight anticipated the estimated value of the height, in 5 cases of the boys and the 7 cases of the girls. In such a way we can determine new line — in 38% of the cases there is not harmony among height and weight, which suggest disharmony in the development of physique of the person and may be one of the favorable agent to be taken ill.

The Somatotype

The different authors have used different terms to mark the somatotype. Thus M. V. Tshernorutski (Riiv, 1990) uses the name of hypersthenic type, E. Kretschmer — pycnic type and W. H. Sheldon and Heath–Carter–endomorphic type. By description we can conclude, that these different terms denote the individual, who's derivate of the endoderm preponderate — of soft roundness throughout the body, with large digestive viscera and accumulations of fat and with large trunk on thighs and tapering extremities.

Also there has been great similarity with the M. V. Tshernorutski asthenic type, E. Kretschmer asthenic and W. H. Sheldon and Heath–Carter ectomorphic type — a type of body build in which tissues derived from the ectoderm predominate, there is a preponderance of linearity and fragility with large surface area and slightly development digestive viscera as contrasted to endomorph.

Analogical has been the situation with M. V. Tshernorutski normosthenic, E. Kretschmer athlethic and W. H. Sheldon mesomorphy. Mesomorphic individual having a type of build in which tissues derived from mesoderm predominate: there is a relative preponderance of muscle, bone and connective tissue, usually with heavy, hard physique

of rectangular outline, a somatotype classified between ectomorph and endomorph.

In our paper we applied the Heath–Carter method for somatotyping, which permits using measuring by anthropometer, pair of compasses, types and pair of scales to assess three components of the body build: endomorph, mesomorph and ectomorph. In the table no. 4 there are our results of somatotyping.

Table 4

The distribution of the somatotype of neurotic children

No.	Somatotype	Boys	Girls	Total
1.	Endomorph	3	5	8
2.	Mesomorph	23	12	35
3.	Ectomorph	31	26	57
	Total	57	43	100

It is evident from the table no. 4 that in a population of children with neurotic disorders has been in preponderance ectomorphic type- fifty seven percent, the mesomorphy dominated in thirty five percent of the investigated children with neurotic disorders and only in eight percent there has been the endomorphic somatotype in prevail. To characterize the relationships among the somatotype and sex we compared the structure of the somatotype separately in boys and the girls. Among the boys fifty four percent has been ectomorphic, the forty percent has been mesomorphic and only five percent has been endomorphic. Among girls has been the situation different sixty percent has been ectomorphic, the twenty eight percent has been mesomorph and only twelve percent of endomorph somatotype.

Discussion

E. Kretschmer 's (1922) research in psychiatric population in German language literature is well-known in which the author introduced the information about 5233 schizophrenic cases. He found that among the schizophrenic cohort the somatotype distribution has been as follows- in 50.3 percent of cases there have been ectomorphic somatotype, in 16.9 percent of cases the mesomorphic (athletic) somatotype, in 13.7 percent of cases the endomorphic (pycnic, pycnomorphic type), in 10.5 percent of cases dysplastic and 8.6 percent of cases indeterminable somatotype. Entirely another has been the somatotype distribution in the cohort of manic-depressive psychosis (now affective reactions, mood disorders) — in 64.6 of the cases were

endomorphs (or the pycnic, or pycnomorphic type), in 19.2 percent of cases ectomorphs (or leptosome, or asthenics) somatotype, in 6.7 percent of cases the mesomorphs (or athletic somatotype), in 1.1 percent of the cases dysplastic somatotype and in 8.4 percent of cases the indeterminable somatotype. In America William H. Sheldon (1940) introduced in 1940 his somatotypes described as endomorphs, mesomorphs and ectomorphs. He also found that schizophrenics showed a conspicuous amount of dysplasia and similar to E. Kretschmer that schizophrenics had a tendency to be an ectomorph. He also declared that the manic-depressive psychosis was closely related to the endomorph and mesomorph.

As E. Kretschmer also W. H. Sheldon found correlates between the ectomorphy and tendency to restrained introversion, love of privacy and solitude and inhibition which has been characteristic also for persons with neurotic disorders. In 1982 E. M. Hartl (Hartl, 1982) presented a theoretical perspective on the constitutional method in their follow-up of the 200 delinquent boys in Sheldon study. They found relationships between somatotype and psychopathology to be important.

In Russian language literature N. N. Karganov (Karganov, 1928) had investigated the somatotype of the patients with hysteria (now it respond dissociative disorders) and found -ectomorphic (respiratory type) somatotype in 28.7 percent of cases, the mesomorph and mixed type in 28.7 of cases, very high percent of the dysplastic type in 28.7 percent of the cases and undetermined somatotype in 14.9 percent of cases. Thus N. N. Karganov did not found the affinity of the ectomorphy to hysteria. P. I. Emdin and coworkers (Emdin, 1928) had been found that among the patients of neurotic disorders has been affinity to the ectomorph somatotype in 44 percent of cases. In 20.3 percent of the cases persons had been considered as endomorph, in 16.5 percent of cases mesomorph and the mixed -undetermined somatotype 1.8 percent of investigated cases. As concern to hysteric neurotics P. I. Emdin and coworkers have found in 60 percent of cases the ectomorphic somatotype, the mesomorphic somatotype in 20 percent of cases , the dysplastic somatotype in 14 percent of cases , in 4 percent of cases the mixed -undetermined somatotype and only in 2 percent of cases endomorphic somatotype. Also in the cohort of the psychasthenic patients (now it is obsessive compulsive disorders) P. I. Emdin found 53 percent of ectomorphic somatotype. Among the schizoid neurosis there has been 40 percent of ectomorphic somatotype.

We may to conclude that our data which has been obtained from the children cohort has been very similar to the data of P. I. Emdin ,who's experience shows most often ectomorphic somatotype among the patients with neurotic disorders. It is also obvious that for the final decision we have to continue our research on the larger group.

Conclusions

1. Our data show that the failing ill with neurotic disorders of childhood has been he highest in the age group of seven to eleven and twelve to fourteen.

2. The sex ratio between the boys and girls to be taken ill with neurotic disorders as a rule has been in the youngest age to the benefit of boys. With the increasing age these benefit decreases and in the adolescence there has been clearly to the benefit of girls.

3. The distribution of height in our cohort is showed towards the shorter end. To the short range belong 51.6 percent of the studied subjects, 32.6 percent of the studied subjects are of medium height and tall and very tall subjects has been less — 15.8 percent.

4. The distribution of the weight in our material has been heterogeneous. Slight and very slight have been 65.3 percent of the studied subjects, middle weight has been in 19 percent and the heavy and very heavy have been only in 15.8 percent of the patients. The number of the slight persons has been four times greater than that with heavy weight and more than three times greater than that with middle weight.

5. Thirty eight percent of the children were found to have disharmony between the height and weight. This results is similar in both sexes.

6. In children with neurotic disorders the ectomorphy has been the prevailing somatotype .

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ESTONIAN SCHOOLCHILDREN'S DISEASES OF THE SPINE CURVES

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During their active lives, 80% of the people suffer for the back pain of various duration, intensity and disability. The pain and discomfort associated with low — back — pain (LBP) are frequently so acute that daily routines are completely disrupted. LBP remains one of the few widespread serious health problems that modern medicine has yet to conquer (Anderson, 1981; Patton *et al.*, 1986).

One step in the primary prevention program is to identify individuals at risk for LBP. The classical back patient is exhibiting one or more of the following characteristics: excess weight, extremely lordotic posture (abnormal curvature of the spine forward), absence of the regular exercise program, weak abdominal muscle, tight ham strings or hip flexors, weak or tight back muscles, and general tension (Kraus, 1972). A recent study found a significant positive correlation between individual strength (in relation to the physical demands of work) and lower frequency of LBP (Mellin, 1988; Troup, Martin, Lloyd, 1981).

Posture also plays a roll in the prevention or causation of LBP. Active dynamic posture is extremely important transporting objects. Static posture, exemplified when sitting or standing, may also contribute to LBP. Sitting in bent — over work postures increases the risk of LBP. It is also important to change posture while working. The need to avoid a prolonged posture and the importance of good body mechanics while standing or sitting can be taught in the health-fitness environment (Magora, 1970; Nachemson, 1976; Patton *et al.*, 1986).

Health — fitness professionals need not be diagnosticians, but should implement physician — prescribed exercise regimens for the acutely impaired. It is important to distinguish between primary prevention (involving individuals with no prior history of significant LBP) and secondary prevention (directed toward those who have evident clinical back disease or injury (Patton *et al.*, 1986).

The physiological spine curves (that we have got) have shown a clear trend of spinal mobility change during the time when the child is growing up. The lateral bending of spine showed a significant decrease between 5 and 10 years of age (30° $\longrightarrow$ 20° in spine).

Thoracic kyphosis angle shows an increase between 5 and 10 years of age. After the age of 10 no other changes (20°–30°) took place, but all age-groups contain children with increased kyphosis more than 40 degree as well. Lumbar lordosis curves are similar to the thoracic kyphosis, the change is also between 5–10 years of age (8).

The theory of physiological unstable spine accounts easily for a great number of postural defects. This find could help to understand better the cause of spinal diseases and postural defects, and their differences. It also permits a full investigation of the sagittal configuration and mobility of the spine in every patient with a spinal problem (Helsing, Reigo, 1987; Patton *et al.*, 1986; Viola, Andrassy, 1992; Willner, 1983).

The aim of the present research was to find out the shifting of spine curves from the normal position with 7–18-year-old schoolchildren (n = 8540). The observation method was used and it was carried out by medical workers.

Obvious changes from the normal curves occurred with 1.225 or 14.3% of pupils. The spine curves mainly happened on the frontal level (scoliosis) with 590 pupils or 48% of the cases. The major reason for developing the physiological scoliosis is the different length of the legs. Pathological scoliosis is caused by the wrong positions of the body while walking, sitting, doing bodily exercises.

Changes in lumbar lordosis occurred with 385 or 31.4% of pupils, the corresponding figures in thoracic kyphosis being 165 or 13.5%. Flattened back occurred with 85 or 7% of the pupils.

Most of the cases of poor carriage happened with the junior pupils (from 7 to 11 years of age), they formed 64% of all the cases (12–15-year-olds: 20%, 16–18-year-olds: 16%).

Our research has proved that more attention must be paid to the development of the right carriage in the junior forms. The wrong carriage is one of the main reasons which results in back pain. To avoid the latter, special programs for bodily exercises must be applied.

Through proper education and appropriate exercise program, health-fitness practitioners may significantly decrease the severity, if not the incidence, of low–back–pain. All the teachers of physical education must know that proper body mechanics (that is, good posture and movement) play a critical roll in preventing LBP not only when lifting objects but in all the activities of daily living. Poor body mechanics place the muscles and vertebrae at a distinct disadvantage. Eventually, the muscles cannot support this added stress and pain occurs. This is especially true in the lumbar region (the lower area of the back), where poor posture and muscle weakness exaggerate the normal curvature (lordosis). Thus, static posture while standing or sitting is surprisingly important in the prevention of LBP.

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INFLUENCE OF PHYSICAL ACTIVITY ON OVERWEIGHT WOMEN'S WEIGHT, PHYSICAL WORK CAPACITY AND BODY COMPOSITION

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Introduction

Physical training according to one's abilities presents one of the best possibilities for regulating one's body weight and body composition, for raising one's working capacity. Bodybuilding is extensively applied for this purpose. Bodybuilding consists of 3 components: weight training, aerobic training and diet. It is suitable for both sexes, all age groups, for people with different levels of physical abilities (Dobbins, 1993; Hartglass, 1993; Weider, Reinolds, 1989).

Many persons tackle the problem of losing weight. Low-calorie diets that reduce weight fast are very often used in practice. Excessive restriction of carbohydrates and liquids is deteriorating to one's physical and mental health and affects working capacity (Tanny, 1993; Tremblay *et al.*, 1986; Tremblay *et al.*, 1988).

The best way to lose weight and raise physical work capacity is a program that combines aerobic work with weight lifting and diet. Aerobic training is perfect for burning fats but it does not guarantee the good physical state of the body and physical work capacity. Bodybuilding guarantees the achievement of the above — mentioned goals. Numerous researches have proved the effect of bodybuilding on the organism of men and women in all the age groups. Bodybuilding makes muscles stronger and gives them a good shape and working capacity increases (Larson, 1993; Lefavi, 1990; Levafi, 1993; Weider, Reinolds, 1989).

Our goals were: to study the effect of bodybuilding on overweight women's weight, physical work capacity and body composition.

Methods

A research was carried out involving 13 women who had not trained before. Their average age at the first stage of the research was 24.5 ± 1.7 years, height 167.2 ± 1.4 cm and weight 81.1 ± 2.5 kg (x ± SE). At the beginning of the experiment the body weight of the observed persons was fixed and the percentage of the fat mass in the whole body mass was determined according to V. Parizkova's method (1977). The ideal weight and body mass index was fixed according to Broca. At the end of the experiment the increase in physical working capacity (PWC 170) was observed in all the subjects.

The 8-week experiment included 2 bodybuilding and 2 aerobic trainings a week. Twelve most common basic and isolated exercises were applied. An aerobic training consisted of swimming (2 × 30 minutes a week) with the average heart beat of 125–135 per minute. Energy balance was reduced to 7.000 kcal a week, including 2.300 kcal covered by the increase of physical activity. Transition to reduce calorage took place gradually (100 calories a day) during one week. The obtained results were statistically analyzed by the paired t-test, comparing the individual's values recorded before and after the experimental period. The level of statistical significance was set at $p < 0.05$.

Results and discussion

At the beginning of the experiment the average weight of the observed was 81.1 ± 2.4. kg being 13.9 kg more than the ideal weight. The ideal weight of the observed persons was 67.2 ± 1.4 kg according to Broca. During the 8-week training period the weight of the participants decreased approximately 7.9 kg ($p < 0.01$). It makes about 1.0 kg a week according to set the goal. The biggest loss of weight took place during the first three weeks caused by changes in the eating habits. During the following weeks weight loss stabilized.

Before the training cycle the mean PWC170 in the group was 901.5 ± 24.4 kg/m by minute.Thus, the mean growth was 138.9 ± 13.9 kg/m by minute ($p < 0.05$) (Figure 1).

The essential changes took place in body composition. The fat percentage of the observed women decreased by 4.3 ± 0.6% ($p < 0.01$) on the average. The average weight of the observed persons decreased together with the decrease of fat mass 5.8 ± 0.7 kg ($p < 0.01$) and with the decrease of fat-free mass 2.3 ± 0.3. kg on the average that was not statistically significant ($p > 0.05$) (Figure 2).

In practice people often use low-calorie diets. Immoderate restriction of carbohydrates and liquids leads to the deterioration of one's physical and mental state, including one's working capacity. To nor-

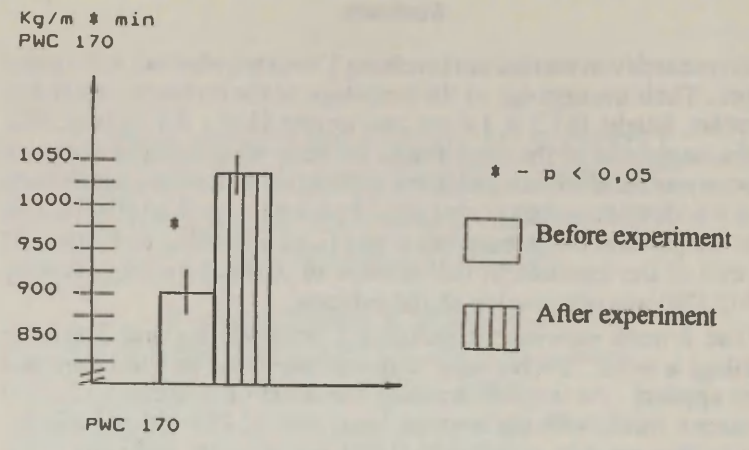

Figure 1. Effect of 8-week program on physical working capacity (PWC_{170}

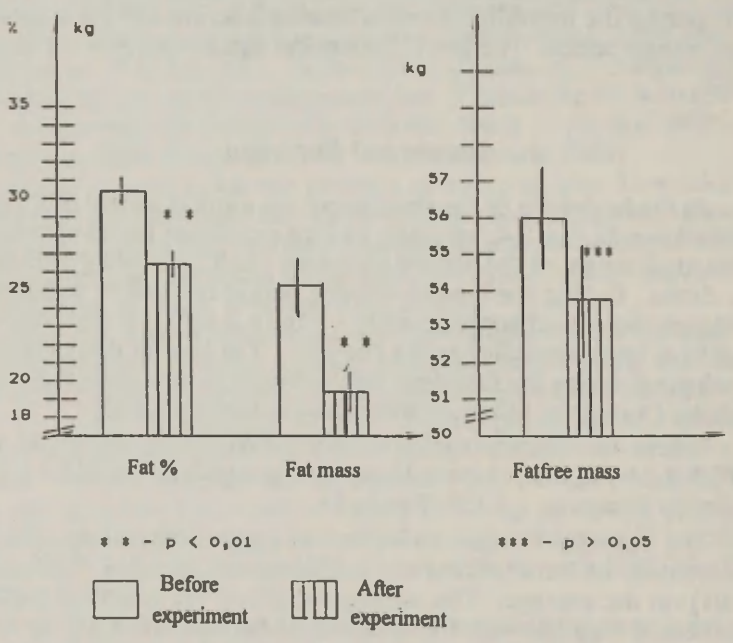

Figure 2. Effect of 8-week training on indices of body composition

malize one's body weight one must first use a long-term low-calorie diet which results in the burn-out of fats (Dobbins, 1993; Fahey, 1993;

Lefavi, 1993). To achieve it, one must train with resistance. The ideal solution is the balanced low-calorie ration which enables to reduce one's body weight by 1 kg a week by training regularly (Weider, Reinolds, 1989). Our experiment has proved that bodybuilding is a suitable means for losing weight simultaneously increasing the physical working capacity.

Conclusion

1. During the 8-week experiment (bodybuilding + aerobic work + diet) overweight women (on the average 13.9 kg heavier than the ideal weight determined by Broca) lost 7.8 ± 0.6 kg ($p < 0.05$) on the average. Training and diet guaranteed the decrease of weight of about 1 kg a week. Losing weight took place mostly by means of decreasing passive body mass (fats) 5.8 ± 7 kg ($p < 0.01$) on the average.

2. The physical working capacity (PWC170) increased 138.9 ± 13.9 kg/m by minute ($p < 0.05$).

3. The fat percentage of the observed women decreased by $4.3 \pm 0.6\%$ ($p < 0.01$) on the average. The average weight decreased with the decrease of fat mass 5.8 ± 0.7 kg ($p < 0.01$) and with the decrease of fat — free mass 2.3 ± 0.3 kg on the average ($p < 0.05$).

4. Our experiment has proved that bodybuilding is a suitable means for losing weight, increasing the physical work capacity, at the same time.

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A LONGITUDINAL STUDY OF SOMATOMETRIC MEASUREMENT DYNAMICS AMONG GIRLS FROM 15 TO 17 YEARS

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Abstract

A longitudinal study of somatometric parameters and some functional traits (vital capacity of lungs, hand dynamometry) was carried out on 58 girls at the age of 15 and 17. The post pubertal cessation of growth turned out to be very individual. Besides the inherited factor, the speed for "feminal" body type development is remarkable. In the adolescence years the body proportions change: the sitting height increases, also the significance of head-neck and chest parts in the body dimensions. The relative length of abdomen decreases. The index biacromial breadth / bicristal breadth changes twofold-among some individuals towards the growth of importance of hip breadth, among the others towards the growth of importance of shoulder breadth.

The weight dynamics is related to the active weight, especially to the dynamics of muscle component. The quantity of fat layers does not change notoriously during the adolescent years, but it is relocated from abdomen and trunk to arms, upper parts of thighs and to back. The acceleration among Estonian girls has probably become faster in the last fifteen years.

Introduction

The age standards for evaluating the bodily development of girls have been worked out basically upon cross-sectional study. The evaluations of growth dynamics are based to a noticeable degree on the differences between age groups and thus they equalise the situation (Silla *et al.*, 1989). By this data it is possible to judge the general tendency of changes, but they can not be used in every particular case. For example it is known, that the growth of girls stops at the age of 18–19 (Kaarma, 1981). In fact the cessation of growth is very indi-

vidual. It can be seen also from the big variation in the values of the variable.

The necessity for individualisation of the dynamics of the variables in longitudinal research has been noticed by several authors (Sapin, 1992).

The aim of our work was to state, which are the individual characteristics in the growth dynamics among adolescent females, as up to recent times there was no data available concerning Estonian girls.

Subjects and methods

The group involved in the study comes from town Põlva and constitutes of 58 girls in the age 15 and 17. The age is based on the anthropological basis (Heapost, 1984). From the contingent under study 80% was from local population. According to well known methodologies (Bunak, 1941; Martin, 1956) 43 anthropological measurements were taken. To investigate the body proportions relative measurements and 18 indices were individually compared on this basis. Skinfolds were measured in 8 different regions according to the caliper method. From physiometric traits vital capacity of lungs and the right hand dynamometry were taken. The sexual development was evaluated by the existence of menarche. The exactness in linear measurements was 1 mm, in body weight 0.1 kg, dynamometry 0.5 kg, in lung capacity 0.1 liters. To avoid technical mistakes both measurements were carried out in the season (spring), in the morning and by the same person.

The data is calculated, using the method of multivariate statistical analysis. Paired Student t-tests were used to compare the differences between the groups. The p-value of 0.05 was accepted as statistically significant.

Results and discussion

The most important absolute and relative measurements and indices of longitudinal research are brought in Table 1. In post adolescent period statistically remarkable increase takes place in bicromial and bicristal diameters and in the circumference of neck, body trunk and proximal parts of limbs. The absolute increase of limb length is bigger in the upper limbs (0.67 cm, $p < 0.001$) than in the lower limbs (0.15 cm, $p > 0.05$). At the same time the relative length of limbs did not change.

In the increase of stature an important role was played by the

Table 1

Basic statistics of anthropometric measurements and indices of girls in ages 15 and 17 years and their differences

Variable	Age of 15 years			Age of 17 years			Differences between age of 17 and 15 years				
	Mean	SD	v	Mean	SD	v	Mean	SD	min	max	v
Stature (cm)	166.64	7.07	4.24	169.0	6.98	4.13	2,34*	1.56	0	6.3	2.43
Weight (kg)	54.03	8.92	16.52	58.8	7.77	13.21	4.52*	5.53	–3.9	30.4	30.63
Sitting height	86.94	3.75	14.08	88.74	3.75	3.42	–	–	–	–	–
Biacromial breadth	34.94	1.42	2.09	36.12	1.5	2.4	0.81*	0.77	0	2.8	0.59
Chest breadth	24.23	1.67	6.99	24.53	1.33	4.57	0.21	1.33	–3.1	5.1	1.78
Chest depth	17.06	1.73	2.99	17.15	1.46	2.13	0.15	1.45	–1.4	4.6	2.11
Abdomen breadth	21.51	1.70	2.91	21.89	1.88	3.54	–	–	–	–	–
Abdomen depth	17.14	1.66	3.0	14.79	1.91	3.65	–0.08	1.89	–1.9	5.5	3.55
Pelvic breadth	26.46	1.68	6.34	27.2	1.74	3.05	0.96*	1.96	–1.0	7.4	3.86
Upper limb length	72.46	3.88	15.1	73.09	3.73	13.96	0.67*	1.65	0	5.2	2.74
Lower limb length	78.75	25.1	26.07	79.44	5.03	25.33	0.15	0.15	0	2.4	0.28
Neck circumf.	30.35	1.8	3.24	31.48	1.63	2.67	0.61*	0.72	–0.6	1.9	0.52
Upper chest circumf.	80.26	4.9	24.16	83.37	3.67	14.22	2.3*	2.65	–5.6	8.7	7.03
Lower chest circumf.	71.49	5.71	32.67	73.77	4.7	20.12	0.91	3.59	–4.8	15.8	12.9
Waist circumf.	63.62	5.2	27.07	66.17	5.21	27.14	1.96*	2.87	–3.0	11.7	8.24
Pelvic circumf.	89.78	6.02	43.9	93.62	7.0	49.09	3.86*	5.21	–3.9	26.4	27.14
Arm circumf.	23.69	2.48	6.17	24.82	2.3	5.8	1.06*	1.78	–1.5	8.1	3.16
Forearm circumf.	22.43	1.57	2.46	23.12	1.53	2.34	0.58*	1.00	–1.5	4.5	1.01
Wrist circumf.	15.21	0.72	0.51	15.56	1.31	1.73	0.09	0.58	–1.3	2.4	0.34
Proximal thigh circumf.	54.13	5.04	9.31	55.34	4.33	18.7	2.12*	4.17	–3.4	20.7	17.39
Distal thigh circumf.	48.7	5.13	26.55	18.63	4.25	18.08	0.47	4.39	–5.1	18.5	19.32

Continued Table 1

Variable	Age of 15 years			Age of 17 years			Differences between age of 17 and 15 years				
	Mean	SD	v	Mean	SD	v	Mean	SD	min	max	v
Calf circumf.	34.23	2.48	6.17	34.76	3.07	9.43	0.89	1.72	−1.7	8.7	2.95
Lower leg circumf	21.92	1.34	1.8	22.04	1.13	1.29	0.26	1.09	−0.9	5.3	1.18
Finger lenght	9.82	0.49	8.25	9.97	0.48	0.23	0.13	0.19	0	0.7	0.03
Relat. head -neck lenght	3.07	1.15	1.32	31.39	1.36	1.85	–	–	–	–	–
Relat. chest lenght	8.61	0.86	0.76	9.35	0.9	0.81	1.25*	2.05	–	–	4.2
Relat. upper limb length	83.72	1.02	1.05	43.45	1.01	1.03	−0.31	0.85	−2.0	1.5	0.72
Relat. lower limb length	47.5	1.61	2.59	47.2	1.35	1.81	−0.18	1.21	−2.5	4.6	1.47
Relat. finger length	5.96	0.27	0.07	5.93	0.23	0.05	0.007	0.18	0	0.2	0.18
Relat. abdomen length	20.03	1.61	2.58	10.1	1.25	3.43	−0.61*	1.31	−3.4	2.2	1.71
Relat. biacromial breadth	21.1	0.25	0.73	21.49	0.03	0.69	−0.09	1.41	−7.2	1.14	1.99
Relat. chest breadth	14.89	1.05	1.1	14.6	0.72	0.51	0.07	1.21	−2.2	5.2	1.48
Relat. chest depth	10.29	1.0	1.0	10.21	0.92	0.84	0.3	1.67	−8.2	2.37	2.81
Relat. abdomen breadth	12.99	1.05	1.1	13.02	1.05	1.1	−0.1	0.90	–	–	0.81
Relat. abdomen depth	10.3	6.69	4.8	8.8	1.17	1.37	−0.16	1.21	−1.6	3.7	1.45
Relat. bicrystal breadth	15.87	1.01	1.02	16.18	0.85	0.72	0.12	1.15	−3.1	3.0	1.32
Biacromial breadth											
Chest breadth	144.7	7.15	51.1	147.4	6.91	47.8	3.06	6.27	−17.8	14	39.4
Biacromial breadth											
Bicrystal breadth	133.3	7.72	59.6	133.12	7.29	53.2	−1.44	8.27	−29.2	8.9	68.31
Chest breadth											
Bicrystal breadth	92.3	6.93	46.7	90.4	5.48	30.0	−2.09*	4.11	−10.2	5.0	16.85
Chest circumf.											
Pelvic circumf.	89.45	3.3	11.1	89.3	4.56	20.8	−0.60	3.43	−7.9	9.8	11.81

Continued Table 1

Variable	Age of 15 years			Age of 17 years			Differences between age of 17 and 15 years				
	Mean	SD	v	Mean	SD	v	Mean	SD	min	max	v
Upper chets cicrumf.											
Lower chest circumf.	125.0	71.0	50.9	113.0	4.0	1.0	–	–	–	–	–
Chest circumf.											
Waist. circumf.	126.4	5.82	33.8	126.4	5.57	31.1	0.12	3.39	–5.7	7.5	11.51
Chest breadth											
Chest depth	143.07	14.69	21.6	143.9	13.1	17.1	–0.53	10.18	–31.9	16.8	103.8
Forearm circumf.											
Wrist circumf.	147	6.4	0.41	148.9	9.2	0.85	0.037	0.06	–0.16	0.19	4.05
Wrist circumf.											
Lower leg circumf	69.48	3.34	11.18	70.78	6.25	39.15	–0.5	2.60	–8.4	3.8	6.76
Proximal thigh circumf.											
Distal thigh circumf.	110.4	3.35	11.23	113.74	21.9	48.15	3.85*	4.49	–4.3	17.3	24.4
Rohrer index	1.17	0.19	0.04	1.23	0.17	0.03	0.03	0.24	–0.77	0.57	0.05

* $p < 0.05$;

increase of sitting stature. It is worth mentioning the importance of subcomponents in the relative change of sitting stature during the adolescence. The share of head-neck and chest increases ($p < 0,05$), while the abdomen length decreases.

