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**Andriichuk V.M.,
Shpakova N.A.**

*Department of Human Anatomy of M.I. Pyrohov Vinnytsia National Medical University, Vinnytsia, Ukraine,
vitandr23@mail.ru*

REGULARITIES OF ANNUAL CHANGES IN PHYSICAL HARMONY INDICES IN FIRST YEAR STUDENTS

Abstract. *We have determined indexes of physical development harmony in youths: cadets, students, pupils and analysed the regularities of annual changes in conditions of the pedagogical process during the first year of study. Based on the obtained data, we conducted a comparative analysis of these indicators in boys from different educational institutions. We detected a dynamic growth of most average parameters, which means that their annual changes were reliably higher than those in the students and pupils. The most frequently a reliable difference in favour of cadets was found for the body mass index, mass-growth index and the corpulence index (Rohrer).*

Key words: *adolescence, indexes of physical development harmony, pedagogical process.*

Introduction. The combination of various environmental factors, that affect the body, are exogenous factors: natural, environmental and socio-economic ones. Day regimen and the diet, mode of motion, the emotional stress are among the exogenous factors occupying a special place [6]. These exogenous factors, along with others, are a part of the pedagogical process. By the time of admission to universities, youngest people reach a certain degree of physical maturity, but their physical and mental development continues [2, 7]. The impact of innovative educational loads with high levels of emotional and mental stress, the intensification of educational process, irregularities in the mode of motion have a negative impact on the functionality of the student's body [1]. The importance of optimal and harmonious development of young people leads to an intensive study of morpho-functional parameters influenced by exogenous and endogenous factors. Physical development is traditionally assessed by using different indices. They allow determining the level of the boys' development using the ratio of some anthropometric parameters and indicate the features of the body shape, complement the characteristics of physical development [4]

Thus, today there are some scientific papers which study the effect of endogenous and exogenous factors on anthropometric parameters of youths. However, there are not any papers, which determine and compare annual changes in indices of harmonious physical development during the educational process in various educational institutions.

Objective: determination of features of

annual changes in indices of harmonious physical development of boys in the first year during the educational process in various educational institutions.

Materials and methods. The research was carried out at M.I. Pyrohov Vinnytsia National Medical University and Vinnytsia Higher Vocational School of Civil Protection. The school is a departmental higher institution of the second accreditation level, belonging to the State Emergency Service of Ukraine (SES) where students and cadets are taught. Training cadets has its own features related to the service in the bodies and units of SES. All the cadets are employed in the SES, have special ranks, and their daily routine is compiled in accordance with the Charter of the Armed Forces of Ukraine. The conditions of the pupils differ from those of the cadets in less regulated daily routine and less physical activity. Medical University is a higher school of the fourth accreditation level of the Ministry of Health. Conditions of medical students are different from the living conditions of cadets and pupils. Their regime of the day is not regulated at all, their physical activity is lower and the teaching load is higher. We measured anthropometric parameters [5] and determined indices of harmonious physical development of 87 boys-cadets, 93 pupils, 92 students and analyzed the characteristics of their changes during the first year. We determined the body mass index, proportionality of the chest, shoulder width, pelvic width, proportionality of body length, proportionality of upper and lower limbs, sexual dimorphism as well as corpulence (Pigna) and Rees-Eisenck indices[3]. An analysis of these parameters was carried out using STATISTICA-6,1

(StatSoft) using parametric and nonparametric methods for assessing the performance.