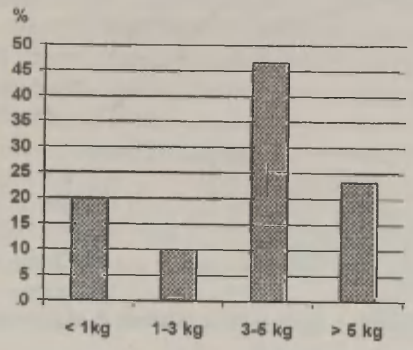

Figure 1. Distribution of stature increase in relation of weight at the age 15

When comparing the girls measured by us with the material gathered by L. Heapost in 1966 and by R. Silla, H. Teoste in 1984–1985, we can see that the girls measured by us when at the age fifteen, are 2 cm taller and when seventeen, were 2.5 cm taller. Also the average increase of stature exceeds notoriously the results gathered by the previously mentioned scholars. One can connect it with regional characteristics, or an important role has been played by the spreading in recent years acceleration.

Both 15 and 17 years old groups lacked any correlation between the stature and their stature at birth. Also the growth between 15 and 17 did not depend from the stature at the age of 15. On the other hand we noticed a negative correlation in connection with the weight of the 15 year group. From the frequency table of increase it is evident that 47% of girls did not grow during the two years, or did it minimally (less than 2 cm). 13% of girls grew more than 5 cm. Most frequently and to a greatest extent grew the girls of the medium stature (Figure 2). The increase in stature correlates with the increase in weight ($r = 0.462$), breadth diameters and with most of the circumferences ($r = 0,4 \ldots 0.3$). There is no link between the increase in stature and the circumference of neck and waist. The increase in stature is in a negative correlation with the trunk and lower limb circumferences at the age of 15. In this case the strongest relations are with the circumference of abdomen ($r = -0,57$) and proximal circumference of the thigh ($r = -0,53$).

The weight of girls was 3.7 kg at the age of 15 and 3,4 kg at the age of 17 less than the data by R. Silla (Silla, 1989). Although the number of individuals under our study was smaller than that in Silla's

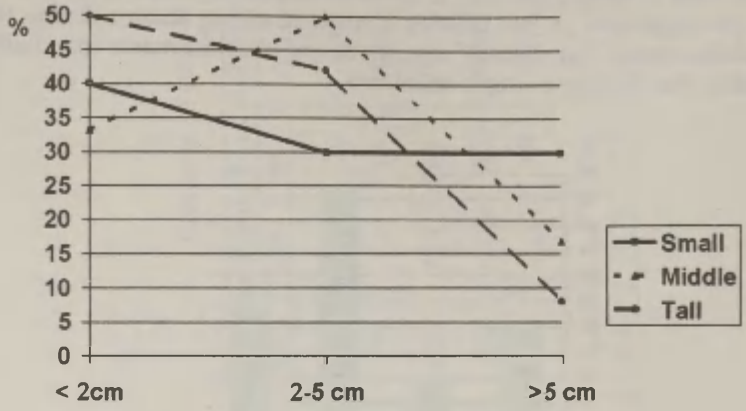

Figure 2. Distribution of stature in relation in stature at the age 15

research, one has to take into account that our study covers 80% of a regional population. According to our data only 5% of girls exceeded the weight of 67.8 kg. At the same time 10% of the girls had their body weight in a critical area (40 kg and below that). An average increase of weight within two years was 4.52 kg, but the degree of variability was noticeably big. Even if we eliminate data concerning one girl gaining 30.4 kg in weight and 6.3 cm in stature within two years, the variability remains noticeable (Figure 1). It is important to state, that among 20% of the girls the weight did not increase, or decreased. The weight dynamics is not dependent on the weight and stature at the age of 15. The increase in weight correlates to the biggest degree with the circumference of wrist ($r = -0.54$) of the 15 year olds. Much smaller are the relations with the data characterising the circumferences of soft tissues of limbs ($r = 0.4...0.3$).

The weight dynamics is most clearly related with the dynamics in the caudal part of body trunk ($r > 0,8$) and the absolute increase of the muscle weight ($r = 0.84$). There is also a noticeable connection with the dynamics in chest breadth diameter ($r = 0.74$). The relations with other diameters and circumferences is much weaker. The weight dynamics does not correlate with any of stature dynamics.

We studied the dynamics of anthropometrics measurements for girls aged 15–17, and found different trends of different anthropometrical measurements. For example the biacromial breadth which had a noticeable increase in the whole group. In fact it did not increase at all, or increased less than 1 cm among 60% of children. The diameter of chest and abdomen depth shortened among 50% and the distal circumferences of thigh decreased among 33% of children.

In post-adolescent years there take place important changes in the

body proportions. Although the index biacromial breadth/bicristal breadth did not change notoriously in 2 years, we noticed that among 59% of girls the index increased and among 40% it decreased The proximal thigh to distal thigh circumference ratio increased notoriously among several girls. It is possible to state that during the adolescence years the transformation from infantile body buildup into an adult one takes place-relatively broad shouldered and narrow hipped individuals are formed. The lower limbs have their cylinder-like forms transformed into a conic one.

Prominent place among the dynamics of different body measurements is reserved for the dynamics of chest breadth diameter. The latter is closely related to the dynamics of the distal parts of the body stem and the dynamics in the circumferences of the lower limbs ($r = 0.7...0.6$). The relations are less stressed with the dynamics in circumferences of the upper limbs and neck ($r = 0.6...0.5$). The correlations between the dynamics of chest breadth diameter and other chest measurements, but also between the bicristal and biacromial breadth does not exceed values of $r = 0.4...0.3$.

Both chest depth and abdomen depth diameter dynamics are notoriously correlating with the dynamics in the circumferences of upper limbs, usually with the wrist circumference dynamics ($r = 0.52$). The dynamics of the biacromial breadth does not correlate with dynamics of any other measure, besides that of the chest breadth diameter. The dynamics in the circumference of neck is related to the dynamics of chest breadth diameter ($r = 0.55$), to the dynamics of the proximal circumference of thigh, circumference of leg and to the dynamics in muscular weight ($r = 0.52$).

The changes in body composition in the adolescence consist respectively in the growth of body weight as a result of growth in muscular weight, at the same time the relative part of the latter in an average does not change. When the dynamics in the muscular weight is analysed individually, it becomes evident, that noticeable increase of it takes place only among 47% of girls. Among 13% the muscular weight both in absolute and relative value even decreased. The dynamics of muscular weight among the 15 year olds correlates with the body weight, chest and abdomen breadth diameters and the caudal from navel circumferences ($r = 0.6...0.5$). The relations of the dynamics in the muscular weight are strong with the dynamics in body weight ($r = 0.84$), the circumference of upper limbs, waist, abdomen, hip and the proximal circumference of the thigh ($r > 0.76$). Notoriously weaker ($r = 0.5...0.4$) are the relations between the dynamics of the stature and the circumferences in the upper part of the body. The dynamics of muscular weight is notoriously related ($r = 0.71$) to the dynamics of Rohrer index. At the same time there is no relations to the dynamics of the fat component.

The quantity of fat practically did not change, the results staying

Table 2

Basic statistics of skinfolds and body composition of girls of the age 15 and 17

Variable	Age of 15 years			Age of 17 years			p
	Mean	SD	v	Mean	SD	v	
Body surface area (m^2)	1.58	0.15	9.54	1.75	0.13	7.67	$p < 0.05$
Mass of muscular tissue (kg)	3.09	5.60	31.3	33.74	6.38	40.7	$p < 0.05$
Relative mass of muscular tissue	57.82	2.12	4.52	57.66	6.03	36.47	
Mean skinfold (cm)	1.02	0.39	0.15	1.07	0.34	0.34	
Chest skinfold	0.87	0.42	0.11	0.8	0.37	0.14	
Subscapular skinfold	0.75	0.28	0.07	0.8	0.70	0.34	
Biceps skinfold	0.85	0.44	0.20	0.85	0.42	0.43	
Triceps skinfold	1.15	0.48	0.23	1.24	0.41	0.16	
Forearm skinfold	0.56	0.26	0.72	0.53	0.24	0.05	
Upper leg skinfold	0.20	0.08	0.40	0.18	0.05	0.30	
Pelvic skinfold	1.25	0.63	0.41	0.96	0.56	0.50	$p < 0.05$
Distal thigh skinfold	2.17	1.01	1.03	2.23	0.82	0.68	
Calf skinfold	1.44	0.54	0.30	1.26	0.43	0.19	
Mean skinfold of upper limb	0.75	0.33	45.07	0.82	0.27	32.9	
Mass of adipose tissue of lower limb (kg)	2.09	0.94	44.88	2.32	0.77	33.93	
Mass of adipose tissue of trunk	0.84	0.14	17.03	0.83	0.04	49.21	
Abs. mass of adipose tissue	11.10	3.89	35.02	11.12	3.08	27.72	
Rel. mass of adipose tissue	19.42	4.28	22.04	19.44	3.39	17.45	
Vital capacity of lungs (l)	2.65	0.47	17.87	2.99	0.56	18.90	$p < 0.05$
Right hand dynamometry (kg)	28.61	4.8	16.80	35.16	5.87	16.70	$p < 0.05$

remarkably lower than these of other researchers (Heapost, 1984; Silla, 1989; Thetloff, 1992). Also there was no dynamics in the mean values of the skinfold. At the same time we noticed a tendency in the rearrangement of the outer fat layer. There is a tendency towards the increase of the skinfold in the region of *m. triceps* and in general towards the increase of the upper limb fat layers. The latter tendency is confirmed by other authors (Gasser *et al.*, 1994; Mueller *et al.*, 1994). The fat layer increases in the subscapular region and in of thighs, it decreases in the areas of abdomen and legs.

When evaluating the functional markers and their dynamics (Ta-

ble 2), we see that although the vital capacity of lungs and the hand dynamometry of the right hand have increased noticeably during the two years, their values are not sufficient as not fulfilling the average requirements. The functional variables did not correlate with any of the anthropological ones. There is also no correlation between the dynamics of the two.

There is possible to see dependence (r = 0.45) between the dynamics of functional markers and their values among the 15 year old individuals. Probably the local characteristics of muscles and several exogenetic factors play a remarkable role for the functional variables.

The cessation of growth among girls in adolescence is very individual, a genetical factor playing the crucial role probably. There is a link between the cessation of growth and development of feminal body buildup.

During the adolescence a typical for adults somatotype is formed. This should perhaps be taken as a basis for later clinical evaluations where anthropometric data is used. The further changes in the somatotype are resulting from secondary exo- and endogenetic influences.

The increase of body weight during the adolescence is related with the increase of active weight, mainly muscular weight. The share of the fat component does not increase remarkably, but there is a rearrangement from abdomen and chest to the upper arm and thighs.

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AEROBIC GYMNASTICS: A TOOL OF IMPROVED STAMINA IN ADULT WOMEN

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Ontogenetic development of motor capacities reaches the top in 16–17-year old female adolescents (Malina, Bouchard, 1991). Nevertheless, systematic physical exercises can essentially correct the level of motor capacities and induce a further improvement. It is assumed by instructors of the continuous activity, the influence on women's body can be regulated. Positive action of aerobic gymnastics or aerobic dance on aerobic working capacity is convincingly evidenced (Williford *et al.*, 1988, Jürimäe *et al.*, 1989). This study was aimed to check the opportunity for improved muscular strength and thereby to promote the women's stamina with the aid of aerobic rhytmic gymnastics.

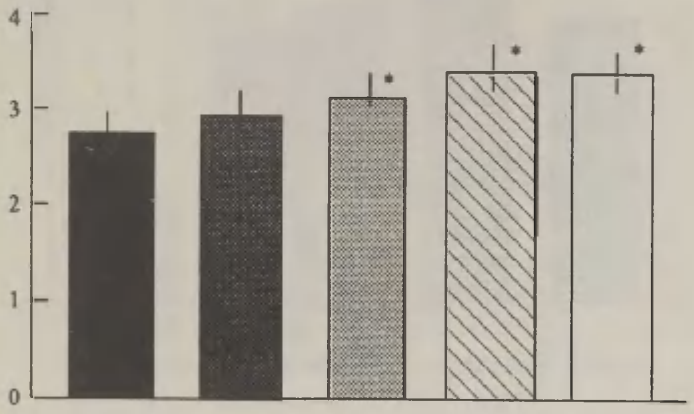
Methods

In a cross-sectional study 5 tests of dynamic strength were performed by 63 female university students (age 18 to 24 years), participating in aerobic rhythmic gymnastics twice in a week. They were divided into groups of gymnasts of the first year ($n = 16$), gymnasts of the second year ($n = 12$), gymnasts of the third year ($n = 14$) and gymnasts of the fourth year ($n = 21$). The control group consistuted 20 physically inactive university students of the same age. The sessions of aerobic gymnastics constituted in three parts: 1. warm-up exercises, 2. 30 min in order to aquire exercise combination and programs, 3. 30 min for aerobic gymnastics. In the part for aerobic gymnastics exercises with elevated resistance were included.

Results

The forward push of stuffed ball occurred to be improved in gymnasts of the second year (Figure 1.). The further improvement was statistically insignificant ($p > 0.05$). Results of throw of stuffed ball to the back improved after a year of gymnastics ($p < 0.05$). The obtained

level persisted during next three years. Results of forward throw of stuffed ball occurred to be improved in gymnasts of the third and fourth year (Figure 2.).



Forward push of stuffed ball in sitting position with fixed back

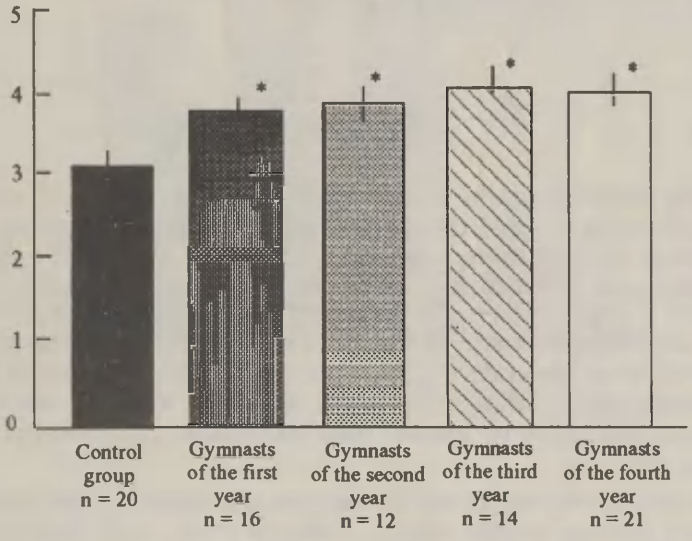


Figure 1. Throw of stuffed ball to the back of in sitting position

After a year of rhythmic gymnastics students were able to lift their legs in hang position twice more times than the students of control

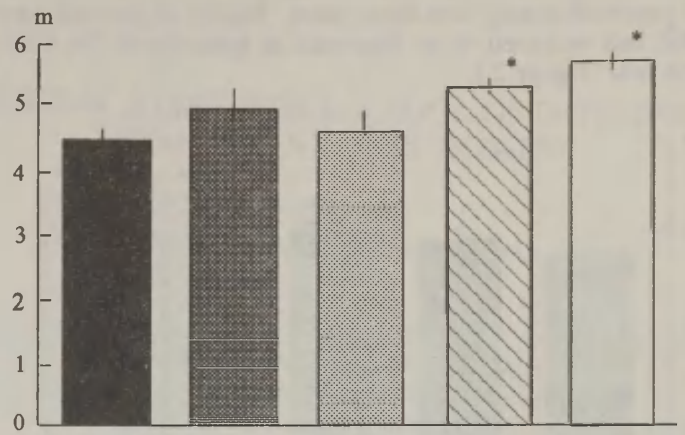


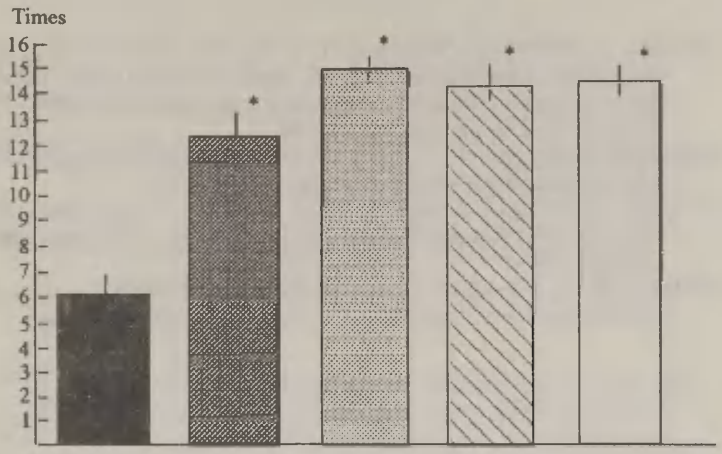
Figure 2. Forward throw of stuffedball in standing position

group. (Figure 3.). A further increase appeared after two year of gymnastics. Then the results stabilized on the achieved level. Results of standing board jump were improved also in the first year gymnasts. Further improvement was not found. A reduced level of results appeared in students of the fourth year.

Discussions

The obtained results showed that already after a year of practice, gymnasts surpassed members of the control group by results of 3 tests of dynamic strength and after 3 years by results of all 5 tests. These results of the cross-sectional study are in accordance with results of a longitudinal study, performed by us (Neissaar *et al.*, 1994). The improvements were not similar to strength training effects in female athletes. Nevertheless, there cannot be serious doubts that the improved muscle strength in women, practicing aerobic gymnastics ensures their ability to "covern" own body and to cope in everyday's motor activities.

Previous results evidence that aerobic gymnastics is a tool for improved maximal oxygen uptake (Williford *et al.*, 1988, Jürimäe *et al.*, 1989) and for antisclerotic change in blood lipoprotein content (Jürimäe *et al.*, 1989). By results of this study aerobic gymnastics can be used for improved muscle strength as well. Consequently, the aerobic gymnastics is a tool for promoting of the women's stamina.



Lifting of legs in hang position

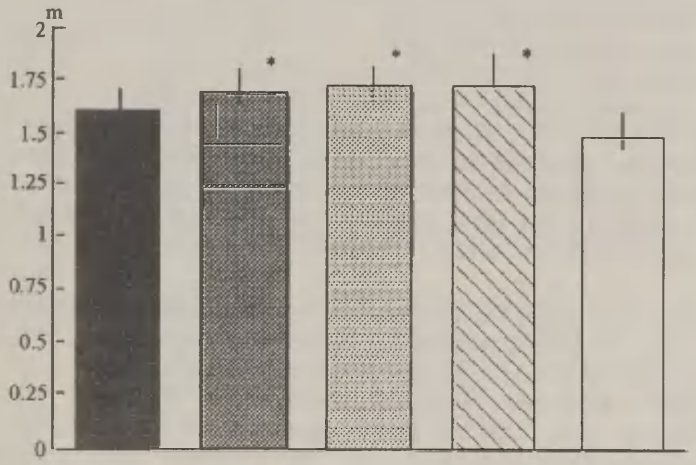


Figure 3. Standing broad jump

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CONSTITUTIONAL APPROACH TO ESTIMATE THE PHYSIOLOGICAL FUNCTION PATHOLOGY OF WOMEN'S GENITAL SPHERE

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Modern practice in obstetrics-gynecology needs a thorough knowledge of the woman's organism. The up-to-date to study the peculiarities of the woman's organism through anthropology.Anthropology enables us to get information on physiological and pathological processes in woman's genital sphere.

The problem of using anthropological research in medicine requires more attention, although some work has been done in this field. A. U. Cliorin (1979) has a method of giving medical prognosis at the beginning of postnatal development about the influence of toxicosis of pregnancy. I. A. Arshavski (1968) has pointed to the dependence the child's constitution on the course of pregnancy. H. T. Kaarma (1991) has defined a regularity between the course of pregnancy and the weight of the newborn, which depends on mother's somatotype, but the number of these articles is few. One can meet only a few works in the connection between gynecological diseases and the patient's constitution.

Therefore, the staff of the Chair of Anatomy at Krasnoyarsk Medical Institute made anthropological measurements among 991 women, aged 17–35, inhabitants of Krasnoyarsk. I. B. Galant's scheme (1927) with 7 basically types of soma was used. The definition of soma is based on a 5 point system. There are three main groups: leptosomatic constitution (asthenic and stenoplastic) which includes narrowly constituted, thin and not tall women; mesosomatic (athletic, subathletic) — with thick bodies and some fat. One more soma is distinguished as an indefinite soma, which does not correspond to any special group and includes stout women.

The analysis of the investigation gave the following results: 69.7% of women are constitutionally megalosomas, 14% — athletic, 23.3% — subathletic, 32.4% — euriplastics. Leptosomas are the next, they make up 13.6% (asthenics — 1.3%, stenoplastics — 13.6%). Mesosomas constitute 11.5% (mesosomatic somatotype 8.48%, pycnic — 3.03%). 55 women, that is 5.15%, had anindefinite somatotype.

Another research is presented by the Krasnoyarsk center "Matrimony and family on the base of gynecology clinic No. 4". They studied not only anthropological measurements but also the menstrual cycle and diagnosed diseases. The number of women investigated 245. By somatotype they were distributed in the following way: megalosomas — 64% (athletic somatotype — 13%, subathletic — 17%, euriplastic — 34%); leptosomas — 13% (asthenic somatotype — 1%, stenoplastic — 12%); mesosomas — 16% (mesaplastic — 11%, pycnic — 5%); non-definite somatotype — 7%. This proves the fact the distribution of women by somatotype, studied at the clinic, corresponds to their distribution in the population.

Next, the time of menarche, the period of menstrual cycle were studied (Figure 1, 2). At the age of 13–14 70% of girls in all the groups had menarche (mesosomas — 70%; indefinite — 61%). Before 12 years leptosomas — 20%, megalosomas — 21% and indefinite — 28%. And at a later age — 17%, 16% and 18% accordingly.

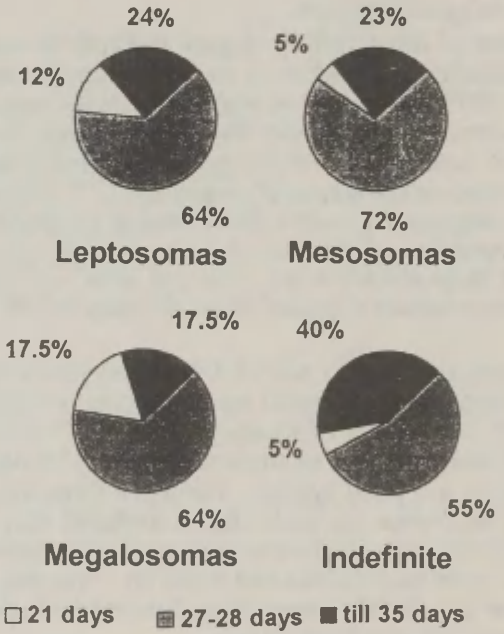

Figure 1. About menstrual cycle at the examed women depending in somatotype

The period of menstrual cycle displayed some differences too: it lasted 27–28 days in 71% of mesosomas, 64% of leptosomas, 65% of megalosomas and 55% of the indefinite group. A shortened cycle —

occurred in 5% of mesosomas, 12% of leptosomas, 17.5% of megalosomas and 5% of the indefinite somatotype. A prolonged cycle (till 35 days) occurred in 23%, 24%, 17.5%, 40%.

The period of menstrual cycle depends on the constitution of the body (Figure 2):

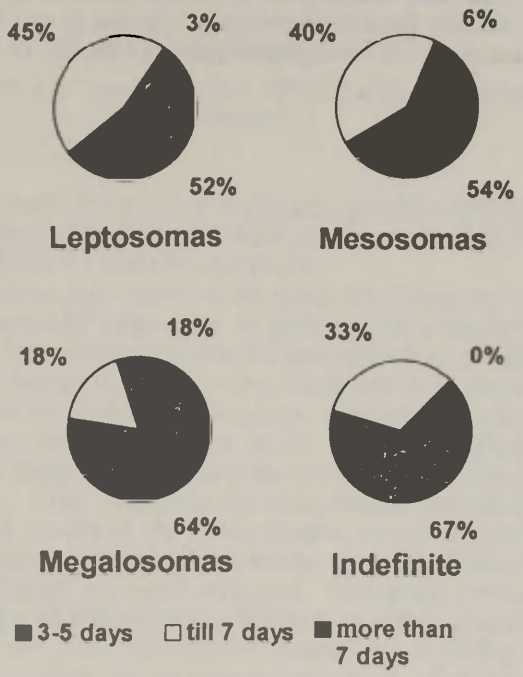

Figure 2. Menstrual period at the examed women in dependence on somatotype

* a period of 3–5 days: mesosomas 54%, leptosomas 52%, megalosomas 56%, indefinite 67%;

* a period of 7 days: mesosomas 40%, leptosomas 45%, megalosomas 42%, indefinite 33%;

* more than 7 days — 6%, 3%, 2%, 0%.

The incidence of gynecological diseases in connection with constitution was also analysed.

Cervical erosion occurred in of 30% leptosomas and in 44% of the indefinite somatotype; adnexitis in 46% of mesosomas. As for the indefinitegroup, it gets more pathology in all types of diseases but except adnexitis.

Primary and secondary sterility occurred in 31% of mesosomas, 36% of leptosomas and 45% of the indefinite somatotype. Among

the megalosomas of euriplastic somatotype we discowered sterility 5–6 times more. In 50% primary sterility occurs — 42% in leptosomas, 72% in megalosomas and 87% in the indefinite somatotype (secondary sterility — 50%, 58%, 23%, 13%).

Thus we have found a certain constitutional dependence of different types of diseases and tendencies in their occurrence. Primary and secondary sterility presents a paricular interest as can be seen from the studies carried out among the womens of the city of Krasnoyarsk.

A SYSTEM FOR RECORDING VOLLEYBALL GAMES

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In recent years, along with other games, greater attention has been paid to volleyball. The Republic of Estonia needs physically fit players who master different technical elements.

The technique and tactics of the game are constantly developing, and every successful player has to have a good command of them (Liik, 1994). It is noteworthly that the technical elements of volleyball cannot be measured directly by time, kilograms or metres. The only objective criterion is the team's victory or defeat. The share of each concrete player in this victory or defeat can be objectively estimated only after analysing separately the technical elements performed by the player. Later, summing up these evaluations and comparing them with the results of the other players, we can say who was the best in the game, and to the performance of which technical element each player should pay more attention. Volleyball coaches and experts working with the teams use different methods for recording the games. The five most widely used systems for recording volleyball games are: (1) using certain conventional signs, (2) graphic recording, (3) stenography or recording on audio tape, (4) video recording, (5) recording by computer. In Estonia the first two methods have been used, to a lesser extent also the fourth. It should be kept in mind that no matter which method is used, in any case it is difficult to record all the elements performed by each single player during the game and to evaluate them.

For example, in the case of the first two methods of recording usually three note-takers are used simultaneously. One of them registers serves and receptions, the second — attacks, and the third — blocks and digs. This, however, increases the possibility of errors as some note-takers may be more critical and the others more lenient. Therefore the comparison of different games is also complicated.

In Estonian little attention has been paid to special recording systems for volleyball. One of the best-known systems is that of H. Aunin (Aunin, 1969). I. Drachov's methodology is also used in Estonia, his criteria for evaluation are stricter (Kaarma, 1988). In Germany

Table 1

Efficiency of players during two seasons

Player	Results	Serve	Reception	Attack from Zone 2	Attack from Zone 3	Attack from Zone 4	Feint	Block	Dig	Total efficiency
Kulvi	Efficiency	0.447	0.597	0.708	0.800	0.675	0.643	0.363	0.716	0.619
	No. of gr.	103	129	12	5	100	21	51	74	
	Aver. grade	3.21	2.61	1.58	1.40	1.65	1.71	2.27	1.28	
Laidro	Efficiency	0.493	0.618	0.656	0.500	0.628	0.529	0.453	0.765	0.580
	No. of gr.	152	136	32	2	207	35	53	102	
	Aver. grade	3.03	2.53	1.69	2.00	1.74	1.94	2.09	1.24	
Lepa	Efficiency	0.474	0.585	0.636	0.553	0.538	0.450	0.453	0.765	0.580
	No. of gr.	95	123	22	19	117	20	86	86	
	Aver. grade	3.11	2.66	1.73	1.89	1.92	2.10	2.09	1.43	
Nõlvak	Efficiency	0.518	0.438	0.500	1.00	0.444	0.600	0.512	0.667	0.575
	No. of gr.	123	12	29	3	9	20	86	60	
	Aver. grade	2.93	3.25	2.00	1.00	2.11	1.80	1.98	1.33	
Ottel	Efficiency	0.656	0.439	0.000	0.000	0.500	0.500	0.000	0.667	0.345
	No. of gr.	8	33	0	0	3	3	1	9	
	Aver. grade	2.38	3.24	0.00	0.00	2.00	2.00	3.00	1.33	
Partel	Efficiency	0.565	0.591	0.625	0.000	0.750	0.633	0.455	0.588	0.345
	No. of gr.	69	11	16	0	2	15	55	34	
	Aver. grade	2.74	2.64	1.75	0.00	1.50	1.73	2.09	1.41	

Continued Table 1

Player	Results	Serve	Reception	Attack from Zone 2	Attack from Zone 3	Attack from Zone 4	Feint	Block	Dig	Total efficiency
Ree	Efficiency	0.602	0.485	0.667	0.000	0.750	0.625	0.458	0,839	0.553
	No. of gr.	32	34	3	0	8	4	12	31	
	Aver. grade	2.59	3.06	1.67	0.00	1.50	1.75	2.08	1.16	
Saal	Efficiency	0.502	0.593	0.635	0.689	0.641	0.561	0.473	0.638	0.591
	No. of gr.	147	153	52	53	39	41	167	94	
	Aver. grade	2.99	2.63	1.73	1.62	1.72	1.88	2.05	1.36	
Savina	Efficiency	0.607	0.450	0.700	0.788	0.692	0.625	0.557	94	
	No. of gr.	56	40	20	26	13	12	79	43	
	Aver. grade	2.57	3.20	1.60	1.42	1.62	1.75	1.89	1.14	
Sepp	Efficiency	0.500	0.750	0.500	0.000	0.000	0.400	0.400	0.600	0.394
	No. of gr.	25	3	2	0	1	13	10	15	
	Aver. grade	3.00	2.00	2.00	0.00	3.00	2.20	2.20	2.20	
Somer	Efficiency	0.450	0.529	0.629	0.660	0.627	0.600	0.449	0.625	0.571
	No. of gr.	130	136	58	78	63	45	166	64	
	Aver. grade	3.20	2.88	1.74	1.68	1.75	1.80	2.10	1.38	
Tomberg	Efficiency	0.455	0.530	0.661	0.500	0.500	0.630	0.449	0.678	0.550
	No. of gr.	133	25	28	1	7	23	68	121	
	Aver. grade	3.18	2.88	1.68	2.00	2.00	1.74	2.10	1.32	

No. of gr. — Number of grades
Aver. grade — Average grade

M. Fiedler has devised his own system for noting down the games of young volleyballers (Fiedler, 1978).

Considering the abovementioned, the author investigated the possibilities for computerized registration of the quality of performance of volleyball elements. A special computer program **Game** enables one expert to register and evaluate the performance of 9 technical elements by all the players of a team during the game. The technical elements are the following: (1) serve, (2) serve from jump, (3) reception, (4) attack from Zone 2; (5) attack from Zone 3, (6) attack from Zone 4, (7) feint, (8) block, (9) dig.

The performance of a given technical element is evaluated by the expert: serve, serve from jump and reception are evaluated on a five-point scale; attack, feint and block on a three-point scale; and dig on a two-point scale. The maximum grade is 1, followed by 2, 3, etc.

The abovementioned computer program was used for registering the performance of all the players of the Tallinn Pedagogical University women's volleyball team during the Estonian championships in 1993/94 and 1994/95. The data recorded in the computer were later processed statistically. One of the principle indices for evaluating the performance of a player was

$$\text{Efficiency P} = \frac{\text{maximum grade x no. of performances - sum of grades}}{\text{(maximum grade - 1) x no. of performances}}$$

The result will be between 0 and 1. the more the value approaches 1, the better the given technical element was performed.

Having recorded 12 games during 2 seasons the following conclusions can be drawn: the performance of the team as a whole has improved. It can be noticed first and foremost in blocking; during the first season the grade was 0.38, during the second season 0.53. Improvement in digs could also be noticed, the grades for the first and the second season being 0.61 and 0.81 respectively.

All this is also confirmed by the results at the Estonian championships. While in 1993/94 the team of Tallinn Pedagogigal University got the third place, then in 1994/95 it won the Estonian championship Table 1 gives the grades of all players in the games of two seasons.

In sum it can be said that the system of recording proposed by the author is worth applying in Estonian volleyball.

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SAAMI IMAGES IN THE FINNISH TOURIST INDUSTRY

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Some insight into Finnish tourism as a phenomenon of late capitalism will be given presently. First of all, however, it has to be noted that this paper does not analyse the tourist influences in a hosting population as the Saami[1]. The nucleus is limited to discourse production made through Saami images by the Finnish tourist industry. This paper is not looking for truths in Saami images but for the way they convey meanings.

It is noticeable that little attention, if any, has been given to the combination of such subjects as Saami/tourism/discourse when a single glimpse to Lapland's tourism clearly underlines an "exotic Lappish experience". This paper is an attempt and its guiding assumption is that the "exotic Lappish experience" can be understood through an analysis of Lapland's imagery made for tourists. Accordingly, this paper surveys one of the main medias through which Lapland at large is presented by the Finnish tourist industry.

The Finnish tourist industry is a unit of the service sector interested in a common consumer. It includes a blend of enterprises ranging from hotels and restaurants to souvenir shops, airlines and travel agencies. The tourist industry at large is transnational; its operators are not limited to one nationality and do not acknowledge neither political nor geographical bounderies. Nonetheless, as the sector here under scope is limited to a segment of firms utilizing Finland as its operating arena, it is taken a priori that the enterpreneurs of this trade unit are mainly Finns, and therefore refered to as the Finnish tourist industry.[2]

The data for this paper has been gathered through an intertextual procedure which basically consisted in following Saami images and

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[1] In other contexts the Saami are refered to as Lapps. As the latter has to a certain degree a negative connotation, here the English version is an adaption from sámi.

[2] Contrary to what is believed, here it is also a priori that an industry of this character, as many other transnational partnerships, does present a modus operandi conditioned by both its own cultural trends and the specific social/structural processes of the society/ies where it operates.

signs through the different brochures where they emerge. The intention was not to establish statistical correlations or frequencies but to allocate the discourse/s structuring the seemingly disconnected texts of the brochures marketing Lapland.

Discourse fabrics in tourism are constituted by the making of images. Images are not signs. Readers of semiotics will scarcely need to be remined that a sign is

> "— *everything* that, on the grounds of a previously established social convention, can be taken as a *something standing for something else* (Eco 1976, 16)."[3]

Precisely, a sign appears as the subsitute for *something* whereas an image is the obverse (the side intended to be seen) of the represented *something*. By the same token, a Saami image is a representation of Saami and their culture; a Saami sign is *something* standing for a cultural element which may be taken as Saami.

The Finnish tourist industry offers Lapland through a variety of attractions as a tourist region. Making use of brochures, the industry puts on the market an Eldorado for ski-lovers, arctic safaris, tropical spa holidays, accomodation in igloos, goose hunts in the unspoiled nature, the magical search for Father Christmas, reindeer driving, arctic golf and so on. Undoubtedly, the tourist industry creates various messages through different kinds of images without limiting Lapland to a particular one. In this way, another result of its discourse is to leave Lapland as an open-ended territory.

This is illustrated by the following text of the brochure Finland 1992/1993 Winterfun with snow guaranteed published by the Finnish Tourist Board:

> "**If Kuusamo** is not part of Lapland adminstratively, it is certainly just as geographically beautiful as a winter sport resort and equal to the centres in Lapland in terms of what it offers the holiday-maker: Kuusamo is Lapland!"[4]

What is more, the Guide for Shopping and Leisure Time Activities 1995 which functions like a telephone catalogue for visitors in northern Finland, published by Telemedia and with a preface by the county governor of Lapland, includes announcements of enterprises operating in Kuusamo and other areas surrounding Lapland. So, the tourist is offered a territory in northern Finland which might start as south as Helsinki, if there is a resort claiming so.

Inspite of the above, Saami images and signs remain in the landscape of the Lapland made for tourists. An illustration is figure 1.

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[3] Emphasis in the original.

[4] Emphasis in the original.

Figure 1. From the brochure Lapland in search of Father Christmas published by Canterbury Travel LTD. 1993/94.

This figure, like the entire brochure where it was published, has Father Christmas as the main character; nonetheless, Saami elements form the background and surroundings where he "operates". This is due, perhaps, to the supposition that what is Saami stands for exotic, mythic and magical features.

Another interesting example with which Lapland is offered to visitors is the following text from a brochure published by Lapland Travel Ltd of 1991 under the title Lapland The Ultimate Experience:

> "Lapland will enchant the most pampered incentive traveller. Even a quick visit to see the midnight sun, autumn "ruska", Lapps, reindeer, gold, and pink-fleshed salmon will be the experience of a lifetime."

This example signals the existance of several characteristics of tourism. The point to emphasis here, however, is that tourism refers to spectacle. As tourists are moved to experience temporarily something out-of-the-ordinary to contrast with every day life, the tourist industry is persuaded to increasingly put on more exuberant exhibits. Therefore, as Urry (1990, 82 & 86) argued, tourist sites struggle one another to provide the best and smallest, largest, loneliest resort in the most visited, sunniest, coldest place on Earth. In this way, tourists find pleasure in programmed attractions. Precisely, tourism is involved with forms of consumption where the emphasis is placed upon the consumption of experiences and signs. With this in mind, it should not come as a surprise that in the above example what is offered is a possibility to gaze at different items, or signs, of which one is precisely

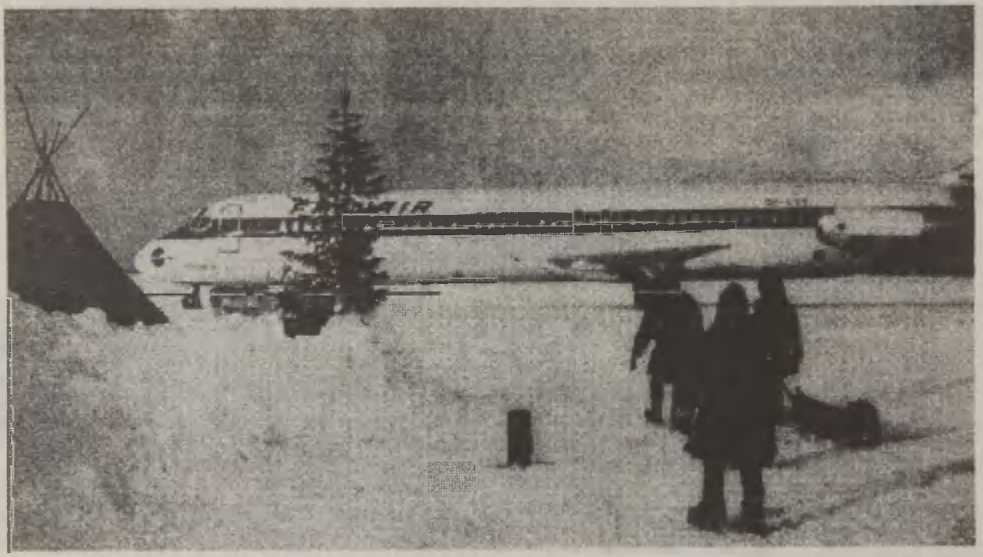

Figure 2. From the brochure Finnland 1993/1994 winterfreude mit schnee-garantie published by finnische zentrale für tourismus (German version of Finland 1993/1994 winterfun with snow guaranteed of the Finnish tourist board.)

"Lapps". In other words, by the act of gazing at Lapland, the tourist consumes the experience of a lifetime not only through the midnight sun, autumn colours and alike but also through gold, fish, animals and "Lapps".

On similar lines, the Finnish tourist industry devises Saami images. An example of this is figure 2.

Taking for granted that people do not live next to runways — even if the airports were next to the Arcti Circle where anything could happen — this image seems to have the intention of illustrating to the readers that if they visit Lapland, they are met by their exotic experience right after their airliner opens its doors. Saami images and signs deviced and used by the Finnish tourist industry form cultural pastiches. In Finnish tourism, its industry selects fragments of Saami culture and, together with elements of other cultures, presents them as a Saami coherent whole marketing Lapland. A prime example is the Reindeer Farm whose handout induces the following comments.

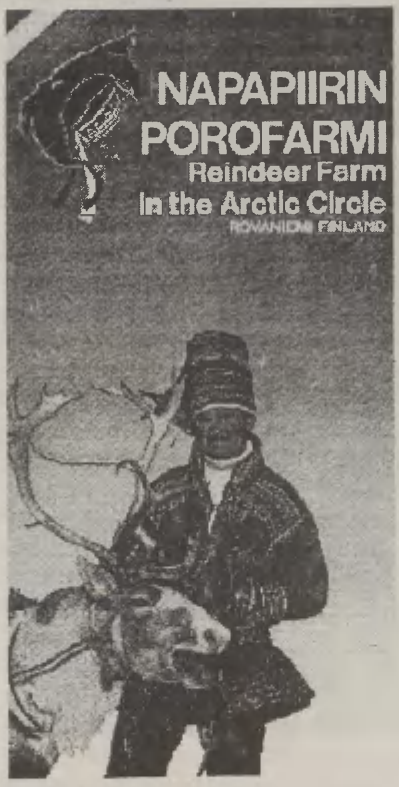

Figure 3. Partial view of the handout napapiirin porofarmi (the Reindeer Farm of the Arctic Circle. Free translation.) Publisher unknown 1993.

To begin with, the brochure is a A4 sheet where the headline *Reindeer Farm in the Arctic Circle* can be well noticed. The Arctic Circle is an imaginary line, a parallel of latitude 66° 33' N and not a place. How can the *Reindeer Farm* be there? For a tourist coming to gaze it, to experience it, it might be there. For another thing, the brochure depicts a man in Saami cloths with a reindeer. Reports on Saami in Finland keeping reindeer in farms is totally absent from the ethnographic records, but it exists in Rovaniemi. Still another, the place is not only dedicated to farming. The visitor has the possibility to take part in the *Reindeer Driver's Licence Test*. In Finland it is not an official requirement to have a licence for driving reindeer, as it is for motor vehicles. Similarly, the visitor can also choose whether to drive reindeer in a *Minisafari* or in *a Safari from Rovaniemi to a Reindeer Farm*. Never has the Saami language been so near to Swahili, and hopefully, for the sake of the tourists, reindeer, giraffes and other local animals are getting along very well. One last observation, the traveller can join *The Lappish Baptism Ceremony to Order*. This pagan Saami ritual is another fact absent from the ethnographic records unless the *Reindeer Farm*, some hotels and other tourist resorts are taken into account.

The Reindeer Farm illustrates how Finnish tourism is related to the latest cultural tendencies in contemporary society. The cultural pastiche provided by the Farm makes no differentiation between the Saami cultural praxis and features provided by programmed events. Futhermore, local history is not an important issue in the Farm; by using Saami signs the Farm provides exoticness to those visitors who seek for a real break from the ordinary. These two conditions, de-differentiation and a historicity, are part of the tendencies of the cultural logic of late capitalism, or, what in other contexts is refered to as postmodernism.

In conclusion. The analysis presented above offers a plausible interpretation of several distinct relationships of Saami images and signs by treating them not as conveyers of isolated messages but as promoters of discourse. The point, however, has been a dichotomy. On the one hand, tourists are moved to experience something out-of-the-ordinary; this persuades the tourist industry to stage exhuberant exhibits. And on the other, in the Finnish context, these exhibits are presented and justified through a discourse whose images are cultural pastiches where cultural differentiation and historical processes are overlooked.

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CHANGES IN RAT'S GASTRIC MUCOSA FREE MACROPHAGES ACTIVITY AFTER TRUNCAL VAGOTOMY OR ADMINISTRATION OF INDOMETHACIN OR PGE_2

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Introduction

Macrophages exist in living organism in two forms: 1) **fixed macrophages** (for example Kupffer's cells in liver, the macrophages of spleen, bone marrow etc.) and 2) **free macrophages** (polyblasts), that are situated diffusely all over the organism and are derived from blood monocytes (Carr, 1978). Indomethacin (Schnyder *et al.*, 1981) and PGE2 (Bray *et al.*, 1978; Schnyder *et al.*, 1981; Webb *et al.*, 1979) have been found to regulate macrophages activity *in vitro*. At the same time there is quite few data about the influence of these factors on macrophages activity *in vivo* — so the aim of this study was to investigate the *in vivo* changes in rat's gastric mucosa free macrophages activity caused by indomethacin and exogenous PGE_2. Another aim of this work was to study whether and how cessation of parasympathic innervation (vagotomy) influences gastric mucosa free macrophages.

Materials and methods

Animals. 31 white male Wistar rats (180–240 g) were divided into 5 groups: 1) control group; 2) truncal vagotomy, rats sacrificed on the 6th postoperative day; 3) truncal vagotomy, rats sacrificed on the 14th postoperative day; 4) PGE_2 500 g/kg orally for 6 days; 5) indomethacin 10 mg/kg for 4 days via orogastric intubation.

Surgical procedures. Rats fasted for 12 hours, but allowed free access to water were operated under diethyl ether anaesthesia cutting both *n. vagus* trunks at the middle level of abdominal *oesophagus*. To avoid gastric evacuatory disorders after vagotomy all the operations were completed with pyloroplasty *de modo* Heinecke-Miculicz. The instruments used were clean, but not sterilized.

Histological study. Estimation of the macrophageal activity was

done using the vital staining of the macrophages with 2.5% solution of lithiumcarmine, which was injected intraperitoneally to each rat 2.5 hours before sacrifice 0.5 ml/kg. Rats were sacrificed by decapitation, followed by laparatomy. The stomach was opened and a biopsy specimen (0.5 × 1 cm) was taken from the corpus part or the stomach along its great curvature. The specimen was fixed in 10% formalin before routine processing to paraffine. The macrophages that had stored (phagocyted) lithiumcarmine were considered to be active and those who had not stored inactive. On each histological slide about 200 macrophages were counted (both active and inactive) and calculated the relative number (%) of active macrophages.

Statistical analysis. Student's t-test was used to determine the statistical significance of the data, and $P < 0.05$ value was regarded as significant. All data represent the mean ± SEM.

Results

The results are presented in a following table.

Group	n	The relative number (%) of active macrophages (mean ± SEM)
Control	8	24.3±1.9
Truncal vagotomy 6 days	6	32.9±2.2*
Truncal vagotomy 14 days	6	30.1 ±1.5*
PGE_2	6	28.5±1.2
Indomethacin	5[1]	34.1±1.7*

* — $P < 0.05$
1 — one animal in indomethacin group died during the experiment due to gastric perforation and peritonitis

Truncal vagotomy and pyloroplasty caused significant increase in the number of active macrophages in the early postoperative period (e.g. 6th and 14th postoperative day), increase on the 6th day was bigger than on the 14th day.

Indomethacin was the most potent activator of the macrophages- the number of active macrophages in indomethacin group was about 10% higher than in control group.

Exogenous PGE_2 didn't cause statistically important changes in the number of active macrophages.

Discussion

Truncal vagotomy caused a statistically significant increase in gastric mucosa free macrophages activity which in our opinion has 3 explanations: 1) possibly the most important factor was operative trauma — the fact that macrophages activity on the 6th postoperative day was higher than on the 14th postoperative day supports this theory; 2) it has been reported (Jonsson *et al.*, 1988) that vagotomy causes chronic body gastritis of the stomach and so the increase in the macrophages activity may be associated with chronic inflammation in gastric mucosa after truncal vagotomy; 3) cessation of parasympathic innervation of the gastric mucosa might also cause an increased macrophageal activity. Tay *et al.* (1984) have found in monkey's (Macaca fascicularis) cardiac ganglions a similar increase in the number of macrophages after cervical vagotomy.

The effect of exogenous PGE_2 and indomethacin on macrophages activation *in vitro* have been found to be contrary — indomethacin and other enzyme cyclooxygenase inhibitors activate resting macrophages and increase the activity of active macrophages, exogenous PGE_2 had an opposite effect (Schnyder *et al.*, 1981). Other authors have also reported that PGE2 (both exo- and endogenous) is a potent inhibitor of macrophages activity (Bray *et al.*, 1978; Webb *et al.*, 1979). Our data on the *in vivo* material is more or less content with those of the literature about *in vitro* material. Indomethacin was found to be the most potent activator of the macrophages, PGE_2 in our material also activated the macrophages, but it was found to be statistically unimportant ($P > 0.05$).

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THE ANTHROPOLOGICAL WORKS OF K. E. VON BAER

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"Anthropological period" of scientific work of K. E. von Baer appertains to 1850–60, when he led the department of comparative anatomy and physiology of St. Petersburg University. Baer defined the anthropology as "all what we know about man" ("Alles, was wir vom Menschen wissen"). Baer brought anthropology into prominence of other disciplines. "The history shows, that the first question of each culture is the origin of man and his relations with the nature, the first signs of culture are the attempts of self-determination of man." (Baer, 1824). Baer's definition of anthropology included anatomy, physiology, ethnology, prehistoric anthropology and archeology.

One of the first osteological works of Baer was report of tibia and femur of one giant at Academy Of Sciences St. Petersburg 1844 (Baer, 1844). The next was report about similarity of crania of cargass and samoyed. (Baer, 1844) Baer has repeatedly made reports about studies of exhibits of comparative anatomy museum.(Baer 1846, 1850) He complemented the craniological collections of above-mentioned museum, initiated large drive of exhibit's collection. In 1858 there was 350 crania in museum, 281 contemporaneous and 69 arceological.

1858–59 Baer studied the anthropological collections of Göttingen, Stockholm,Paris, London and Copenhagen. 1859 he made 4 reports of craniology, 2 of them worth mentioning. At March 18th was report about remarkable crania of museum with illustrations: "Crania selecta ex thesauris anthropologicis Academiae Imperialis Petropolitanae" (Baer, 1863). Baer used here his system for measurement of crania by Retzius. The addition of this work was German "Ueber Papuas und Alfuren (Baer, 1859). The latter included comments for above-mentioned. Baer's system included following measures:

Calvariae: *1. Longitudo* *4. Latitudo frontis*
2. Altitudo *5. Latitudo parietalis*
3. Latitudo *6. Latitudo zygomatica*
Calvariae: *7. Ambitus horisontalis*
8. Arcus verticalis a sutura nasali ad foramen magnum
9. Longitudo rhacheos

Occipitis: 10. Arcus transversus
11. Diameter transversa
Porus acusticus: 12. distat a glabella
distat ab occipitale
Locus maximae latitudinis calvariae: 13. quoad altitud.
quoad meatum auditorium

September 1861 Baer organized in Göttingen together with R. Wagner anthropological conference which purpose was the finding of integral craniometrical methods. In conference took part prof. Vrolik, prof. Lucae, prof. Bergmann, prof. Weber and others. The materials of conference were issued in Leipzig as collections of writings compiled by Baer: "Bericht über Zusammenkunft einiger Anthropologen im September 1861 in Göttingen, zum Zwecke gemeinsamer Besprechungen erstattet von K. E. v. Baer und Rud. Wagner."

The conference was the first such conference of anthropology. The report of Baer was about measurement methods of cranium. Lucae demonstrated the instrument of cranium drawing. Vrolik and Wagner introdused his large collection of brains in spirit. Baer wrote the summary of conference. The conference in Göttingen was the scientific action of Baer and the collection of writings is rarity (Raikov, 1961).

In his article Baer took stand on race theory — he said all races are unitary and equivalent. The only distinctive sign in the morphology of race is cranium. From this comes his interest for unitary craniological methods.

Remarkable is the large work in Russian "Anthropology" in the Lawrow's "Encyclopedic dictionary".

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ANTHROPOMETRIC VARIABLES IN FORMER ATHLETES

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Summary

The aim of the study was to compare different anthropometric parameters in physically active and passive middle-aged former top level athletes with those in recreational exercisers and nonexercisers. The subjects of the study were 123 males and 147 females (age range 40–50 years). Their body height and mass were measured and the body mass index calculated. The body fat percentage was measured using skinfold thickness method (Pollock et al. 1980) and bioelectrical impedance method (Bodystat-500, UK). Our results confirm the well established observation that physical inactivity has a negative influence on the different anthropometric parameters.

Introduction

Several methods were recommended for measurement of body composition. One of the most popular method is the measurement of skinfold thicknesses. A lot of different equations were recommended for calculation of body fat percentage (Parizkova, 1977; Jackson *et al.*, 1980; Pollock *et al.*, 1980). As another simple method for measurement of body composition, the body bioelectrical impedance analysis has been used intensively (Lohman, 1989).

Aging is characterized by gradual changes in body composition. There is an increase in body fat and a decrease in muscle mass (Cohn *et al.*, 1980; Riggs *et al.*, 1981). Some of these changes notably increased fat mass. This fact has been attributed to decreased physical activity rather than to the inevitable biological effect of aging itself (Bortz, 1982). Little information is available about the body composition in former middle-aged athletes. The aim of this study was to compare different anthropometric parameters in physically active and passive middle-aged former top level athletes with those in the recreational exercisers and nonexercisers.

Methods

The subjects of the study were 123 males and 147 females (age range 40–50 years). Subjects were divided into four groups:

1. Former top level sportsmen (34 males and 34 females) who were physically active after discontinuation of their sporting career (PAFA). They exercised regularly at least at the minimal level of the recommendations of American College of Sports Medicine (1990) for recreational purposes.

2. Former top level sportsmen (25 males and 29 females) who were at the time inactive (PPFA) had stopped their training and returned to a predominantly sedentary lifestyle after discontinuation of their sporting career 10–12 years ago.

3. Recreational exercisers (RE, 27 males and 39 females), who have almost lifelong gone in for aerobic exercises 3-4 times a week.

4. Nonexercisers (NE, 37 males and 45 females), a control group, having rarely been engaged in physical activities.

The subject's body height was measured with the help of the Martin's metal anthropometer and body mass using a balance-beam medical scale. Their body mass index (BMI) was calculated using a formula: mass (kg)/height (m^2). The subcutaneous skinfold thicknesses were measured in males at chest, abdomen and thigh and in females at triceps, suprailiac and thigh (Pollock *et al.*, 1980) using metal skinfold caliper (Holtain, Crymmych, UK). The skinfold thicknesses were measured in triplicate, averaged and summed to create a skinfold score. The body fat percentage was measured using BODYSTAT-500 bioelectrical impedance method (Bodystat Limited, Isle of Man, UK).

Means (x), standard deviations ($\pm$ SD) and linear correlation coefficients (r) were calculated using conventional statistical methods. Differences between the groups were tested for significance using one way ANOVA. Statistical significance was defined as $p < 0.05$ and in case if the significant difference was observed a test of simple main effect was employed (unrelated T-test).

Results and discussion

The mean body composition parameters in males and females measured by skinfold thickness technique and bioelectrical impedance method are presented in Tables 1 and 3. The levels of significance between the different male and female groups are presented in Tables 2 and 4.

Both in males and females the body mass and skinfold thicknesses were significantly lower in PAFA and RE than in PPFA and NE. The differences in the body fat percentage calculated by skinfold thickness method and bioelectrical impedance method was relatively small and

Table 1

Means (± SD) of different anthropometric parameters in male groups

	PAFA (n = 34)	PPFA (n = 25)	RE (n = 27)	NE (n = 37)
Age (yrs)	44.9± 7.7	46.6± 7.0	43.9± 6.5	43.6± 5.9
Height (cm)	178.5± 6.9	180.1± 5.9	178.4± 7.1	176.4± 5.3
Mass (kg)	76.3± 9.9	88.0±13.2	81.3±11.8	82.4±13.2
BMI (kg/m^2)	23.9± 2.4	27.1± 3.8	25.5± 2.9	26.4± 3.7
BODYSTAT-500:				
Fat%	16.1± 3.5	20.4± 4.2	16.8± 4.9	18.9± 4.8
Fat mass (kg)	12.3± 4.1	18.0± 6.2	13.7± 4.6	15.6± 6.1
LBM (kg)	64.0± 8.1	70.0± 9.2	67.6± 8.8	66.8±10.0
SKINFOLDS (mm):				
Chest	9.5± 5.5	14.8± 6.9	12.1± 6.5	13.3± 5.2
Abdomen	15.1± 7.7	25.0± 9.6	20.3±11.0	23.6±10.1
Thigh	10.5± 3.8	13.1± 4.6	12.4± 4.5	12.2± 4.5
Sum	36.6±15.3	52.5±18.8	42.7±18.5	49.1±17.2
Fat%	12.2± 4.6	18.1± 5.2	14.4± 5.6	16.2± 5.2

Key: PAFA — physicallyactive former athletes
PPFA — physically passive former athletes
RE — recreational exercisers
NE — nonexercisers

Table 2

Levels of significance between male groups

	GROUPS					
	1–2	1–3	1–4	2–3	2–4	3–4
Age	NS	NS	NS	NS	NS	NS
Height	NS	NS	NS	NS	NS	NS
Mass	< 0.001	NS	< 0.05	NS	NS	NS
BMI	< 0.001	< 0.05	< 0.01	NS	NS	NS
BODYSTAT-500:						
Fat%	< 0.001	NS	< 0.05	< 0.01	NS	NS
Fat mass	< 0.001	NS	< 0.05	< 0.01	NS	NS
LBM	< 0.01	NS	NS	NS	NS	NS
SKINFOLDS:						
Chest	< 0.01	NS	< 0.05	NS	NS	NS
Abdomen	< 0.001	< 0.05	< 0.001	NS	NS	NS
Thigh	< 0.05	NS	NS	NS	NS	NS
Sum	< 0.001	NS	< 0.02	NS	NS	NS
Fat%	< 0.001	NS	< 0.05	< 0.05	NS	NS

NS — not significant
Key: 1. physically active former athletes
2. physically passive former athletes
3. recreational exercisers
4. non-exercisers

Table 3

Means (± SD) of different anthropometric parameters in female groups

	PAFA (n = 34)	PPFA (n = 25)	RE (n = 27)	NE (n = 37)
Age (yrs)	43.0± 5.2	44.9± 5.4	43.3± 6.5	44.8± 6.8
Height (cm)	167.5± 5.3	167.4± 4.8	164.0± 5.0	163.4± 5.3
Mass (kg)	62.4±10.5	68.8±11.3	64.0± 9.5	68.2±10.5
BMI (kg/m2)	22.8± 2.8	24.5± 3.9	23.7± 3.4	25.5± 3.2
BODYSTAT-500:				
Fat%	24.8± 4.5	28.3± 5.6	27.3± 5.7	31.0± 5.9
Fat mass (kg)	15.5± 4.7	19.5± 7.5	17.5± 6.2	21.1± 6.9
LBM (kg)	46.9± 7.8	49.3± 8.1	46.5± 8.0	47.1± 7.7
SKINFOLDS (mm):				
Chest	14.5± 3.9	18.2± 6.0	16.1± 6.4	20.6± 6.1
Abdomen	9.4± 4.2	11.7± 6.7	10.8± 6.7	15.4± 8.2
Thigh	22.0± 8.2	26.7± 8.6	27.9± 9.6	32.9± 9.6
Sum	45.9±13.3	58.5±20.4	55.4±22.0	68.3±21.3
Fat%	20.3± 4.6	24.5± 4.0	23.3± 6.8	27.9± 6.5

Key: PAFA — physically active former athletes
PPFA — physically passive former athletes
RE — recreational exercisers
NE — nonexercisers

statistically non-significant ($p > 0.05$, Tables 1, 3). The mean body fat percentage was significantly ($p < 0.05$-0.001) lower in physically active groups (PAFA, RE) than in passive groups (PPFA, NE). The mean body fat percentage in our study was similar to the corresponding indices revealed in other studies where inactive middle-aged males and females were observed (Heitmann, 1991). In PAFA the body fat percentage was higher than in young active sportsmen (Withers *et al.*, 1987). Our results confirm the well-established observation that physical inactivity has a negative influence on body composition measures. In the PAFA groups and in NE the measured parameters were in general not so favourable as in both physically active groups.

Table 4

Levels of significance between female groups

	GROUPS					
	1–2	1–3	1–4	2–3	2–4	3–4
Age	NS	NS	NS	NS	NS	NS
Height	NS	< 0.01	< 0.001	< 0.01	< 0.001	NS
Mass	< 0.05	NS	< 0.05	NS	NS	NS
BMI	< 0.05	NS	< 0.001	NS	NS	< 0.05
BODYSTAT-500:						
Fat%	< 0.01	< 0.05	< 0.001	NS	NS	< 0.01
Fat mass	< 0.01	NS	< 0.001	NS	NS	< 0.05
LBM	< 0.01	NS	NS	NS	NS	NS
SKINFOLDS:						
Chest	< 0.01	NS	< 0.001	NS	NS	< 0.001
Suprailiac	NS	NS	< 0.001	NS	< 0.05	< 0.01
Thigh	< 0.05	< 0.01	< 0.001	NS	< 0.01	< 0.05
Sum	< 0.01	< 0.05	< 0.001	NS	NS	< 0.01
Fat%	< 0.001	< 0.05	< 0.001	NS	< 0.05	< 0.05

NS — not significant

Key: 1. physically active former athletes
2. physically passive former athletes
3. recreational exercisers
4. non-exercisers

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RELATIONSHIP BETWEEN PHYSICAL GROWTH AND MOTOR PERFORMANCE IN PREPUBERTAL SCHOOLCHILDREN

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Abstract

The purpose of this study was to examine the relationships between physical growth measurements and motor performance characteristics in prepubertal schoolchildren. Ninety-two 7–9-year-old children were divided into two groups: 44 boys (mean age 8.1(1.5 yrs) and 48 girls (mean age 7.9(1.4 yrs). Twenty-two physical growth measurements were taken according to the O-SCALE physique assessment system. Estimated percentage of body fat was determined from four skinfold measurements following the procedures of Durnin-Womersley (1974). EUROFIT test battery was administrated to evaluate the motor performance of the children. The findings of the study indicated that relationships between physical growth measurements and motor performance characteristics were mostly non-significant ($p > 0.05$) and there were no clear differences in associations in respect of boys and girls. Furthermore, although the boys surpassed the girls in circumferential measurements and girls surpassed boys in skinfold thicknesses and body fat percentage, these differences were generally non-significant ($p > 0.05$).

Introduction

The development of the child occurs in numerous ways that include physical growth of the body, consecutive appearance of physiological reflexes and attainment of specific motor development milestones. Each of these phenomena may be affected by intrinsic biological and environmental factors and are interrelated to a certain degree (Livshits *et al.*, 1993). The researchers of motor development have acknowledged the fact that little information exists about the extent to which various factors such as physical growth actually influence the motor development of young children (Malina, 1980).

tween physical growth measurements and motor development characteristics in prepubertal schoolchildren.

Materials and methods

Ninety-two elementary school children from Tartu, Estonia, aged 7–9 years, served as subjects in the study. They were divided into two groups: 44 boys and 48 girls. The parents of every child were informed about testing procedures, and they consented to their child's participation in this study. Twenty-two physical growth measurements were taken according to the O-SCALE physique assessment system (Ward, 1989). The girth of the arm (relaxed and tensed), forearm, wrist, chest, waist, gluteal, thigh, calf and ankle were measured using a steel tape measure. Body height was measured using Martini's metal anthropometer to the nearest 0.1 cm and body mass was measured to the nearest 0.1 kg. Body mass index (BMI) using the formula body mass (in kg) divided by height (in m) squared was calculated. The measurements of skinfold thickness were obtained with HOLTAIN caliper by one investigator at the following sites: triceps, subscapular, biceps, iliac crest, supraspinale, abdominal, front thigh, and medial calf. Three complete sets of measurements were carried out on each subject and the mean of three measurements at each site was used. Estimated percentageof body fat was determined from four skinfold measurements following the procedures of Durnin-Womersley (1974). EUROFIT test battery (1988) was used to evaluate the motor performance of the children. Standard statistical procedures were used to analyze the data. Descriptive statistical procedures included means, standard deviations and zero-order correlations. A one-way ANOVA was used to test the significance of the mean difference between the sexes on the physical growth and motor performance characteristics. The 0.05 level of probability was accepted as stastically significant.

Results

The means and standard deviations of anthropometric characteristics of the subjects are presented in Table 1. the results of the one-way ANOVA indicated that there was a significant ($p < 0.05$) differences between sexes on forearm, wrist, chest and ankle girth. The mean scores of boys on these characteristics were significantly higher than those of the girls.

The means and standard deviations of body fatness measurements

Table 1

Means (X) and standard deviations (± SD) of anthropometric characteristics

Characteristics	Boys (n=44)		Girls (n=48)		p
	X	SD	X	SD	
1. Height (cm)	130.8	8.1	127.8	6.2	ns
2. Mass (kg)	27.2	5.5	24.9	4.2	ns
3. BMI (kg/m2)	15.6	1.5	15.2	1.3	ns
4. Arm girth relaxed (cm)	18.1	1.9	17.9	1.5	ns
5. Arm girth flexed and tensed (cm)	19.8	2.2	19.3	1.9	ns
6. Forearm girth (max. relaxed) (cm)	19.1	1.8	18.3	1.4	*
7. Wrist girth (meso-sternale) (cm)	13.2	1.1	12.5	0.9	*
8. Chest girth (cm)	63.4	4.8	60.4	3.6	*
9. Waist girth (cm)	56.5	5.4	55.7	5.1	ns
10. Gluteal girth (cm)	38.5	4.8	39.1	3.6	ns
11. Thigh girth (cm)	35.8	4.3	35.4	3.8	ns
12. Calf girth (cm)	26.5	2.7	25.7	2.3	ns
13. Ankle girth (cm)	19.3	1.8	18.2	1.7	*
14. Humerus width (cm)	5.5	1.1	5.2	0.9	ns
15. Femur width (cm)	6.9	0.9	6.4	1.3	ns

* $p < 0.05$

are presented in Table 2. The boys surpassed the girls significantly ($p < 0.05$) only in biceps skinfold and body fat percentage.

Table 2

Means (X) and standard deviations (± SD) of body fatness characteristics

Characteristics	Boys (n=44)		Girls (n=48)		p
	X	SD	X	SD	
1. Triceps skinfold (cm)	7.7	3.4	7.3	3.1	ns
2. Subscapular skinfold (cm)	6.3	1.8	6.9	1.7	ns
3. Biceps skinfold (cm)	7.3	2.4	8.7	2.8	*
4. Iliac crest skinfold (cm)	5.7	2.9	6.0	2.4	ns
5. Supraspinale skinfold (cm)	6.3	2.8	6.4	2.6	ns
6. Abdominal skinfold (cm)	7.5	3.8	7.9	3.4	ns
7. Front thigh skinfold (cm)	12.1	4.1	11.6	2.2	ns
8. Medial calf skinfold (cm)	11.9	3.8	11.2	2.5	ns
9. Body fat percent	11.5	3.2	13.8	3.4	*

* $p < 0.05$

The means and standard deviations of motor performance characteristics are presented in Table 3. The boys surpassed the girls significantly ($p < 0.05$) in sit ups, 10 × 5m shuttle run, standing broad jump, handgrip strength and endurance shuttle run. The mean results of the sit and reach test was significantly ($p < 0.05$) higher in girls.

The correlation coefficients for selected anthropometric measurements and motor performance characteristics are presented in Table 4. In general, only low or moderate ($r = 0.2–0.5$) correlations were found between the physical growth measurements and motor performance tests scores for both sex groups. BMI and body fat percentage had either low negative or positive relationships with motor performance characteristics.

Table 3

Means (X) and standard deviations (± SD) of motor performance characteristics

Characteristics	Boys (n=44)		Girls (n=48)		p
	X	SD	X	SD	
1. Balance (x)	5.9	3.8	6.2	4.2	ns
2. Sit and reach (cm)	15.1	8.1	20.3	8.6	*
3. 10×5m shuttle run (s)	23.5	2.2	25.9	3.7	**
4. Standing broad jump (cm)	130.1	17.9	121.2	23.3	*
5. Bent arm hang (s)	9.2	6.5	8.8	8.1	ns
6. Plate tapping (s)	20.5	5.1	21.4	6.1	ns
7. Handgrip strength (kg)	15.7	3.9	11.9	4.2	**
8. Sit ups (x)	16.4	4.2	11.8	5.8	**
9. Endurance shuttle run (min.)	4.9	2.4	3.8	3.1	*

* $p < 0.05$ ** $p < 0.01$

Discussion

The results of this study concerning relationships between physical growth measurements and motor performance confirm the previous findings (Slaughter *et al.*, 1977, 1980; Cureton *et al.*, 1977; Malina, 1980; Hensley *et al.*, 1982; Pate *et al.*, 1989). It was observed that the correlations between body fat percent and motor performance are relatively low in absolute magnitude. The relatively higher negative relationships between body fatness and motor performance tests were found where movement of the body mass is required (standing broad jump, shuttle run). This fact is confirmed by previous studies (Cureton *et al.*, 1975; Slaughter *et al.*, 1977, 1980; Malina and Bouchard, 1991).

Table 4

Correlations between selected physical growth measurements and motor performance characteristics

Characteristics	Boys (n=44)				Girls (n=48)			
	Height	Mass	BMI	%fat	Height	Mass	BMI	% fat
1. Balance	–.15	.22	–.21	.11	.07	–.16	.13	.41
2. Sit and reach	–.06	–.17	–.22	–.37	–.18	.06	.24	–.11
3. 10×5m shuttle run	–.21	.29	.23	.19	.26	.11	.04	–.31
4. Standing broad jump (cm)	.24.	–.16.	–.29	–.28	.19	–.25	–.27	–.52*
5. Bent arm hang	.14	–.13	–.27	–.18	–.17	–.27	–.44	–.30
6. Plate tapping	–.23	–.15	.37	.32	.05	–.16	–.07	.33
7. Sit ups	–.17	–.04	.15	.24	.22	–.16	–.31	–.63*
8. Handgrip strength	.05	–.14	–.22	.18	.15	.22	.12	–.10
9. Endurance shuttle run	.18	–.33	–.39	–.60*	.28	–.18	–.12	–.44*

*$p < 0.05$ BMI= body mass index

Theoretically, this relationship is due to the fact that body fat adds to the mass of the body without contributing to the force producting capability, thus becoming excess weight to be moved during the weight-bearing tasks (Astrand and Rodahl, 1977).

Examining sex differences in physical growth measurements of children revealed that although the boys tended to surpass the girls in most of the anthropometric measurements and girls exceed boys in skinfold thicknesses and body fat percent, these differences are not statistically significant (Table 4.). It should be noted that this finding is in agreement with other reports (Parizkova, 1977; Pate *et al.*, 1989) that have found little if any sex differences in body composition among preadolescent children. Hensley *et al.* (1982) have reported that other underlying biological and cultural factors than body fatness are more important in the explanation of gender differences in motor performance in prepubertal children.

In summary, the findings of present investigation indicated that the relationships between physical growth measurements and motor performance were mostly non-significant and there were no clear differences in associations in respect of boys and girls. Furthermore, although the boys surpassed the girls in anthropometric measurements and girls surpassed boys in skinfold thicknesses and body fat percent, these differences were generally non-significant.

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SOMATOTYPES OF PREPUBERTAL SCHOOLCHILDREN

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Abstract

The purpose of this study was to determine the somatotype of prepubertal schoolchildren. In addition, gender differences on somatotype distributions were examined. Heath-Carter somatotypes were anthropometrically determined on 92 7–9-year-old schoolchildren from Tartu, Estonia. The mean somatotype was that of a mesomorph-ectomorph in both boys (1.9–3.6-3.5) and girls (2.2–3.3–3.5). A one-way ANOVA indicated that there were non-significant differences in mean somatotype components between boys and girls.

Introduction

One method of describing human morphology is that of somatotyping in which shape, but not size, is expressed by a 3-number rating that represents the components of endomorphy (fatness), mesomorphy (musculo-skeletal development) and ectomorphy (linearity). Several studies (Cureton *et al.*, 1975; Slaughter *et al.*, 1977; Stepnicka, 1977; Duquet, 1980; Holopainen *et al.*, 1984; Eiben, 1985) have reported the age and sex peculiarities in somatotype in ages 6–10 years. Although sex differences at ages to 6 years are somewhat less than at ensuing ages, it is evident that boys are more mesomorphic and less endomorphic than girls (Carter and Heath, 1990). It appears that the somatotype reflects the general biological differences in shape and composition of boys and girls, as reported in Hall (1982).

The purpose of present investigation was to determine the somatotype of prepubertal schoolchildren. In addition, gender differences in mean somatotypes were examined and compared with previous reports.

Materials and methods

Ninety-two elementary schoolchildren from Tartu, Estonia, aged 7–9 years, served as subjects in the study. They were divided into two groups: 44 boys (mean age 8.1 ± 1.5 years) and 48 girls (mean age 7.9 ± 1.4 years). Somatotypes were determined using the Heath-Carter anthropometric method (Heath and Carter, 1967; Carter, 1980) with the endomorphy ratings being corrected for height.Body neight was measured using Martini's metal anthropometer to the nearest 0.1 cm and body mass was measured to the nearest 0.1 kg. Body mass index (BMI) using the formula mass (in kg) divided by height (in m) squared was calculated.

Standard statistical procedures were used to analyze the data. Descriptive statistical procedures included means and standard deviations. A one-way ANOVA was used to test the significance of the mean difference between the sexes on the somatotype ratings and anthropometric variables. The 0.05 level of probability was accepted as statistically significant.

Results and discussion

Descriptive data on anthropometric and somatotype characteristics are presented in Table 1 as mean values and standard deviations for each sex group. There were no significant ($p > 0.05$) sex differences regarding the mean somatotype components and anthropometric characteristics. It should be noted that the observed sexual dismorphism in somatotype distributions is in agreement with previous studies (Stepnicka, 1976; Duquet, 1980; Holopainen *et al.*, 1984; Eiben, 1985). General findings from our and earlier reported studies indicate that boys are more mesomorphic and less endomorphic than girls. Although gender differences in somatotype are appearant in preshool and elementary school years, the marked sexual dismorphism appears after adolescence (Carter, Heath, 1990).

Mean scores obtained on the somatotype ratings were generally similar to values reported in previous research. Stepnicka (1976), Duquet (1980) and Holopainen *et al.* (1984) reported mean scores for the somatotype ratings for 8 year old boys (2.3–4.5–3.2; 1.9–3.8–3.1; 2.5–4.2–2.9) and girls (2.9–3.9–3.3; 2.2–3.8–3.4; 3.6–3.6–3.0). In general, it appears that the mean somatotype scores reported in this study fall within the range of expected values in both boys and girls.

In summary, the findings of this investigation indicated that the mean somatotype of prepubertal children was that of a mesomorph-ectomorph in both boys and girls. Furthermore, there were non-significant differences in mean somatotype ratings between boys and girls. Mean somatotype values obtained in this study were generally similar to the values reported in previous research.

Table 1

Descriptive characteristics of prepubertal boys and girls (Means and ± SD)

Variable	Boys (n=44)		Girls (n=48)		p
	Mean	SD	Mean	SD	
1. Height (cm)	130.8	8.1	127.8	6.2	ns
2. Body mass (kg)	27.2	5.5	24.9	4.2	ns
3. BMI (kg/m^2)	15.6	1.5	15.2	1.3	ns
4. Endomorphy	1.9	0.9	2.2	0.8	ns
5. Mesomorphy	3.6	1.5	3.3	1.6	ns
6. Ectomorphy	3.5	1.2	3.5	1.3	ns

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ANTHROPOMETRICAL INVESTIGATION OF THE NEWBORN

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Relatively little attention has been focused on special newborns' anthropology in present-day anthropological research (Kulkarni, Rajendran, 1992; Tateishi, Kajii, 1992; Amit *et al.*, 1993). However, there are some important medical and biological aspects connected with the variability of newborns' body build. Firstly, on the basis on neonates' anthropological data and lack of abnormalities an estimation of the quality of their embryonic and fetal life period may be given (Abrans, Laros, 1986; Haste *et al.*, 1991; Raman *et al.*, 1992; Petersen *et al.*, 1992).

Secondly, the external body parameters of a newborn are necessary for comparison with the fetal anthropometric measurements taken from the mother at the end of her pregnancy (Poll, 1979; Miller, 1980).

And thirdly, a systematical longitudinal examination of the physical development of children and adults should start soon after their birth (Oliver *et al.*, 1977).

At the Women's Hospital of Tartu University nonpregnant and pregnant women have been investigated anthropologically since 1974. For the last two years a detailed anthropometric study of neonates has been carried out as well.

In this paper we present data on 292 healthy neonated delivered of normal births at the Women's Hospital of Tartu University (150 boys and 142 girls). The following parameters were measured: height, weight, sitting height, length of sternum and abdomen, shoulder width, upper and lower width and depth of thorax, width and depth of abdomen, *D. cristarum*, *D. trochanterica*, *pelvic* depth, 16 circumferences, foot length and two skinfolds (on abdomen and back). The measurements were carried out by micropediatrician U. Salundi, and data were processed by S. Koskel at the Computing Centre of Tartu University.

The mean weight of a neonate was 3620.5 g $\pm$ 448.7 (minimum 2400 g and maximum 4854 g). Boys were somewhat heavier than girls (3684.7 and 3551.3 g respectively). The average height of children was 49.9 cm $\pm$ 1.9 cm (minimum 44 cm and maximum 54.5 cm).

Studies of body structure showed an analogy wih the body composition of women (Kaarma). It was a system of well-correlated anthropometric measurements where the body height and weight were the leading characteristics. Their leading role was also shown by linear regression analysis where, using the height, weight and sex of the children as argument characteristics, all the other characteristics could be prognosticated significantly within the limits of r = 0.4° – 0.85° (see Tabel 1).

Consequently further investigation of body structure as a whole should be provided in body height-weight classes.

Table 1

Multiple linear regression equation for estimating various body measurements of neonates by body height, weight and sex

Criterion variable	Multiple regression equation by sex (2), weight (3), height (4)	Multidimensional correlation coefficient R
1 sitting height	0.1033(2)+0.0013(3)+0.3828(4)+ +9.8778	0.8724°
2 sternum length	–0.1180(2)+0.0004(3)+0.0960(4)+ +2.1616	0.3584°
3 abdomen length	0.1917(2)+0.0009(3)+0.0030(4)+ +2.3650	0.4103°
4 biacromial breadth	–0.0594(2)+0.0011(3)–0.0030(4)+ +6.3618	0.5174°
5 upper chest breadth	0.0999(2)+0.0005(3)+0.0268(4)+ +5.4342	0.4584°
6 lower chest breadth	0.0726(2)+0.0007(3)+0.0107(4)+ +5.7746	0.3911°
7 upper chest depth	–0.0023(2)+0.0009(30–0.0089(4)+ +6.0853	0.5688°
8 lower chest depth	0.0103(2)+0.0009(3)–0.0075(4)+ +5.6827	0.6209°
9 abdomen depth	0.1420(2)+0.0011(3)–0.0552(4)+ +6.0503	0.6331°
10 abdomen breadth	0.0840(2)+0.0013(3)–0.058(40+ +6.1833	0.6792°
11 *D. cristarum*	–0.1123(2)+0.0008(3)+0.0098(4)+ +4.6631	0.7374°
12 pelvis depth	0.0961(2)+0.0007(3)–0.0244(4)+ +3.7755	0.6586°
13 *D. Trochanterica*	0.0123(2)+0.0007(3)+0.0829(4)+ +2.2803	0.7554
14 head circumference	–0.5304(2)+0.0016(3)+0.0303(4)+ +29.0207	0.6359°
15 neck circumference	–0.2052(2)+0.0027(3)–0.2374(4)+ +20.6501	0.7062°

Continued Table 1

Criterion variable	Multiple regression equation by sex (2), weight (3), height (4)	Multidimensional correlation coefficient R
16 upper chest circum-ference	0.1414(2)+0.0031(3)–0.0773(4)+ +24.7959	0.7758°
17 lower chest circum-ference	0.0031(3)+0.0009(4)+ +21.0800	0.8490°
18 abdominal circum-ference	0.6576(2)+0.0036(3)–0.1145(4)+ +21.5988	0.7264°
19 hips circum-ference	0.6560(2)+0.0035(3)–0.0818(4)+ +18.6040	0.8543°
20 thigh maximal circum-ference	0.8102(2)+0.0026(3)–0.1001(4)+ +12.0377	0.6783°
21 thigh minimal circum-ference	0.1513(2)+0.0021(3)–0.1085(4)+ +10.5080	0.8616°
22 calf maximal circum-ference	0.1134(2)+0.0018(3)–0.1121(4)	0.8419°
23 calf minimal circum-ference	–0.0386(2)+0.0012(3)–0.0616(4)+ +7.7690	0.7248°
24 foot length	–0.0915(2)+0.003(3)+0.0815(4)+ +3.0580	0.6637°
25 arm circum-ference	0.1791(2)+0.0017(3)–0.0966(4)+ +8.9037	0.8062°
26 wrist circum-ference	–0.0847(2)+0.0008(3)–0.0297(4)+ +6.6726	0.6307°
27 back skin-fold	0.0417(2)+0.0001(3)–0.0074(4)+ +0.1486	0.5693°
28 abdominal skinfold	0.0068(2)+0.0001(3)–0.0051(4)+ +0.1728	0.4544°

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ANATOMICAL CAUSES OF ILIAC COMPRESSION SYNDROME

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Anatomically the right common iliac artery crosses the left iliac vein. Compression of the left iliac vein between the right common iliac artery and the fifth lumbar vertebra is a recognized cause of non-thrombotic venous obstruction of the left leg. The first clear description on the lesion was given in 1908 by J. P. Mc Murrick (Mc Murrick, 1908). In a study of 105 autopsy specimens "adhesions" were found in 34 cases, and most of them were located at the site of compression of the iliac vein by the artery.

More recently W. E. Erich and E. B. Krumbhaar reported their findings in 412 autopsies (Erich, 1943). They found iliocaval compression with intraluminal webs in 95 cases (23.8%). Most of the patients had no premorbid manifestations of venous abnormalities in the left leg. Only in some patients iliocaval compression produced lower extremity pain, swelling, varicosity and stasis changes.

Despite the earlier anatomic and pathologic descriptions, after publication of research by F. B. Cockett (1965) and R. May and J. Thurner (1957), iliocaval compression was recognized as a syndrom. These scientists demonstrated iliocaval compression in 20–22% of patients.

At present time the compression of the left common iliac vein by the right iliac artery with or without intraluminal webs has been given the eponyms May-Thurner syndrome and Cockett syndrome and venous compression syndrome.

Affected patients usually present with unilateral leg edema, telangiectasis and venous varicosities of the left lower extremities in older persons (Sloane, 1993). Clinically significant obstructions are five times more common in women (Taberi 1987; La Page, 1981), partly associated with vulvar varicosities. In men iliac vein obstruction may be associated with ipsilateral varicocele (Bomalaski M. W. 1993).

It is significant that the iliac vein compression may by caused by a tortuous left common iliac artery (Uchino, 1989; Hassel, 1987).

Some authors consider the intraluminal webs to be congenital in origin, resulting from the persistence of an "embrionic loop" (Mc Murrick, 1908). Other authors are in opinion that congenital webs are

rare (Zahrani, 1989). These webs are probably related to trauma of the iliocaval junction brought on by chronic compression and pulsation by the iliac artery on the right side (Taheri 1987) and their number increased, according to the age of the patient (Erich, 1943).

Iliocaval compression syndrome has been implicated as a cause of the three to eight times greater frequency of occurrence of iliofemoral venous thrombosis on the left side compared with the right side.

We investigated iliac veins in 100 human cadavers. Their ages ranged from 17 to 81 years. Abdominal aorta and iliac arteries, vena cava and iliac veins were exposed from the abdominal approach. Then the artery was dissected above the vein and the vein volume was opened by longitudinal incision. All cases were described and photographed.

The results of our investigation are summarised in table 1.

Table 1

Anatomical findings in iliac veins

Findings	Number
Longitudinal webs in the iliocaval junction	18
Stenosis of the left common iliac vein	11
Webs in the left common iliac vein	3
Thrombosis in the left common iliac vein	6
Thrombosis in the right common iliac vein	5
Iliac veins without pathological findings	57
TOTAL	100

Pathological changes were found in 43 cases. The intraluminal web construction (fibrous septa) extended longitudinally in the iliocaval junction was identified most frequently (18 cases). These webs occluded the lumen of common iliac veins about 1/4 to 1/3.

The left side predominance of the webs may be connected with the anatomical peculiarity- the angle at which the left common iliac veins flows into the vena cava is smaller than the right .

In three cases the fibrous adhesions developed within the lumen of vein at place it crossed by the artery. These webs were 3–4 mm thick, binding the anterior and posterior walls of the vessels together. An obvious stenosis, caused by compression of the left common iliac vein by the overlying right common iliac artery was established in one case.

The stenosis of the left iliac vein was identified in 11 cases (11%). The artery was fast adhered with the vein. In 3 cases the vein wall was thickened in the place where it contacted the artery. In one case

we identified an athrophy of the iliac vein wall with a macroscopical phlebosclerosis. The left common and external iliac vein thrombosis was established in 6 cases (6%). The premorbid manifestation of thrombosis was identified only once.

In general it may be concluded that almost half of the human cadavers investigated by us had some kind of changes in iliocaval function.

Undoubtedly, in some patients, although probably a minority, it may cause a significant disorder, connected with lower extremity pains, swelling. varicosity and stasis changes. Sometimes the initial manifestation of this anomaly may be an iliofemoral thrombosis. However, in most cases these changes were asympthomatic. Recognition of these lesions are important in case of the surgical reconstructions of the deep veins of the leg to prevent recurrent thrombosis.

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DETERMINATION OF BODY COMPOSITION AND MORPHOMETRIC CHARACTERISTICS OF THE HUMAN WITH THE AID OF MAGNETIC RESONANCE TOMOGRAPHY

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The article demonstrates the possibility of using magentic resonance tomography for the intravital determination of the constitutional features, body composition and morphometric characteristics of the human. By means of magnetic resonance tomography % of muscle mass, the % of fat mass; the area of cross section of bones, muscles, and tendons of the distal part of the leg; the length of the Achilles' tendon and the moment arm length of the *triceps surae* and *tibialis anterior* muscles; the mass, moment of inertia, and position of the center of gravity of the foot; the composition of the foot tissues were determined with high accuracy. It is concluded that the prospects for the use of magnetic resonance tomography in order to determine the constitutional features, body composition and morphometric characteristics of the human are good.

For the sport selection choosing, prognostic information and early professional orientation in kinds of sport for children and juniors the use of quantitative data of the constitutional features of individual, of body composition and the morphometric characteristics of the human motor system is now customary. These data include, in partiular, the length of ligaments, tendons, and muscles; the moment arm length of muscles; the area of cross section of muscles, tendons, and bones; mass-inertia characteristics of segments of the body; the composition of the tissues of the body, etc (Zatsiorskii, Aruin, Seluyanov, 1981).

Until recently the morphometric characteristics of the human motor system have been measured mainly on cadavaric preparations (Aruin, Zatsiorskii, Prilutskii, 1988; Alexander, Verton, 1975), and they have then been used to analyze movement of the living human being. The disadvantages of this approach are obvious. Improvement of measuring methods has thus proceeded along the lines of recording the morphometric characteristics in the living subject. For instance, the use of roentgenograms has enabled the moment arm length and

the length of muscles to be determined with the joint at different angles (Kozlov, Zvenigorodskaya, 1982; Smidt, 1973). With the introduction of the ultrasonic echolocation method, it became possible to measure the area of the anatomical cross-section of muscles to be measured during life (Ikai, Fujunaga, 1968; Kots, Bolkhovskikh, 1975). With the radioisotope method (Zatsiorskii, Aruin, Seluyanov, 1981), the mass, moment of inertia, and position of the center of gravity of segments of the human body can be measured during life. In recent years the method of computer-assisted tomography has enabled most of the above-mentioned the morphometric characteristics to be measured with high accuracy.

The above-mentioned methods of intravital recording of the constitutional features, body composition and morphometric characteristics of the human do, however, have their limitations. For instance, the roentgenographic method and computer-assisted tomography cannot be widely used because of the ionizing radiation induced by them. The method of ultrasonic echolocation is not sufficiently sensitive and, in particular, it does not allow the boundary between muscles to be defined. The radioisotope method of determination of mass and inertia characteristics of the body segments (mass, moment of inertia, and so on) does not pose any risk for the health of an adult undergoing a single investigation (Zatsiorskii, Aruin, Seluyanov, 1981). However, in the case of frequent use of this method on the same individual the dose of radiation received may be extremely high. This method cannot be used to investigate children.

The most promising technique for intravital measurement of morphometric characteristics and body composition of the human, and especialy children, is a new method of introscopy, namely magnetic resonance tomography, which combines high resolving power with absence of risk to human health (Kutushenko, Bushuev, Okon, 1982; Nuclear magnetic resonance..., 1981).

The aim of this investigation was to demonstrate the possibility of using of the magnetic resonance tomography to determine the constitutional features of individual, of body composition and the morphometric characteristics of the human motor system during life.

Method

The investigation was conducted on one healthy subject (a man aged 31 years, height 1.83 m, weight 78 kg). The subject lay in the supine position on the platform of an the magnetic resonance tomograph. In the course of 15 min 30 pictures were obtained of the left foot and distal part of the left leg in frontal, sagittal, and axial planes. The distance between the sections was 1 cm.

The investigations were conducted on a BNT-1100 MR-tomograph (Burker, West Germany). The instrument has a resistive magnet with magnetic field intensity of 0.234 T, a working frequency of 9.95 MHz, and a diameter of the excisting coil of 0.27 m in the field of the image.

Results

With high resolving power following procedures have made:

determination of Length of Ligaments, Tendons, Muscles, and Bone Formations;

determination of Moment Arm Length of a Muscle (tendon);

determination of the Area of Cross Section of Anatomical Formations;

determination of Masses, Moments of Inertia, and Positions of Centers of Gravity of Body Segments;

Table 1

Morphometric characteristics of the foot, determined by MR tomography

Characteristics	Value, dimensionality	Remarks
Length of Achilles' tendon	6.0 m	Measured on axial MR-tomograms
Moment arm length of triceps *surae m.*	3.8 m	Measued on sagittal MR-tomograms
Moment arm length of *tibialis anterior m.*	3.6 m	Angle of ankle 162 (angle between long axis of *tibia* and line connecting center of rotation inankle joint with center of fifth metacarpophalangeal joint)
Weight of foot	0.941 kg	
Position of center of gravity of foot	0.045 m	
Moment of inertia of foot	0.0023283 $kg \cdot m^3$	
Weight of bones of foot	0.883 kg (72.6%)	
Weight of tendons and ligament of foot	0.024 kg (2.6%)	
Weight of muscles of foot	0.090 kg (9.6%)	
Weight of skin of foot	0.144 kg (15.3%)	

determination of the Weight of the Bone, Fat, Muscle, and Other Tissues.

Tables 1 and 2 gives values of several morphometric characteristics determined from sagittal and axial MR-tomograms of the foot and distal part of the leg.

Tabel 2

Area of cross section of bones, muscles and tendons measured on axial MR tomogram

Bone, muscle tendon	Area, cm^2
Tibia	0.5
Finula	1.9
Soleus muscle	3.0
Flexor hallucis longus	4.0
Flexor digitorum longus	1.4
Extensor digitorum longus	3.0
Extensor hallucis longus	0.5
Peroneus longus and peroneus brevis	1.7
Tendon of extensor *hallucis longus muscle*	0.1
Tendon of *tibialis anterial muscle*	0.4
Tendond onf *tibialis posterios muscle*	0.5
Tendon of *plantaris muscle*	0.05
Achilles' tendon	0.8
Tendon of extensor *digitorum longus muscle*	0.2
Tendon of extensor itav hallucis longus muscle	0.2
Tendons of *peroneus longus and peroneus brevis muscles*	0.4

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THE CRANIOBASILAR INDEX AND ITS USE IN MORPHOMETRICAL STUDIES OF THE CRANIAL BASE

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The cranial breadth-length index, commonly used in craniology, defines rather the form of the vault than that of the base of the skull. In classical craniology the special definition of the form of the cranial base is absent, and conception of dolicho-, meso- and brachocrany includes the base of the skull as well (Martin, 1928). However the vault and the base of the skull have different origin and structure and features of their development and growth are also different. The cranial base may be considered as a "startpoint" in the development of the cranium as a whole (Moore, 1981). The middle part of the cranial base influences by its development the vault as well the facial skeleton. Therefore the form of the cranial base must not be considered as derivative from the form of the vault.

The present study aims to obtain an exact metrical characteristic of the cranial base and to compare it with forms of the vault. The material consisted of 248 dry skulls of adult humans of known age and sex from the collection of the anatomical Museum of Saratov Medical University. The following measurements were taken according to Martin's technique:

1) maximal length of the skull from *glabella* to *opisthocranion*;
2) maximal breadth of the skull from left to right *eurion*;
3) length of the cranial base from nasion to *opisthion*;
4) breadth of cranial base from left to right *auriculare*.

Two indices were calculated:

1) cranial index = *eurion-eurion* breadth/*glabella-opisthocranion* length × 100;

2) craniobasilar index = *auriculare-auriculare* breadth/*nasion-opisthion* length × 100.

The cranial index in our sample varies from 71.3 to 95.5 (mean 79.5 ± 0.3; standard deviation ± 3.4). In accordance with its values skulls were divided into dolichocranic (28 specimens), mesocranic (109 specimens) and brachycranic (111 specimens). The craniobasilar

index varied from 79 to 106 (mean 93.5 ± 0.3; standart deviation ± 3.7). In accordance with its values skulls were divided into dolichobasilar (index less than 89), mesobasilar (index 89–97.2) and brachybasilar (index above 97.2). The limits between these three forms are the standard deviation. Dolichobasilar are 48 skulls, mesobasilar 172 and brachybasilar 28 skulls. The forms of the vault and that of the cranial base coincided only in 116 specimens (46.8%) and were different in 132 specimens (53.2%). The correlation between cephalic and craniobasilar indices equals 0.7 ±0.04.

Depending on the combination of two indices, 9 groups of skulls may be distinguished; 10 dolichocranic and dolichobasilar — 14 (5.6%); 20 dolichocranic and mesobasilar — 13 (5.2%); 30 dolichocranic and brachybasilar — 1 (0.4%); 4) mesocranic and dolichobasilar — 26 (10.5%); 50 mesocranic and mesobasilar — 79 (31.9%); 6) mesocranic and brachybasilar — 4 (1.6%); 7) brachycranic and dolichobasilar — 8 (3.2%); 8) brachycranic and mesobasilar — 80 (32.3%); 9) brachycranic and brachybasilar — 23 (9.3%).

Aforecited classification of the base of the skull in our study of bony structures of the cranial base have been used. The space relations of the foramina of the cranial base by technique of craniostereotopometry have been investigated. This technique is based on the system of three-dimensional orthogonal coordinates and permits to define abscisses (distance to median sagittal plane), ordinates (distances to the frontal biauricular plane) and applicates (distance to the horizontal Frankfurt plane) of any bone structure.

This study demonstrates that in the majority of cases abscisses of the foramina of the cranial base are greater in mesobasilar skulls than in dolichobasialr ones. Ordinates of the external opening of the hypoglossal canal, the jugular foramen and the external opening of the condylas canal are greater in mesobasilar skulls than in dolicho- and brachybasilar ones. Applicates of the jugular foramen and external opening of the hypoglossal and condylar canals are greater in mesobasilar skulls than in dolicho- and brachybasilar ones. The distance between the external opening of hypoglossal canal and the stylomastoid foramen is greater in brachy- and mesobasilar skulls than in dolichobasilar ones. The distance between the jugular and stylomastoid foramina is greater in brachybasilar skulls than in meso- and dolichobasilar ones. Some differences in forms of the petrygomacillary fissure in dolicho-, meso- and brachybasilar skulls have been observed as well.

Our results allow to consider the craniobasilar index as an appropriate characteristic of the skull, which may be recommended to be used in craniometric studies.

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AGE AT MENARCHE IN WOMEN SOFIA

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Age at menarche is very sensible to sociofamilial enviroment influences. Studies on this subject are rare in Bulgaria. The aim of the present paper is to trace the relationships between some factors of the social enivroment (level of urbanisation, number of sibs etc) and the age at menarche retrospetively.

510 women, mothers of schoolchildren in three schools in Sofia been investigated during 1984–1987. 54 did not respond to the question about their age at menarche. 21 have been excluded from analysis because they are born outside Bulgaria or without data of birth year and birth place. 435cases are relatively complete. They are born in the period from 1928 to 1957 (mean birth year 1947 with SD arount 5 years). 195 are Sofia natives and 240 migrants. They have been classified the number of inhabitants in their birth place in their birth decade (census data of 1926, 1934, 1946 and 1956) and according to the number of their sibs. In 153 women (in one scool only) additional data about their parents occupation and education have been collected.

The mean age at menarche in the whole sample is 13.32 ± 0.07 years ($n = 435$, $SD = 1.38$). In women born in localities of population over 5000 it is 13.19 ± 0.07 ($n = 330$, $SD = 1.33$). there is no significant difference between Sofia natives and migrants from other big localities. In women, born in localities of less than 5000 inhabitants the mean age at menarche is 13.73 ± 0.14 years ($n = 105$, $SD = 1.45$) whish is significantly higer ($p = 0.001$). Later the terms "urban" and "rural" women shall be used for these two groups differing in age at menarche.

In women without sibs the mean age at menarche is 12.90 ± 0.16 years ($n = 76$, $SD = 1.36$), in women with one sib — 13.27 ± 0.08 years ($n = 252$, $SD = 1.26$) and in women with two and more sibs –13.75 ± 0.13 ($n = 106$, $SD = 1.38$). This gradient can be traced well both in urban and in rural women (Table 1).

An acceleration trend of age at menarshe can be traced only in Sofia natives. Among them the mean age at menarche was 13.66 ± 0.21 in women born in 1930s and decelerate to 13.00 ± 0.17 in these born in 1950s ($p = < 0.02$). There is no acceleration trend in other

Table 1

Age at menarche according the number of sibs

Origin	Number of sibs	n	Age at menarche, years			Notes
			Mean	SE	SD	
Urban	0	63	12.87	0.17	1.36	
	1	197	13.18	0.09	1.29	
	2-5	69	13.50	0.16	1.35	$t_{02} = 2.67, p < 0.01$
Rural	0	13	13.08	0.38	1.38	
	1	55	13.55	0.20	1.46	
	2-5	37	14.23	0.22	1.33	$t_{02} = 2.61, p < 0.02$
All	0	76	12.09	0.16	1.36	
	1	252	13.27	0.08	1.26	$t_{01} = 2.07, p < 0.05$
	2-5	106	13.75	0.13	1.38	$t_{02} = 4.13, p < 0.001$

urban and rural women, their mean ages at menarche remain stable around 13.2 and 13.7 years respectively (Table 2).

Table 2

Age at menarche according the birth decade

Origin	Birth decade	n	Age at menarche, years			Notes
			Mean	SE	SD	
Urban	1030–39	19	13.66	0.21	0.91	
	1940–49	112	13.22	0.13	1.39	$t_{34} = 1.78, p < 0.10$
	1950–59	63	13.00	0.17	1.35	$t_{35} = 2.44, p < 0.02$
Rural	1030–39	12	13.21	0.30	1.03	
	1940–49	82	13.19	0.15	1.32	
	1950–59	41	13.21	0.22	1.38	
All	1030–39	12	13.75	0.54	1.86	
	1940–49	68	13.72	0.17	1.39	
	1950–59	24	13.77	0.30	1.47	

There are also significant between the mean ages at menarche according to parental education and occupation. Sexual maturation is later in daughters of less educated paerents, occupied in manual work. It can be seen also that the differences in mean age at menarche depending on the mother's education and occupation are higer than the ones on the father's side.

There is a significant difference of mean age at menarche between the generation of mothers and their daughters — from 13.32 ± 0.07 to 12.86 ± 0.11 years (Stoev *et al.*, 1989/90). But the realationships between the age at menarche and the social environment are the same both in the mothers and in daughters. They are similar to the

Table 3

Age at menarche and some parental characteristics

Parental characteristics		n	Age at menarche, years			Notes
			Mean	SE	SD	
Father's education	primary	32	13.67	0.23	1.28	$t_{ps} = 2.21$, $p < 0.05$
	secondary	55	13.05	0.16	1.22	
	high	51	13.08	0.18	1.32	$t_{ph} = 2.02$, $p < 0.05$
Father's occupation	manual work	45	13.43	0.20	1.32	$t_{mn} = 1.72$, $p < 0.10$
	nonmanual w.	75	13.01	0.14	1.23	
Mother's education	primary	35	13.54	0.23	1.34	$t_{sh} = 2.93$, $p < 0.01$
	secondary	78	13.25	0.15	1.33	
	high	25	12.57	0.18	0.88	$t_{ph} = 3.38$, $p < 0.002$
Mother's occupation	farm work	14	13.75	0.35	1.31	$t_{fn} = 2.21$, $p < 0.05$
	manual work	33	13.48	0.25	1.44	
	nonmanual w. urban	60	12.90	0.16	1.21	$t_{mn} = 1.96$, $p < 0.10$
	housewife	11	12.68	0.25	0.84	$t_{fh} = 2.47$, $p < 0.05$

ones in other European and are very well expressed. The difference between opposite subsamples are 0.5–1.1 years — very high compared to the West European level and even higer than the level in Eastern Europe (Danker-Hopfe, 1986; Hulanicka *et al.*, 1993). These results mean that around 1960 the social diversity in Bulgaria concerning the biologically important factors was hig and close to the one found around 1985.

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HORMONAL CHANGES IN TRIATHLETES DURING THE PRE-COMPETITION TRAINING CAMP AND SUBSEQUENT NATIONAL CUP

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Abstract

Six elite triathletes, aged 26.5 ± 2.7 years weighing 69.0 ± 4.8 kg, were studied for 7 consecutive days on the pre-competition training camp followed by competitions (National Cup; 1.5 km swimming, 40 km cycling and 10 km running). Capillary blood was sampled every morning, in the preprandial state. On the day of competition three samples were taken — in the morning, at about 9:30 (before start) and about noon (after the finish). Cortisol and testosterone were determined by specific radioimmunoassays. Mean cortisol values steadily decreased from 592 ± 80 $nmol \cdot l^{-1}$ on the first day, to 410 ± 44 $nmol \cdot l^{-1}$ 4 days later, then increased and decreased again, reaching lowest level on the eve of competition (322 ± 52 $nmol \cdot l^{-1}$). On the day of competiton cortiosol levels were elevated reaching highest values after the competition (609 ± 91 $nmol \cdot l^{-1}$). Testosterone levels were more uniform, ranging from 15.3 ± 4.6 to 23.0 ± 4.7 $nmol \cdot l^{-1}$ throughout the study. The testosterone-to-cortisol index averaged 4.1 ± 1.5 over the training period. These data suggest a satisfactory fitness level attained by the athletes and their ability to control the pre-start emotions.

Introduction

Olympic triathlon, consisting of three events making together a strenuous endurance performance, elicits physiological responses which differ from those observed following either of those exercises separately (Kreider *et al.*, 1988). This makes that sport interesting from the hormonal point of view, especially regarding cortisol and testosterone — hormones engaged in competition-included stress and

metabolic regulations (cf. Urhausen *et al.*, 1987). The aim of this study was to provide information on hormonal changes associated with the pre-competition training period and the competition itself.

Material and methods

Six elite triathletes, preparing for National Cup, volunteered to participate in the study. Their mean age was 26.5 ± 2.7 years, mean body mass — 69.0 ± 4.8 kg, training experience ranging from 11 to 15 years (one athlete had only 3 years of competitive experience). The study was conducted at the pre-competition swimming, 40 km bike course, 10 km running) which took place at a different location.

Capillary blood (from fingertips) was taken in the preprandial state in the morning for 10 consecutive days preceding the competition, on the eve of competitions (resting day), and on the day of competition — in the morning, just before the start (about 9:30) and after the finish (about noon). During the training camp, also the night portions (from 22:00 to 7:00) of urine were collected.

Cortisol and testosterone were determined in blood serum by specific radioimmunoassays by using commercial kits (Orion Diagnostica, Finland). Cortisol in urine was determined by the same method following methylene chloride extraction.

Data were presented as means ±SD and analyzed by conventional methods (Student's t-test for dependent and independent data, ANOVA). The level of $p \leq 0.05$ was considered significant.

Results and discussion

Mean (±SD) values of cortisol and testosterone concentrations in serum and of cortisol content in night portions of urine are presented in Fig. 1. Lowest values of cortisol and highest ones of testosterone were observed on Days 3–5 of the training which was associated with highest values of the T:C ratio. The very low cortisol level on the eve of championships can be partly attributed to a later time of blood sampling (10:00), which decreased just before the start (at 10:00) but was still considerably higher than on the previous day at the same time. This was probably due to pre-start emotions as confirmed by an increased urinary cortisol on the pre-competition night.

The anabolic-catabolic balance, expressed as the testosterone-to-cortisol ratio, was low at the beginning of training and two days before competitions. However, on the eve of competitions it increased to

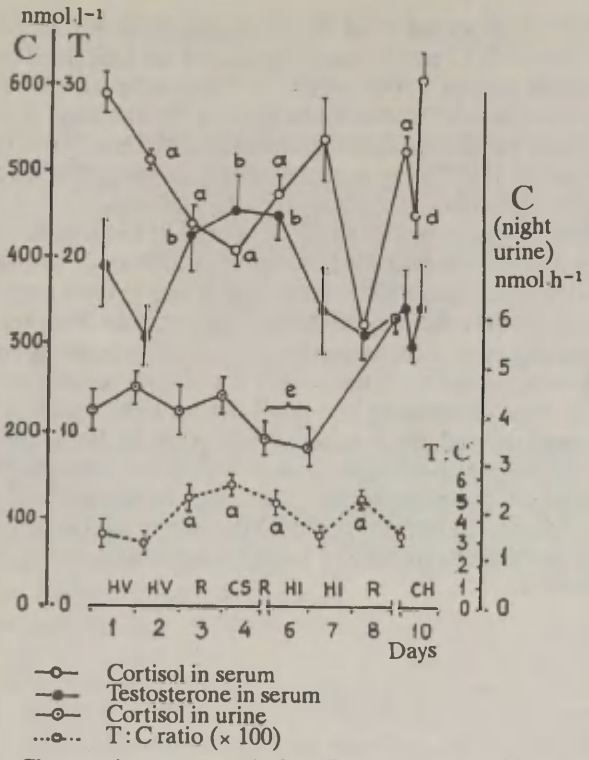

Figure 1. Changes in serum cortisol and testosterone and in urinary cortisol excretion during the pre-championship training and competitions in elite triathletes. Data are presented as means ±SE.

C — Cortisol in serum (nmol·l^{-1}); T — Testosterone in serum (nmol·l^{-1}); T:C — Testosterone-to cortisol ratio; U — Urinary cortisol (μg/night; 9 hourts, from 20:00 to 7:00); R — Resting day; HV — High volume training; HI — High intensity training; CS — Control starts; CH — Competitions
a — Significantly ($p < 0.01$) different from the respective vlaue on Day 1; b — significantly ($p < 0.01$) different from the respective value on Day 2; d — significantly (< 0.01) different from the corresponding value on Day 8 and from the morning value; e — combined values on Nights 6 and 7 significantly (< 0.01) different from the values on previous nights (all by paired t-test)

a satisfactory level due to a decreased serum cortisol. Together with cortisol values, that ratio suggested a good preparation of athletes and their ability to suppress anxiety before the start. The results they achieved (total time ranging from 118 to 128 min) evidenced their good fitness; these results were comparable with those of De

Vito (1995) who reported total times ranging from 112 to 137 min. The much lower T:C ratios found by us can be explained by early blood sampling (about 7:00), while De Vito sampled blood about noon, when cortisol levels were lower than in the morning. The much higher post-competition serum cortisol values observed by Urhausen and Kindermann (1987) was probably due to a lower fitness of their triathletes as follows from the total times they achieved (171 ± 22 min, and at a shorter swimming distance). It should be emphasized that all the athletes studied exhibited a homogenous pattern of responses to training and competition which was probably due to their long-lasting experience and thus relatively advanced age — about 30 years.

The excretion rate of cortisol with urine, which was about 4 nmol/h, agrees well with values reported earlier for resting conditions (Stupnicki, 1992), thus confirming the good fitness level attained by the triathletes studied and their good mobilization to the competition evidenced by the pre-competition rise in cortisol excreation (Fig. 1).

In conclusion, the monitoring of changes in cortisol and testosterone levels during the pre-championship training, helped preventing the athletes from overtraining and provided a pattern of such changes in elite triathletes.

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ON THE VARIABILITY OF THE TOPOGRAPHY OF THE MAXILLARY ARTERY AND ITS POSSIBLE CORRELATION TO THE RACIAL PECULARITIES AND CEPHALIC INDEX

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The present study was carried out due to the need to explain the contradictions between our long-term dissection experiences concerning the topography of the arteria maxillaris and the trigeminus nerve in the fossa infratemporalis and the literature data of anatomical textbooks and atlases. The dissections were performed in the chair of anatomy in the Institute of Anatomy.

The complex and variability behavior of the arteria maxillaris in the fossa infratemporalis have been the subject of investigatons by Lurje (1947), Lasker (1951), Adachi (1928), Navarro (1981), Krizan (1960). Adachi (1928) arose considerable interest and intrigued morphologists with his data suggesting that there are racial differences in the frequency of the different types of position of the maxillary artery and concluding that it is a racial blood vessel — (the Rassengefas).

The present study suggests the possibility of different frequency of the two types of topography of the second part of the *a. maxillaris* — the lateral (superficial variation) and the medial (deep variation).

The arteria maxillaris being in close relation to the branches of the trigeminus nerve, the topgraphical relationships between them is of some practical interest.

Material and methods

Our study analized the data of anatomical dissection of the faces of man's cadavers (46 halves). The hypothesis of existing correlation of the position of the maxillary artery between the racial peculiarities and cephalic index of the individuals was the main reason for us to resolve the following problems:

first — to study the variability of topography of the arteria maxillaris in relation to pterygoid lateral muscle in the fossa infratemporalis;

second — to analize the relationship between the type of coursing maxillary artery (deep, superficial or pierce) and the trigeminus nerve V 3 in the fossa infratemporalis;

third — to study quite a problematical correlation between the type of position of the maxillary artery and the cephalic index of skulls.

Results

The high individual variability and differences of the arborisation of the maxillary artery in the fossa infratemporalis has been found. According to conventional analysis, the first beginning part of the artery extends to the posterior margin of the musculus pterygoideus lateralis coursing between collum mandibulae and the *m. temporalis* on the one side and m.pterygoideus medialis on the other side. The second part of the artery extends either to the outer (superficial, lateral variation) or to the inner (deep, medial variation) side of the *m. pterygoideus lateralis*. There is the third — perforated, pierced variation, when the artery courses between the upper and lower heads or passing through the muscle into the medial side of *m. pterygoideus lateralis*. The results obtained are shown in table 1 and fig. 1.

Table 1

Relationship of the maxillary artery to the trigeminus nerve V 3

Position of the *a. maxillaris* to the *m. pterygoideus lateralis*	N	%	laterally		medially		between *n.alv. inf.* and *lingualis*	
			n	%	n	%	n	%
lateral to the *m. pterygoideus lat.*	12	26	–	–	–	–	–	–
medial to the muscle	28	61	21	75	3	11	3	11
pierces the muscle	6	13						
total number	46							

In 28 out of 44 dissections, the maxillary artery is located on the inner side (deep variation) of the lateral pterygoid muscule, in 12 cases on the lateral side (superficial variation). In 3 cases it courses between the upper and lower heads to medially and in 3 cases it pierces the muscle. Table 1.

The most widely spread opinion is that the lateral position of the maxillary artery in relation to the pterygoid muscle is prevalent (Adachi (1928), Krizan (1960), Skopakoff (1968), Lurje (1947). Table 2. Adachi (1928) revealed and suggested that the arborisation of the maxillary artery has ethnic peculiarities — in the Japanese it takes place more laterally in comparison with the Europeans. Lasker (1954) suggests how ever the possibility of different frequency of the two major types of course of maxillary artery in American negroes and the whites. Contrary to Adachi (1928), Lauber (1901) in Vienna reported the lateral superficial type of the artery in only 8,5% of the individuals.

Table 2

Topographical relationships of the *a. maxillaris* and *m. pterygoideus lateralis*

	Long (1891)		Lauber (1901)		Adachi (1928)		Krizan (1960)		Skopakoff (1968)		Ortug (1991)	
	n	%	n	%	n	%	n	%	n	%	n	%
on the lateral side of *m.pterygoideus lateralis*	50	53,8	17	8,5	310	93,7	132	66	125	69,4	87	44,8
on the medial side of muscle	43	46,2	183	91,5	21	6,3	63	34	55	30,6	107	55,2
total number	93		200		331		200		180		194	

On the basis of our dissection materials, the medial type to certain extent predominant in Estonians — the maxillary artery lies deep in the external pterygoid muscle, on its inner side in 34 cases of total 46.

The relationships between maxillary artery and *m. pterygoideus lateralis* affects the order of topographical relations of the trigeminus nerve V 3 and maxillary artery and are of considerable clinical interest. Table 1. According to our dissection data in 75% of faces the artery crossed the branches of the nerve laterally, in 11 — medially. In 3 cases the artery courses between the *n. alveolaris inferior medially* and *n. lingualis laterally*. In one case the artery perforated *n. alveolaris inferior* and after that crossed the *n. lingualis laterally*. Above — mentioned results corresponds to data of Ortug (1991), Lauber (1901).

The third problem about the position of the maxillary artery and its relation to the cephalic index is quite questionable. The data of different authors are of great interest — Lurje (1947) have reported the correlations between topography of the arteria maxillaris and the cephalic index. Lasker (1951) and Krtizan (1960) on the contrary to Lurje negate these correlations. With this in mind we have studied the cephalic index in 23 adult dissections (46 halves). We have found the brachycephalic skulls in 16 adults individuals, the mesocephalic type in 18 skulls and dolichephalic type in 12 cases. In 8 cases out of 12 (66%) sides of dolichephalic individuals, in 9 out of 18 sides (50%) of mesocephalic individuals and 11 out of 16 (68 %) of brachycephalic individuals the maxillary artery laid in the deep position. Table 3. The close relation existing between the topography of the maxillary artery and the peculiarities of different cranial types should not be stressed. We fully aware that the number of our dissections is not sufficent for making profound conclusions either confirming or disproving these correlations. Nevertheless some tendency of the deep position of the maxillary artery to prevail in mesocephalic and brachycephalic skulls was observed. We compared our date of frequency of the cephalic types with those of Heapost (1984), who suggested that the mesocephalic skull prevails in Estonians and has a tendency to become more brachycephalic. Table 4 gives the comparison of data by different author. Lurje suggested that the brachycephalic skulls have the deep position of maxillary artery in 69% of cases and confirmed opinion of Tandler that maxillary artery develops from the anastomoses between the *a. carotis externa* and stapedian artery, which is a branch of the internal carotid artery. As the dolichocephalic skulls have a narrow transverse diameter, so the shortest course from the *a. carotis externa* to the *a. stapedia* is on the outer side of the *m. pterygoideus lateralis*.

Table 3

Relationship of the type of position of the maxillary artery to the cephalic index

	Dolicocephalic c.i = less than 75			Mesocephalic c.i. = 75 to 80			Brachycephalic c.i = 80 or over		
	superf.	pier-ces	deep	superf.	pier-ces	deep	superf.	pier-ces	deep
number of cases	3	3	3 (41%)	7	2	12 (66%)	2	3	11 (68, 75%)
total number	12			18			16		

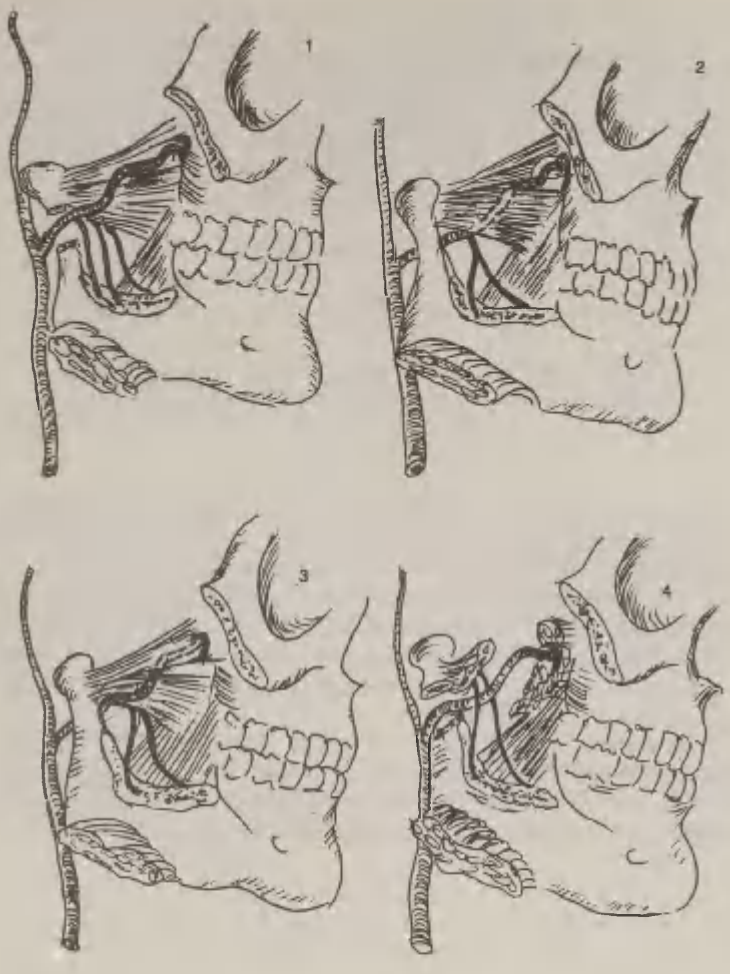

Figure 1. The scheme of the different types of the topography of the maxillary artery in relation to the pterygoid muscle and the trigeminus nerve.

The scheme of the different types of the topography of the maxillary artery in relation to the pterygoid muscle and the trigeminus nerve.

1, 3 — the lateral, superficial position of the *a. maxillaris*

2, 4 — the medial, deep position of the artery; 2 — artery crosses the nerves laterally; 4 — artery courses between the *n. alveolaris inf. medially and n. lingualis* laterally

Table 4

Relationship of the type of position of the maxillary artery to the cephalic index

	Dolicocephalic		Mesocephalic		Brachycephalic	
	superf.	deep	superf.	deep	superf.	deep
Lurje (1947)	93.4%	6.6%	71.85%	29.15%	31%	69%
Krizan (1960)	66.7%	33.3%	80%	20%	56%	43.9%
Lasker (1951)	18%	15%	52%	50%	29.3%	33%

Summary

1. In our dissections of the fossa infratemporalis the maxillary artery is running more frequently in 34 out of 46 cases on the medial side (the deep variation) of the *m. pterygoideus lateralis*.

2. The topographical relation between the trigeminus nerve V 3 and maxillary artery reveal that in 21 of cases the artery crosses the branches of *n. mandibularis laterally*, in 3 cases medially and in 3 cases courses between the *n. alveolaris inferior* and *lingualis*, in one case perforates *n. alveolaris inferior*.

3. The close relation existing between the topography of the maxillary artery and the peculiarities of different cranial types we should not to declare, but some tendency to the deep position of the maxillary artery we have seen in mesocephalic and brachycephalic skulls.

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BODY COMPOSITION AND SOMATOTYPES OF TARTU SCHOOLCHILDREN

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In the present work we tried to find out relationships between body composition and somatotypes of 9-year old children. Age 9 years has traditionally been considered to be the time where the signs of maturity have not as yet appeared and where there are no major intersexual differences.

The contingent of the investigation was: 52 subjects (22 boys and 30 girls) from Tartu secondary schools. The study was carried out in 1991–1992. Anthropometric measurements were carried out by the author according to the methods developed by R. Martin (Martin, 1928). Skinfolds were taken with a special constant pressure calliper (10 g/mm) designed by the Experimental Laboratory of the Tartu University. Skinfold measurements were made according to the suggestions of J. Pařizková (Pařizková, 1977) and E. Martirosov (Martirosov, 1982). All skinfolds were measured vertically and on the right-hand side of the body, except abdomen skinfold (umbilicus), which was measured horizontally, and the subscapular skinfold, measured at a 45 degree angle to the vertical.

Children were somatotyped visually according to Shtefko-Ostrovsky scale (Shtefko, Ostrovsky, 1929). In the analysis the somatotypes of this scheme were combined into four cohorts:

1) thinframed cohort (asthenoid, thoracal and thoraco-muscular types)

2) muscular cohort (musculo-thoracal and muscular types)

3) digestive cohort (musculo-digestive, digestive-muscular and digestive types)

4) unidentified cohort

For statistical analysis of the total sample the statgraphic package was used.

Body fat percentages were calculated by skinfold measurements according to the suggestion of R. Silla and M. Teoste (Silla, Teoste, 1989). Body surface area is determined by Isaksson equation.

The mean values and standard deviations of selected anthropometric variables are given in Table 1.

Table 1

Anthropometric Characteristics of Subjects

Variable	Mean	SD*	Min	Max
Weight (kg)	31.60	5.34	21.50	46.65
Height (cm)	137.22	5.49	123.20	148.10
Skinfolds (cm):				
Subscapular	0.70	0.33	0.40	2.10
Side (vertically)	0.79	0.47	0.35	2.90
Side (horizontally)	0.66	0.34	0.30	2.00
Abdomen (umbilicus)	0.83	0.48	0.30	2.60
Triceps	1.10	0.37	0.40	2.20
Biceps	0.72	0.33	0.30	2.10
Thigh (median)	1.81	0.71	0.70	3.75
Calf	1.22	0.41	0.60	2.70

* SD Standard deviation

In comparison with the data of R. Silla and M. Teoste (Silla, Teoste, 1989) the skinfolds in Tartu children measured in 1991–1992 were significantly larger than in Estonian children measured in 1985 (thigh skinfolds remarkably over 1 cm, whereas Silla's data for 7–9 years thigh was 1.13 cm for girls and 1.04 cm for boys).

Body fat calculations according to the suggestions of R. Silla and M. Teoste (1989) are presented in Table 2.

Table 2

Body fat calcualtions of subjects

Variable	Mean	SD
Body surface area (dm^2)	108.853	10.086
Body density (g/ml)	1.049	0.011
Mean of subcutaneous fat thickness (cm)	0.396	0.170
Mass of subcutaneous fat (kg)	3.515	1.773
Rel. mass of inner fat (%)	8.276	0.379
Rel. mass of fat (%)	19.033	4.178
Total fat (kg)	6.141	2.266
Total fat by Matiegka	7.196	3.502

Comparing with Estonian 7–9 -year old children studied by R. Silla and M. Teoste (Silla, Teoste, 1989) the body density of Tartu children as measured in this study have not undergone statistically reliable changes. Increase in body surface area and decrease in relative mass of total body fat (%) of no importance. Mass of total fat of examined

children have close correlations with body weight ($r = 0.92$) and body height ($r = 0.92$).

One-way analysis of variance was used to find out relations between visually determined somatotype cohorts and anthropometric variables, body fat and body density.

This analysis revealed that somatotype cohorts and body dimensions are independent. Only body weight ($p < 0.0025$) and more closely the fat and body density ($p < 0.0001$) are connected with somatotype cohort.

Table 3 presents relations between somatotype cohort and body density.

Table 3

Relation between somatotype cohort and body density

Somatotype cohort	Count n	Mean	95 Percent confidence intervals for mean	
I thinframed	19	1.057	1.053	1.060
II muscular	9	1.052	1.047	1.057
III digestive	10	1.036	1.031	1.041
IV unidentified	13	1.048	1.043	1.052

Statistically significant differences of body density ($p < 0.001$) are between the III cohort and the other cohorts. Seems that visually is possible to fix successfully the contrasting somatotypes of children. There may be differencies in body density of different visually by Shtefko-Ostrovsky scale typied somatotype groups analogous to relationships between body composition and Heath-Carter somatotypes, where moderately high assiciations between percentage fat and endomorphy (Carter, Heath , 1990). However, more work needs to be done to examine the relations of somatotypes and body composition in the large-scale anthropometric survey.

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SENSITIVE PERIOD OF ONTOGENESIS AND IMPROVEMENT OF MOTOR CAPACITIES

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The ontogenetic development goes through the so called sensitive (critical) periods. These are time periods when a specific action on the developmental faculties of the organism induces the highest response (Illingworth, Lister, 1964). In these periods new events are introduced by the genetic program (Svetlov, 1972). In a number of studies periodical alterations in the rate of improvement of motor capacities have been found (Hebbelinck, Borms, 1978; Bös, 1988; Malina, Bouchard, 1991). With the aim to generalize the concerned data, a great body of results obtained in Australia, Belgium, Byelorussia, Canada, Czechoslovakia, Estonia, Finland, Germany, Italy, Netherlands, Russia, Ukraine, USA was analyzed.

In these analysis special cautions were made in regard of the validity of the used tests, evaluation of the rate of improvement of motor capacities, and the number of persons studied. According to the last criterion, the most prominent study was made in Byelorussia, summarizing the material obtained in 14812 children of age 7 to 17 years (Guzalovski, 1978).

Despite some minor discrepancies, probably related to methodological problems or possible ethical peculiarities, the results of various authors coincide rather well. Accordingly, periods of accelerated motor development may be suggested. In the male contingent age periods from 8 to 10 and from 13 to 16 years seem to be the most decisive (Fig. 1). In the period from 8 to 10 years a rapid improvement of motor skill (co-ordination) and speed occur In addition fast improvements of endurance occurs from 8 to 9 years and of flexibility from 9 to 10 years. There are also results indicating on a rapid improvement of fast strength (8 to 9 years) and absolute strength (9 to 11 years). The period from 13 to 16 years is characterized by rapid progress in all motor capacities. The fast progress in muscle strength seems to appear from the age of 14 years and lasts up to the age of 17 years (probably longer). The periods of accelerated progress in endurance

exist from 12 to 14 and from 16 to 17 years. An intermediate period of rapid improvement of speed may exist at the age of about 11 to 12 years.

In the female contingent two decisive periods seem to exist also (Fig. 2). The first period may be divided into two parts. The first part is revealed at age of 7 or 8 years and is characterized by the highest rate of development of motor coordination, as well as by the onset of rapid development of speed and fast strength. During the second part of the first period (from the age of 10 years) the rapid development of speed and fast strength continues in combination with a pronounced improvement of muscle strength, endurance, and also flexibility (from the age of 11 years). The first period comes to an end at the age of 12 to 13 years (in regard to flexibility a year later). The second period begins at the age of 14 for rapid development of speed and strength or 15 for endurance and flexibility improvement. A secondary acceleration of the development of coordination or strength was not found in most studies, differently from male adolescents.

The second period of accelerated motor development ceases usually at the age of 17 (in the female contingent a year earlier). However, a caution have to be made due to the fact that in most of references the period of study ended at the age of 17 years.

Special experiments demonstrated that trainability is the highest when there is a high rate of ontogenetic development of the concerned motor capacity (Guzalovski, 1978).

The existence of the two periods indicates that in the course of ontogenetic development favorable conditions for the improvement of motor capacities appear twice. Several suggestion are possible in order to explain the situation:

1. The concerned favourable conditions are fairly similar in both periods; the time separating these two periods expresses a necessity for the accumulation of several quantitative changes, the integrated whole of which provides an opportunity for qualitative changes, measurable by improved motor capacities.

2. The low rate of improvement of motor capacities in the time interval between the two periods of favorable development is caused by new events in the ontogenetic development, utilizing the potential opportunities of body development. Therefore, the possibilities for improvement of motor capacities are reduced.

3. The event(s) which reduces the rate of improvement of motor capacities results in new qualitative changes in the organism. The new situation sets up a new physiological mechanisms enabling a secondary increase in the rate of improvement of motor capacities. Thus, the second period of favourable conditions for motor development is founded on essentially different mechanisms in comparison with the first period.

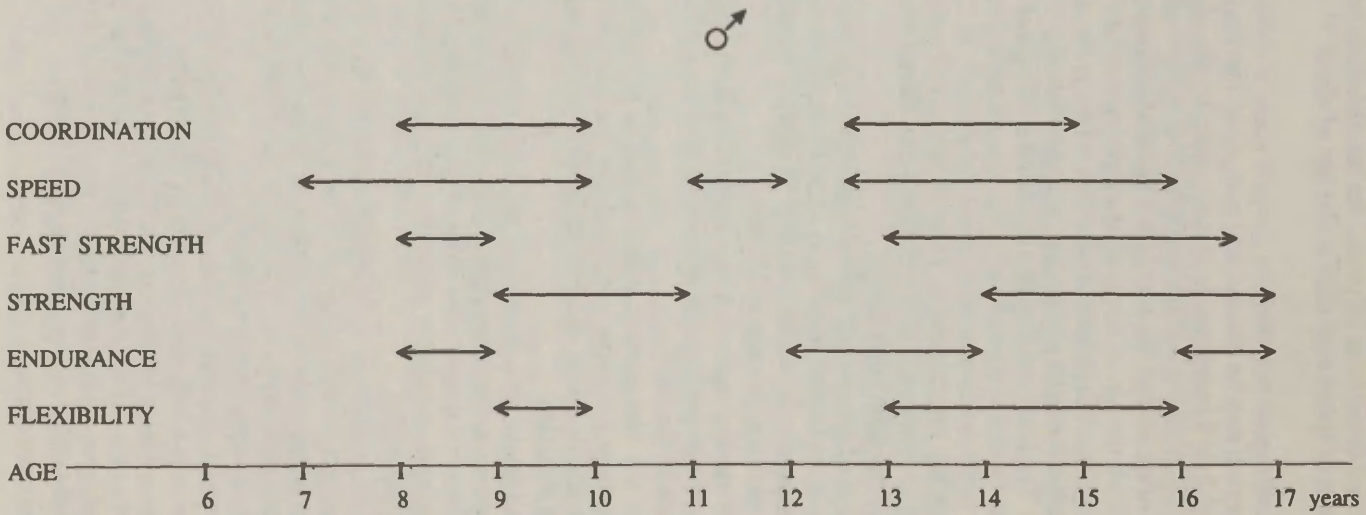

Figure 1. Time periods of increased rate in improvement of motor capacities (indicated by horisontal lines with arrows) in boys.

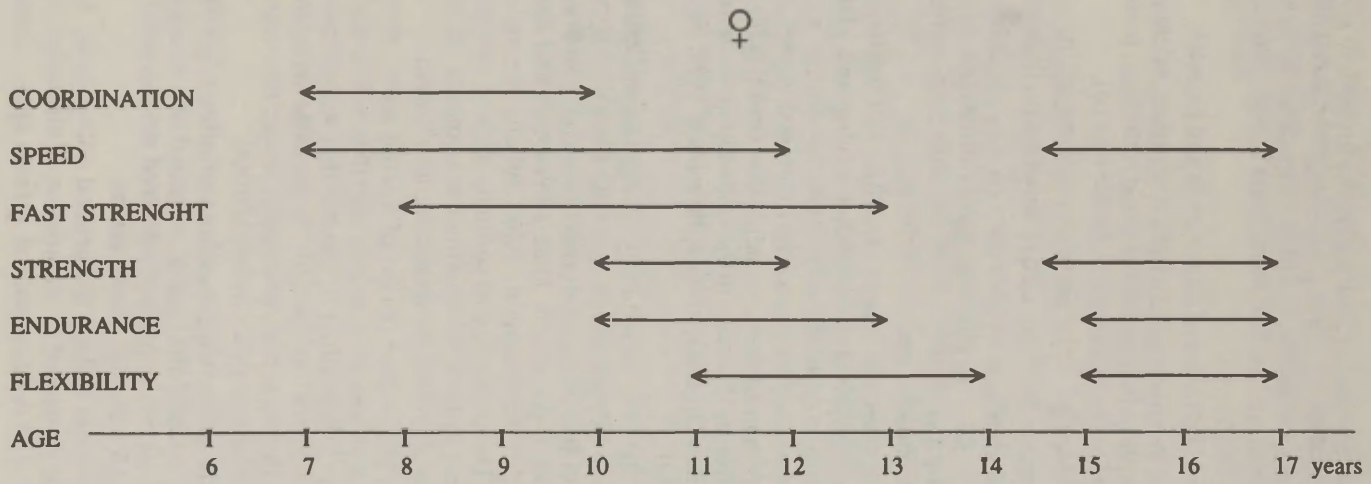

Figure 2. Time periods of increased rate in improvement of motor capacities (indicated by horisontal lines with arrows) in girls.

Analyses of foundations of motor capacities in children and adolescents provide material for the assumption that pronounced differences exist in the physiological essence of motor capacities at various ages. By way of generalization, the following main foundations for motor capacities may be listed:

– coordination of activities of motor units and muscles,

– intramuscular mechanisms (excitation-coupling, calcium sequestering and reabsorption by the sarcoplasmic reticulum, formation of cross-bridges in protofibrils, capacity of ionic pumps),

– functional capacities of the oxygen transport system,

– metabolic reserves and increased possibilities for their utilization,

– muscular and glandular hypertrophy (and hyperplasma) mainly in regard to active skeletal muscles, myocardium and adrenals, as well as hypertrophy and hyperplasia of the most responsible cellular structures in active muscles and endocrine glands.

Up to the school-age the motor capacities can improve only on the account of accomplished coordination mechanisms. Further up to sexual maturation, coordination mechanisms continue to develop. In addition, a pronounced increase in functional capacities of the oxygen transport system appears, including the possibility for a modest myocardial hypertrophy. Increase in the cross-sectional area of muscle fibers is modest (Bar-Or, 1983; Malina, Bouchard, 1991, Farfel, 1959, Ramsay *et al.*, 1990).

After puberty the main new quality among factors limiting motor capacities is a possibility for adaptation with the aid of hypertrophy. Muscular hypertrophy becomes a decisive factor, determining the level of various motor capacities in male adolescents and also gender differences in motor development. After puberty the metabolic reserves augment. The possibility to continue intense exercise despite the decrease of pH in body compartments increases. Some results indicate also to an improved intramuscular mechanism.

Consequently, the second period of intense motor development is founded on new possibilities, arising together with sexual maturation. Accordingly, it is justified to assume that sexual maturation is the reason for ending the first period. At the same time new mechanisms developing during sexual maturation ensure new opportunities leading to the appearance of the second period.

According to the presented discussion a question arises whether we have to consider "critical" the time of increased rate of improvement or the time between two periods of advanced development ensuring new opportunities for further improvement.

Motor development reflects the general ontogenesis. Motor development may be promoted by stimulation of utilization of the outcomes of ontogenetic development at various ages. Consequently,

the sensitive and critical periods have to be distinguished. The sensitive periods are characterized by an increased rate of improvement of motor capacities. The critical period is a time when new events are created which enable further improvement. Sexual maturation is a critical period.

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THE INFLUENCE OF THE ENVIRONMENTAL CYCLICITY ON THE PSYCHOLOGICAL CHARACTERISTICS, THE PROFESSIOGRAM OF A HUMAN BEING

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It is extremely important for teachers, parents, physicians to know individual typical peculiarities of children. The process of teaching, bringing up, treatment, must come out from the personality structure of the concrete child, concrete class. The influence of the environmental cyclicity on various levels of the integral individuality of a human being — the indices of the immune status, brain functional asymmetry, the structure of motivations, etc. was found out previously. The correlation of the human indices dynamics with the cosmo-physical fluctuations of the birth and conception periods (Volchek, 1992; Volchek, 1993; Волчек, 1994) was discovered. The aim of this work was to study the psychological characteristics, professiograms of a human being in connection with the moment of birth. The personality structure, psychological characteristics form completely by the age 20–24. For this reason the grown ups were investigated in the research. The test data of a group of men working as leaders was obtained by the Humanistic Centre of St.-Petersburg guided by S. A. Manichev. 237 persons born in 1936–1967, who live in Ukhta, Kostroma, Tolliatty, Omsk, Elgava, Petersburg, were tested.

The indices were studied with the use of the follawing methods: locus of control by Rotter J., logic of thinking by Raven J., disturbance by Taylor J., test 16-PF by Cattell J., OST of Rusalov V. M., POI — self actualization by Maslow A. Totally — 44 indices. The test data were grouped in relation to the year of birth in the European calendar and the 12-year cycle the eastern calendar.

As it was found out, the values of all the psychological characteristics vary in connection with the year of birth, representing in aggregate the unique groups. The differences are trustworthy on the level of $p < 0.05$; 0.005. Such facts cannot be explained from the positions of the age psychology. For example, the index of plasticity, the easiness of switching from one type of activity to another for the persons born in 1954, 1955, 1958, 1960, 1961 equals to 9.5, 6.7, 8.4, 4,9, 6.8 correspondingly.

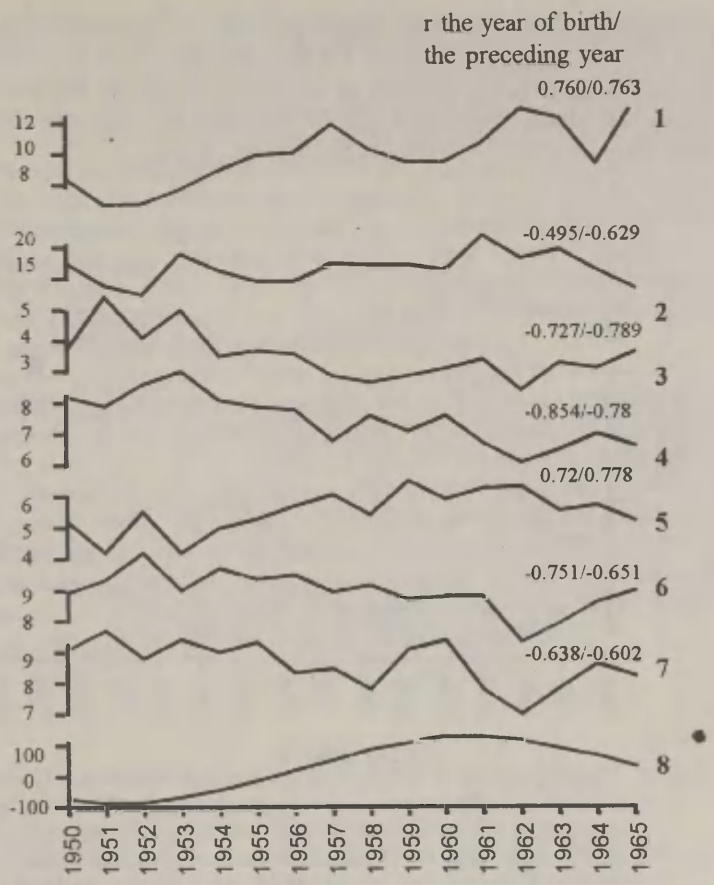

Fig. 1. The connection of the psychological characteristics (1–7) with the long-period potential of the high-tide forming force of the moon and the Sun (8) of the year of birth and the preceding year. Along the abscissas axis the calendar years are marked. Along the ordinates axis: locus of control (1); disturbance by Taylor J. (2); "mendacity" by V. M. Rusalov (3); M, D-factor — the adequateness of the self valuation (4); F-factor — self-control — expressiveness (5); C-factor — emotional unstability — emotional stability (6); G-Factor Liability to emotions — high normativeness of behaviour (7) by Cattell J.

The correlation analysis between the dynamics of the psychological indices and cosm. physical fluctuations for the period of 1950–1965 was carried out. The following indices were used: the number and square of the Sun spots — W, S; geomagnetic indignation — Kp and

geomagnetic activity — Dst; polarity of the interplanetar magnetic field — IMF, high-tide forming force of the Moon and the Sun — g (Воробьев, 1967); the number of conjunctions of the Mercury, the Venus, the Mars, the Jupiter, the Saturn with the Moon at the new moon days — Mrc, Vn, Mrs, Jp, St (Волчек, 1994).

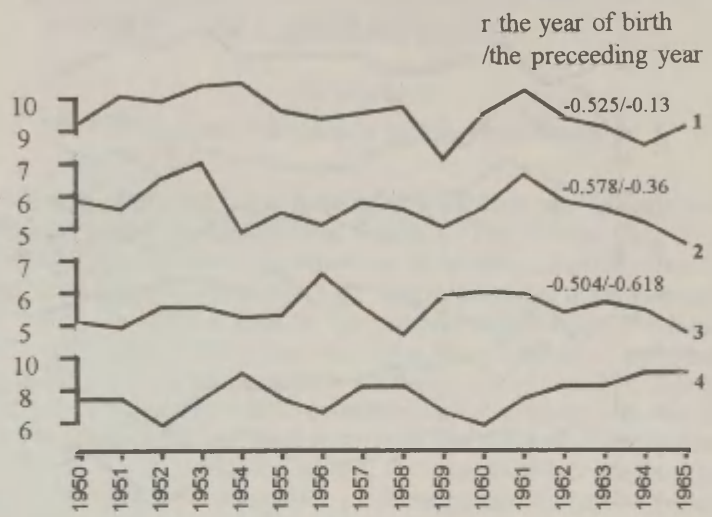

Fig. 2. The connection of the psychological characteristics (1–3) with the number of conjunctions of the Mercury with the Moon at the new moon days (4) for the year of birth and the preceding year. Along the abscissas axis — the calendar years. Along the ordinate axis: rate (1) and emotionality (2) after V. M. Rusalov; creativity (3) by Maslow A.

Many valuable correlations were discovered, $p < 0.05; 0.005$. Their number is 19.5% higher for the year preceding the year of birth. The leading factors of the environment for the year of birth are the following ones (in decreasing order): g, St, Vn, Dst, Mrc. For the year before the birth year — g, Jp, Mrc, Dst, St. Among the psychological characteristics the largest correlation with cosmo-physical fluctuations in relation to the year of birth was found out for the indices of creativity (creative talent), timidity-courage, ergicity (the need for activity, level of activation and tone of living); in relation to the year preceding the year of birth — for the indices of self content, irritation, self-control — eccentricity, emotionality (Figure 1 and 2).

The achieved results correspond to the conclusions of other researchers concerning the influence of cosmo-planetar conditions of the moment of birth on the personality profile (Eysenck *et al.*, 1982).

The mechanism of the discovered dependencies must be the following. Gravity, solar activity, other cosmo-physical factors of the environment tell on the rate of growth and development of the embrional leaves, structural-morphological derivatives of the neurogenal ectoderm. Owing to the succession (after Никитюк, 1991) of the rates of growth and development in the embriogenes and ontogenes, the influence of the environmental cyclicity in many aspects determines the formation of the anatomic, neuro-physiological, biochemical basis of the concrete persons's mentality. Since the real course of the gravity changes differs from the calculated values determined by the high-tide forces (Буланже и др., 1984), the correlation of the gravity and psychological characteristics must be higher.

So the cyclicity of the external environment, determined by he joint position of the solar system planets, through weather phenomena on Earth, tells on the psychological characteristics profile, professiogram, and as a result — on the ability of the human cohorts being born to learn one or another discipline. The changeability of the high-tide force of the Moon and the Sun, gravity, geomagnetic activity act as the leading factors of the environment. This process starts from the very moment of conception and expresses the low about the forestalling reflection of the reality by the living systems (Анохин, 1975). Thereby the diversity of the human individualities is provided.

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THE POSSIBLE CAUSES OF DESYNCHRONIZATION OF MEN'S AND WOMEN'S ORGANISMS RESPONSE TO THE COSMO-PHYSICAL FLUCTUATIONS

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All the existing diversity of constitutional manifestations, including the neurodynamic features, brain asymmetry, reactivity, etc., springs up under the conditions of harmony or violation in the processes of growth and differentiation of the embryonic leaves, when the acceleration or slowing down of the growth and development rates of ectoderm, mesoderm, endoderm and their derivatives take place (Никитюк, 1991). We have studied the influence of conditions during the birth and conception periods on the characteristics of the integral individuality of a human being. It was discovered that the cyclicity of the environment, on a level with genetics and geographical area, provides the variety of integral individualities of a human being. Desynchronization may be observed in the dynamics of men's and women's indices in connection with the moments of conception and birth, in correlational pleyads with the corresponding cosmo-physical factors. Its qualitative and quantitative values change alongside with the changes of the cycle being studied — the seasonal one, the cycle of long standing, the ones of elements and signs of the Eastern Zodiac. The sexual differences exist not only in the indices of the individual-typical peculiarities, brain functional asymmetry, but in the functional manifestations as well. In particular, it is observed in the variations of the emotional orientation, social mood, caused by the cosmophysical fluctuations (Volchek, 1993; Волчек, 1993; Волчек, 1994; Волчек, 1995).

The environment's cyclicity influence on the inconstancy of absolute and relative constitutional markers — the eye and hair colour, the head circumference, height and weight at the age of 20, reactivity — is of special interest. They were studied on 549 men and 593 women of St.-Petersburg, born in 1930–1975. For the cosmo-physical factors of the environment the following indices were used: the geomagnetic activity — Dst, the disturbance of geomagnetic field — Kp, the interplanetary magnetic field — IMF, the indices of number and square

of solar spots — W, S [6], the long-period component of tide-forming force potential of the Moon and the Sun — G [7], the indices of the joint position of the solar system planets — the numbers of conjunctions of the Mercury, the Venus, the Mars, the Jupiter, the Saturn with the Moon at the new moon days, the sums of the five planets' conjuntions with the Moon or the Sun at the new moon days — SCM, SCS (Волчек).

It was discovered that the dynamics of height and weight, other indices of men and women is the most desynchronic for seasonal rnythms and displayed vivid similarity for 12-year cycles. The features of likeness and difference in this dynamics were found for 10-year cycle and the period of 1930–1975 (Fig. 1, 2). The above mentioned cycles are remarkable for specific reiteration of the cosmo-planetary events, variations of the cosmo-physical factors and their cohesion. For example, it is correct for 10-year cycle of elements with distinctly expressed reiteration of such astronomic events as the conjunction of planets with the Sun and the Moon, the correlation of the IMF and the W indices; $r = -0.869$, $p < 0.005$.

The sexual dimorphism promotes the evolutional plasticity of a population. One of its manifestations is the heterochronism of development, the desynchronization in the evolutional rates of male and female organisms. The dechronism can be found in the phylogenes and ontogenes in various signs of a human being, especially the brain asymmetry (Геодакян, 1989). What does predetermine and provide this phenomenon? Many living organisms have the expressed active and passive orientation in respect to the poles of the Earth geomagnetic field — the GMF. The orientating geomagnetic influence is shown on various bioobjects, from molecules to whole organisms. For example, the sprouted seeds roots' orientation in respect to the poles of the GMF changes their growth rate. The geomagnetic orientation influences the functional features of bioobjects. The effect depends on the "left" modification, geographical position, research time (quoted from Durov, 1978).

One of the wonderful phenomena was discovered by V. V. Abroskin: the dependence of sexualization on the prevailing orientation of the mother organism in the GMF during embriogenes for different animals. So, for 1018 human research cases it was discovered that the prevailing orientation of the future mothers' heads during sleep to the south causes the birth of boys in 89% cases, to the north — the birth of girls in 86,3% cases (Durov, 1978; Аброськин, 1971; Абрлськин, 1972).

The mechanisms of the activation energy of the tissue structures consist in the shifts of electronic covalent bounds, in dipole induction, in deformation of the layers of peripheral electrons and so an (Чижевский, 1973). That means the source of Abroskin phe-

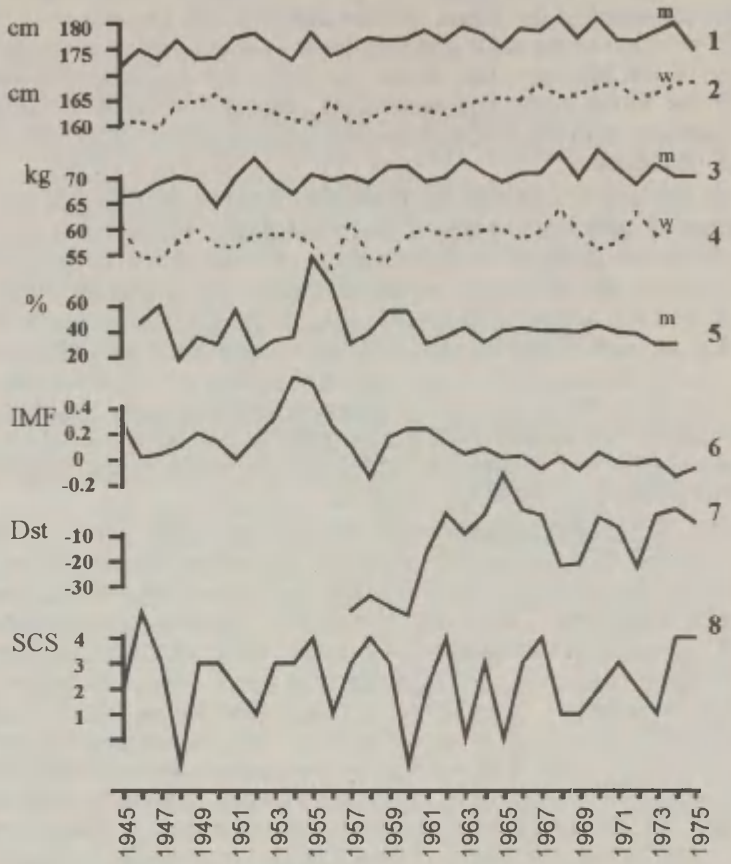

Figure 1. The connection of the indices of growth (1, 2), weight (3, 4) reactivity (5) of men and women with the parameters of the external environment of the year of birth. Along the abscissas axis years are marked. Along the ordinates axis — height in sm. and weight in kg, reactivity — the numbers of men in % "easy bearing the weather changes". Conventional signs: 6 — interplanteray magnetic field — IMF; 7 — geomagnetic activity — Dst; 8 — sum of conjunctions of the Mercury, the Venus, the Mars, the Saturn, the Jupiter with the Sun — SCS.

nomenon — the dechronism of the environmental cyclicity's influence on the indices of the integral individuality of men and women — must be the asymmetry and polarity of electromagnetic, physico-chemical characteristics of the spermatozoons having the X or Y chromosome sets. As a result the geomagnetic orientating influence provides the

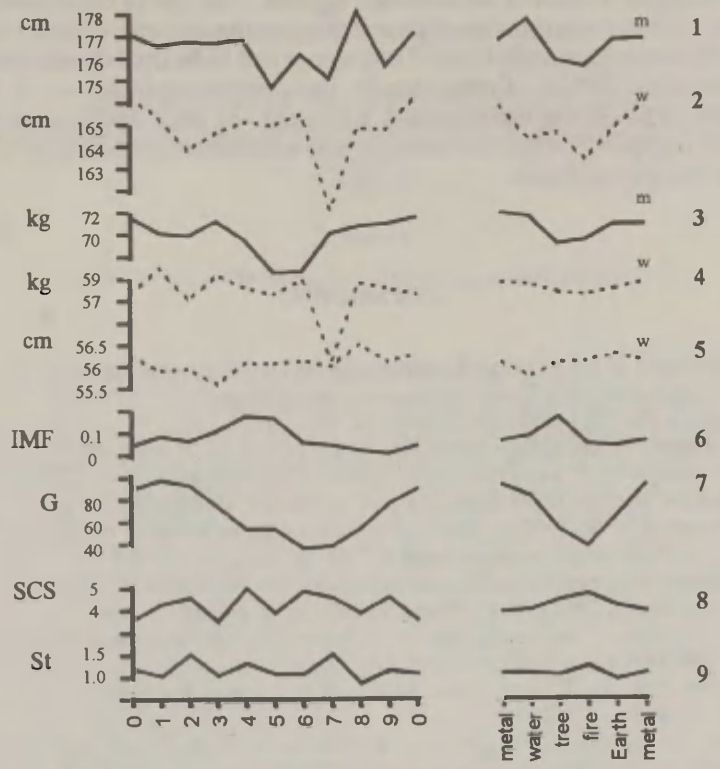

Figure 2. The connection of the indices of height (1, 2), weight (3, 4), head circumference (5) of men and women with the parameters of external environment during the 10-year cycle of the Eastern Zodiac elements (6–9). Along the abscissas axis — the years of the 10-year cycle: 0,1 — elements of metals, correspond to the years of birth ending with the numbers 0 and 1 in the European calendar; 2, 3 — elements of water; 4, 5 — of trees; 6, 7 — of fire; 8, 9 — of Earth (analogous remarks). Along the ordinates axis — height in sm., weight in kg and head circumference in sm. Conventional signs: 6 — interplanetary magnetic field — IMF; 7 — tide-forming force potential of the Moon and the Sun — G; 8 — sum of the five planets conjunctions with the Sun — SCS; 9 — number of conjunctions of the Saturn with the Moon at the new moon days — St. The right part of the figure illustrates the same dependencies, but related to the medium values for the sum of even and uneven years of five elements.

start to the first or the second set during the fertilisation; together with the IMF, other cosmo-physical and physico-chemical factors of

the environment it establishes and maintains different growth and development rates of the fertilised egg-sell. The rate of the intrauterine and extra-uterine development displays the successive connection and causes the peculiarities of ontogenes and individual development (Никитюк, 1991). Consequently, the orientating influence of the GMF tells on the embriogenes, ontogenes of male and female human organisms, their functioning and sensitivity to one or another environmental factor.

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SEXUAL MATURATION EFFECT ON STIMULATION OF MOTOR DEVELPOMENT IN GIRLS

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Several findings indicate on the relation between motor development and biological maturation in adolescents (Kemper, Verschuur, 1981; Malina, Bouchard, 1991). However, the correlation between motor performance capacities and indices of skeletal and sexual maturation is in male adolescents of 13 to 16 years age more pronounced that in girls (Beunen *et al.* 1976, 1981; Espanschade, 1940). In a limited number of studies different sensitivity to exercise training influences has been reported in pre- and postpubelescent children (Bar-Or, 1983; Vrijens, 1978), prior and after peak height velocity (Beunen, Malina, 1988; Rutenfranz *et al.* 1982). Recently we found that the minimal amount of exercises (physical education classes twice in a week) stimulate improvement of various motor capacities only in certain stadiums of sexual maturation in girls (Volver, Viru, 1995). This study was conducted in order to clarify whether the effect of various directions of school physical education on motor capacities of girls depends on sexual maturation stages.

Methods

The study was performed on 70 healthy girls of 10 to 14-year-old age. Sexual maturation stages were evaluated by Tanner's (1962) method. Fitness tests were selected according to results of a questionnaire with fitness experts of European countries (Bös, 1992). The battery of test (20 m dash, shuttle run 4 × 9 m, standing long jump, number of squats in 30 s, number of sit ups in 30 s, trunk forward flexion and Harvard step-test) was performed in September and again in March. During the period between the two sets of testing, children practized in physical education classes twice a week. In half of children the exercise program was directed for improved endurance, in the other half — for improved fast strength. The results were analyzed using paired t-test and ANOVA procedure.

Results

The changes in motor capacities were rather variable during the experimental period (Table 1). Improvement of sprint velocity appeared only in sexual maturation stage 3 in case of special attention to improved fast strength. This direction of exercising improved results of shuttle run in all three stadiums, and additionally also in girls of stadium 1 with prevealing endurance exercises. The most favorable conditions for stimulation of the development of explosive strength (results of standing long jumping) were in stadium 1 and for the combined development of fast strength and endurance (number of squats in 30 s) in stadium 2 independent on direction of training. The latter test revealed a positive change also in those girls of stadium 1 who exercized for improved fast strength. Only in this subgroup the number of sit ups in 30 s increased significantly. Flexibility increased in stadium 1 and 2 independent on direction of exercises.

Discussion

The obtained results confirm the dependence of training effects on motor capacities on stadium of sexual maturation of girls. The most favorable conditions were in stadium 2 for improvement of fast strength in combination with endurance, and in stage 1 and 2 for improved flexibility. Our previous study demonstrated a favourable improvement of flexibility only in stage 2 (Volver, Viru, 1995). By findings of this study results of standing long jump improved only in stage 1. The previous study demonstrated the improvement in stage II (Volver, Viru, 1995). The discrepancy may be related to the difference in initial level. The highest level in standing long jump was detected in girls of stadiums 2 and 3 (Volver *et al.* 1995). Comparison of two subgroups in each stadium of sexual maturation indicated that the direction of training does not influence the advanced increase of number of squats in 30 s in the stadium 2. Flexibility improved similarly in both subgroups of stadiums 1 and 2 as well. In regard of flexibility one must point on the similar use of aerobic exercises in both subgroups. Nevertheless, the training was ineffective in stadium 3 for improved flexibility.

Results of shuttle run improved independently on stadium of sexual maturation, but only under the influence of prevealing fast strength exercises. In our previous study favourable conditions were found for speed development in stadium 3 (Volver, Viru, 1995).

This study revealed this positive change only when the prevaling exercises were for improved fast strength. By results of our cross-

Table 1

Individal changes in various motor capacities in dependence on sexual maturation stage and direction of exercise program (mean ± SE)

	Stadium 1		Stadium 1		Stadium 1	
	EN	FS	EN	FS	EN	FS
Number of girls	3	15	14	13	17	8
20 m dash (s)	+0.07 ± 0.13	–0.01 ± 0.07	+0.01 ± 0.03	–0.07 ± 0.03	+0.06 ± 0.05	–0.14 ± 0.03*
Shuttle run 4 × 9 m (s)	+0.17 ± 0.03*	–0.34 ± 0.08*	–0.14 ± 0.06	–0.22 ± 0.08*	+0.04 ± 0.06	–0.33 ± 0.08*
Standing long jump (cm)	–3.3 ± 0.9*	+11.7 ± 2.8*	+0.6 ± 11	–1.2 ± 0.9	–1.0 ± 1.3	+1.3 ± 1.4
Number of squats m 30 s	+1.0 ± 0.6	+1.9 ± 0.5*	+3.5 ± 0.3*	+2.0 ± 0.5*	+0.4 ± 0.4	0.0 ± 1.0
Number of sit ups m 30 s	–0.3 ± 2.7*	+4.5 ± 0.7*	+1.1 ± 0.8	+1.9 ± 1.0	+1.4 ± 0.5	+1.0 ± 0.8
Flexibility (cm)	+2.3 ± 0.3*	+3.5 ± 0.4*	+3.1 ± 0.4*	+2.2 ± 0.7*	+0.5 ± 0.6	+0.3 ± 0.8

Key: EN — prevaling volume of exercisers was directed for improved endurance
FS — prevaling volume of exercisers was directed for improved fast strength
* — $p < 0.05$

sectional study, the best results in 20 m dash appear in stadium 3 (Volver *et al.* 1995).

In conclusion, the obtained results support the suggestion that the stimulation of motor development is specifically related to sexual maturation.

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CONSTRUCTIONAL TYPOLOGY OF HUMAN CEREBRAL CRANIUM

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Aim — to study the variation in the morphogeometrical parameters underlining the biomechanical stability of the human cerebral cranium to external mechanical influences and to develop its morphofunctional constructional typology.

Materials under study — 819 skulls of men and women belonging to different age groups (250 skulls were frontally sectioned), along with the Z-ray photographs of these skulls.

The study is based on the approach to the cerebral cranium as a gently sloping three layered schell, close in its form to a half of a ellipsoid with variable axes of rotation.

The main morphogeometrical parameters of the cerebral cranium which reflect its stability to external mechanical action are the principal radia of curvature (longitudinal and transverse diameters of the skull), the thickness of the bone and its layers.

The methods of traditional craniometry were used to measure the principal diameters of the skull. The thickness of the bone and its layers was registered with the help of the ocular scale mounted on the microscope MBS-2.

These parameters enable calculation of the morphological stability index (MSI) of a cerebral cranium:

$$MSI = 4 \cdot 10^2 (BT)^2 / D_1 D_2,$$

where BT is the bone thickness, D_1 and D_2 — the longitudinal and transverse diameters of the skull.

The constructional stability of the cerebral cranium, as a shell protecting the brain from external mechanical influences, includes configurational stability (brought about by the small radia of curvature) and structural stability (brought about by the large bone thickness or by the optimal correlation between the thickness of the compact *laminae* and *diploe*.

The following cranium types (the craniotypes) were singled out as the extreme forms of cranial constructional stability (table):

The craniotypes (%, M ± 0.67δ, M ± 0.55δ, where δ — standard deviation, BT — the bone thickness, D_1 and D_2 — the longitudinal and transverse diameters of the skull, in parentheses — the parameters in studied materials are given)

$D_1D_2(mm^2)$ $4BT^2(mm^2)$	$-3\delta \leftarrow \pm 0.67\delta$ 20763(21336) – 26121 $-3\delta \leftarrow \pm 0.55\delta$ 20073(21336) – 26397	$\pm 0.67\delta \rightarrow +3\delta$ 29205 – 34563(33990) $\pm 0.55\delta \rightarrow +3\delta$ 28929 – 35253(33990)
$-3\delta \leftarrow \pm 0.67\delta$ 4.81(7.56) – 30.43 $-3\delta \leftarrow \pm 0.55\delta$ 1.51(7.56) – 31.75	The configurationally stable craniotype (10%, 17%)	The morfologically unstable craniotype (1%, 2%)
$\pm 0.67\delta \rightarrow +3\delta$ 45.19 –70.81(68.06) $\pm 0.55\delta \rightarrow +3\delta$ 43.87 – 74.11(68.06)	The morfologically stable craniotype (3%, 6%)	The structurally stable craniotype (11%, 19%)

a) the morphologically stable type (a large bone thickness, optimal correlation of the layers and small radia of curvature);

b) the structurally stable type (a large bone thickness, optimal correlation of the layers and large radia of curvature);

c) the configurationally stable type (a small bone thickness and small radia of curvature);

d) the morphologically unstable type (a small bone thickness and large radia of curvature).

The constructional type of human cerebral cranium is an objectively existing complex of morphogeometrical indices determined by the structure, configuration and sizes of its constinuent bones, and reflects stability to external, first of all mechanical, influences.

The phylo-ontogenetic transformation of the cerebral cranium occur between the poles, providing optimal volume and optimal constructional stability.

Evolutionary changes in the constructional stability of the cerebral cranium are a result of adaptation to mechanical trauma, and are relatively independent of racial pecularities of the cranium.

Ontogenetic transformations in constructional stability of human cerebral cranium were also traced (Zaichenko, 1994). On the one hand, in ontogenesis the cerebral cranium grows reflecting age variations of the brain (an increase of its mass and volume). On the other hand, the configuration and structure of the bones alter towards an increasing stability of the skull. The tendency, connected

with alterations of the dimensions of the cranium as a receptacle for the brain, has its optimum in the formation of the morphologically unstable craniotype with large radia of curvature and a small bone thickness. The opposite tendency connected with the formation of the craniotype optimal in terms of its constructional stability, leads to the morphologically stable craniotype with small radia of curvature and a large bone thickness. In ontogenesis, a general tendency is observed consisting in the change of the cranium stability from configurational (featured by small radia of curvature) to structural (featured by a large bone thickness). This tendency is more evident among the craniums belonging to men than among those belongig to women.

While using the criteria $\pm 0.67\delta$ every craniotype should have a frequency of 6.0 – 6.5% (alltogethes 25%), and with criteria $\pm 0.55\delta$ — 11% each alltogethes 44%). But it has been noted that the morphologically unstable craniotype has a low frequency, in contradiction to what is theoretically expected (1% against 6.0 – 6.5% or 2% against 11%). For interpretating these results a number of hypothesis could be drawn in for eliminating the morphologically unstable craniotype and positive correlation between the main diameters of the cranium and bone thickness.

The elimination of the morphologically unstable craniotypes may be connected to the non-selection of cranium of people, who suffered cranio-cerebral traumas, since within this groups registered a high frequency of the above craniotype.

Positive correlation between the main diameters of the cranium and bone thickness may be connected with influences of neurohormonal factors on the growth of the bones (because of apposition of the bone tissue against the sutures) and growth in bone thickness (because of subperiosteal apposition of the bone tissue). Besides, bone thickness depends on the curues, the sizes of which inturn grows along with the lengthening and expansion of the cranium and lesses with the increase in its curvatures. Longer and wider, but flattened craniums have greater bone thickness because with the increase in sphericity of the cerebral cranium the greater bone thickness becomes superflouous (Demes, 1985). This hypothesis is supported by the fact that during elimination of the morphologically unstable craniotype the number of cranium belonging to the marginal groups lessined, but along with this an increase in the frequency of configurational and structural stable craniotypes is observed in comparison with the theoretical expectations. On the other hand a relative low frequency of the morphologically stable craniotype is observed.

The morphological stability index (MSI) was 0.6 (0.598) with individual variations 0.017 – 1.477. Minimal values are observed among the morphologically unstable craniotypes: about 0.2 (0.228; 0.017 – 0.439), maximum values are observed among the morphologically sta-

ble craniotypes: 1.1 (1.0.71; 0.665 – 1.477). During this, differences between the indicated groups is statistically confirmed. MSI in groups configurationally and structurally stable craniotypes occupy an intermediate position: a tendency towards minimization of MSI is observed among the configurationally stable craniotypes: 0.3 (0.328; 0.0023 – 0.683), among the structurally stable craniotypes MSI is 0.8 (0.763; 0.500 – 1.025), the differences don't reach levels of statistical importance. This allows us to assume that the stability of the human cranium to external mechanical influences is determined more by the bone thickness, than their radiuses (sizes and configuration). Since, among men, the frequency of structurally stable craniotype (large bone thickness along with greater diameters) predominantes in comparison with woman, where the configurationally stable craniotype predominantes (small bone thickness with smaller diameters), the MSI is somewhat (not confirmed) higher (correspondingly 0.7 and 0.4).

While using the criteria $\pm 0.67\delta$ — the marginal grups included craniums with D_1 158–177 mm and 190–208 mm (D_1 in studied materials — 160–207 mm); D_2 — 126–141 mm and 151–166 mm (D_2 in studied materials — 127–165 mm)l BT_{max} — 6.18 – 8.50 mm (individual cranial specimens may have bone thickness less than 1 mm or greates than 12 mm, but on the whole the mean bone thickness varied between 2.75 mm and 8.25 mm). While using the criteria $\pm 0.55\delta$ — D_1 was 156–178 mm and 189–211 mm, D_2 — 124–142 mm and 150–168 mm, BT — 2.20 – 4.94 mm and 6.06 – 8.80 mm.

Thus the constructional characteristics of a cerebral cranium, which determine its stability and, largely, its phyloontogenetic transformations, represent the gist of its local constitution. The craniotypes described above are the polar morpholigical forms of the local constitution of the cerebral cranium

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THE SOMATIC CHARACTERISTICS IN THE PROGNOSIS OF SPORT SUCCESS IN YOUNG SWIMMERS

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This study is fared on young competitive swimmers. With recommended criteria of selection (Bulgakova, 1986, Timakova, 1976, 1985) 15 girls and 14 boys were accepted to specialized sports school.The length of sport occupation varied between two months and four years. Twice a year, between the ages of 10 and 13, the young sportsmen were investigated longitudinally. Also medical control was done. Purpose of the study was to establish the prognosis value of the indication on the "Individual Sportsman Card". The latter contains:

1) some anthropometric indications (body length and weight, chest circumferences, length of extremities and distality parts, shoulder and pelvis width,spirometry, and hand grip strength);

2) biological age in nine-level scale (Timakova 1985, Absalimov 1990);

3) the most popular physical fitness tests (short and long distance run, shuttle-run, long jump, trowing pull-ups two-kilogram softball;

4) high-speed and special coordination tests ,defined by the starting and turning parts in swimming with four stroke technics (Suslov 1986). The anthropometric data and physical fitness tests were evaluated by universal (for all sports) age groups in a 5-level scale. For swimming tests also the age group normative scales were elaborated.

In the research the total sum of main anthropometric measurements (TSEant.), the total sum of physical fitness tests (TSE), the total sum of evaluations in swimming tests (TSE sw.),and their common sum (CSE) were calculated.In the capacity of integral special ability test the results in 200 meters by Medley werw also used.

The next year after the reception to school, during four months the fulfil training loads data were computered Simultaneously after the main swimming training the heart pulse dynamics (22 different indexes) were registered. The training loads were counted according as the maximal,submaximal, moderate, and easy intensivity swimming.

In the first four sections the data were computared by traditional

statistical methods and correlation analyses separately for girls and boys were computered. The system discription methods were also used. In the volume of data collection (N = 196) the classification and factor-typological analyses methods (with different variants) were used. The collected data was processed at the Computing Centre of Agroprom Ministry with cand. of scien. Alexandra Russo (now in USA) acting as a programmer with special processing package.

Results

Table 1

The main prognostic characteristics in girls (n = 43)

Indications of Sport Achievements	Signs with level of correlation $0.5 < r < 0.7$	$0.7 < r < 1$
1. Qualification grade	TSE ant. TSE swim.	The time in 200 m midley, TSE fit, the time in starting and turning parts by all strokes
2. The time in 200 m midley swimming	Biological age, the time of swimming in the start and turning parts by all strokes	Qualification grade, TSE fit, TSE ant., chronological age, throw-off

The intercorrelations in the collected in four sessions data of swimmers-boys and girls, for 10 to 12 years, were compared. In absence of age, sport occupation length, and on 200 meters by midley results were exposed on the average. The various statistic strength of correlations between the common sum of individual evaluations (CSE), the total sum of evaluations (TSE) in every bloc, and the swimming successfulness charactoristics were found (Table 1 and 2). The common sum of evaluations in the girls and boys groups separately, showed a very specific validity effect. It was fixed, that characteristics as body size, biological age, work-capacity, muscle strength, and weight, had different significance and unequal nature of correlation between sexes.

In general, the strong interaction between CSE, TSEanth., TSE fitn., and TSE swim., the body size, and biological age in girls, was determined. The most factor meaning in the single structure organization of the studied indications are had the result in such power test

Table 2

The main prognostic characteristics in boys (n=37)

Indications of Sport Achievements	Signs with level of correlation $0.5 < r < 0.7$	$0.7 < r < 1$
1. Qualification grade	TSE fit., strength of hand grip; spirometry	The time of swimming in 50 m distance by all strokes; the time In 200 m; midley, chronological age
2. The time In 200 m midley swimming	The time of 500 m swimming by all strikes; sport occupation length; body size; strength of hand grip; spirometry; time in shuttle-run trunk slope depth	Qualification grade TSE fit., time of turning parts by breast and fly strokes

as softball throw-off. It must be mentioned, that among girls the sport occupation length demonstrated a weak links with studied indications ($r > 0,2 < 0,5$). On the contrary, in boys all correlations are not so strong. At a whole, we see tendency towards an increase in the significance of special ability indications. These are such atilities as speed and coordination in swimming technics, common agility and flexibility (Table 2). Using the computer classifcation methods we got the whole numbers of sexually mixed classes. Every cluster had its own type of structure organization.

By this time indidual CSE variability in the classes essentially lowers. It must be noted, that in the age of 10 the diapason of CSE varied from 42 to 114 marks. In all the clusters, excluding one, the CSE fulfils the function of structure organisator. In this study we received the very certain prognostic indications only in one occasion by means of factors multiplication.

So all potentially most gifted swimmers concentrated on two opposite sides of the very definite factor.The factor of cardivascular respons on swimming loads demonstrates the high prognostic significance in age in the age 10–12 years .There were boys and girls with strong reactivity. This factor was expressed as maximal heart rate response in spurt swimming, but also in the results of swimming and running in short length. The young swimmers with more low heart rate in general and with a short of period of heart rate restoration after distance swimming were concentrated on the another end. The less talented

swimmers are in the intermediate position. The following facts explain us the possible errors in early prognosis. Only three girls belonged to the same class. The others drifted from class to class by different data of examinations. This study results tell us about great lability of their age condition states, the latter tied with heterochrony of individual development.

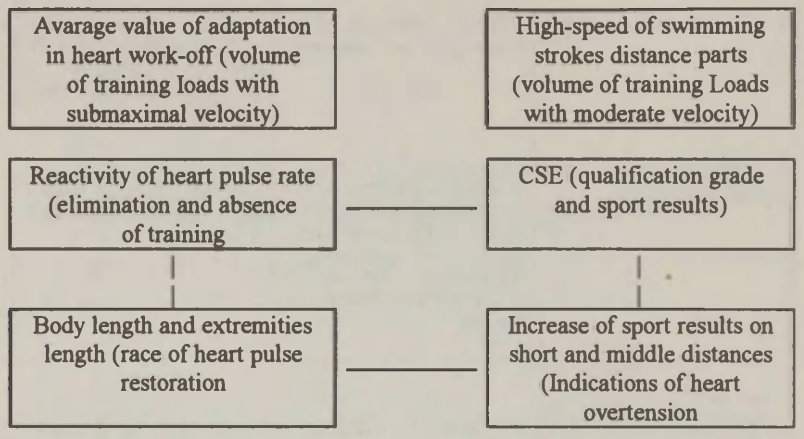

Figure 1. Factors in perspective young swimmers class — positive links, -- negative links

Conclusions

1. In the beginning of sport specialization, high-speed and coordination tests in swimming,total sum of physical fitness evaluations, and functional characteristics are manifested as with the best prognosis value. Among selected by well-known criteria children the long-term prognosis values gave the information about heart rate reaction in short swimming with maximal velocity and in the long distance swimming. The experimental data in training conditions demonstrate an important prognostic significance of individual peculiarities in heart work-capacity.

2. During the age from 10 to 12 years most of the children (boys and girls) showed a high instability of their typology. Only some children with strong displays of total acceleration and retardation belong to the same state cluster. The majority of young swimmers with different investigative sessions passed on class to class. So,classes with enough

defined typological state may be represented by children with very different age years data.

3. The body size, biological age, common sum of all evaluations, total sum of physical development evaluations, and speed-strength tests demonstrated a weak enough prognosis value. But in girls in the studied age period the sport success influence of these indications was essential. The well-known peculiarities of female constitution give a good advantages in swimming special abilities manifestation, permitting the strongest development of compensation processes.

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