Results and discussion. The average annual change in body mass index for boys-cadets during the first year of studies is $(0,23 \pm 0,06)$ kg / m², for pupils - $(0,06 \pm 0,03)$ kg / m², for students $(-0,04 \pm 0,03)$ kg / m². Thus the annual change in body mass index in the first year students is reliably higher by 0.17 kg / m² compared with the pupils ($t = 2,54$ at $r \leq 0,05$) and 0.27 kg / m² compared with the students ($t = 3.11$ at $r \leq 0,05$) (Fig. 1). The average annual change in the index of proportionality of the chest for adolescent first year cadets is $(0,61 \pm 0,05)$, for the pupils - $(0,27 \pm 0,07)$, students $(0,18 \pm 0,03)$. Thus the annual change in the index of proportionality of the chest in the first year cadets is reliably higher by 0.34 compared with the pupils ($t = 3,94$ at $r \leq 0,05$) and by 0.43 compared with the students ($t = 3,00$ at $r \leq 0,05$). The average annual change in the index of shoulder width in adolescent first year cadets is $(0,41 \pm 0,03)$, whereas in the pupils and students it was $(0,01 \pm 0,01)$. Thus the annual change in the index of shoulders width in the first year cadets is reliably higher by 0.40 compared to both the pupils and the students ($t = 10,61$, and $t = 9,21$ at $r \leq 0,05$) (Fig. 2).

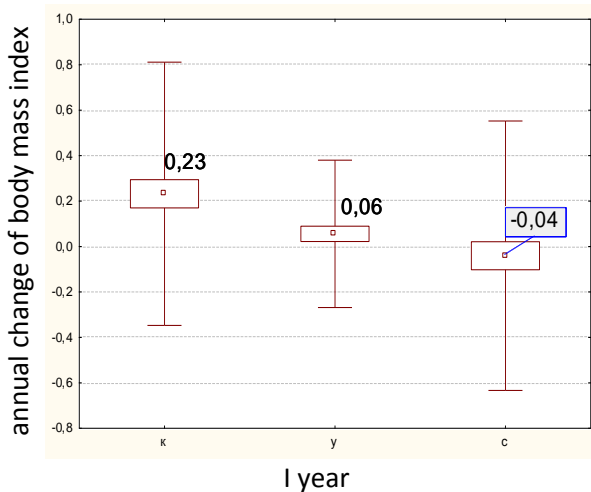


Fig. 1. The difference between the annual change in BMI at the first year of study.

The average annual change in the index of pelvic width of adolescent first year pupils is $(0,02 \pm 0,01)$, the minimum rate is $(-0,27)$, the maximum one reaches 1.14. The average annual index changes in the width of the pelvis of cadets and students is $(0,12 \pm 0,02)$. Thus the annual change in the index of pelvic width in the first year cadets is reliably higher by 0.10 compared with the pupils ($t = 3,03$ at $r \leq 0,05$). The average annual change in the index of

proportional length of the upper extremity in adolescent first year cadets is $(0,17 \pm 0,04)$,

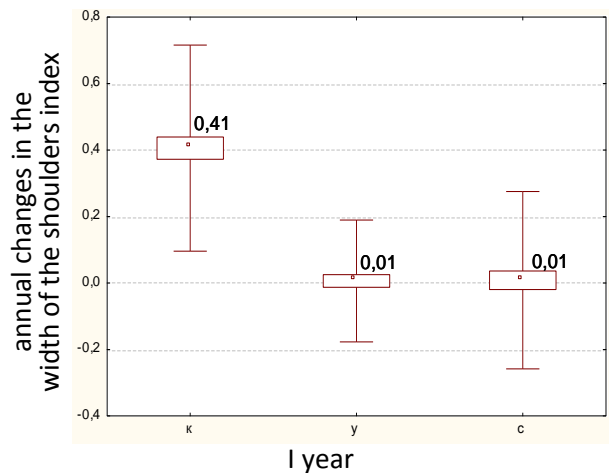


Fig. 2. The difference between annual changes in the width of the shoulders index at the first year of study.

for the pupils - $(0,03 \pm 0,02)$, for the students $(-0,13 \pm 0,03)$. Thus the annual change in the index of proportionality of the upper limb length in the cadets is reliably higher by 0.14 compared with the pupils ($t = 3.41$ at $r \leq 0,05$) and by 0.30 compared with students ($t = 7,06$ at $r \leq 0,05$). Besides, the same annual change in the pupils was reliably higher by 0.16 than in students ($t = 4,51$ at $r \leq 0,05$). The average annual change in the index of lower limb length proportionality in adolescent first year cadets is $(0,12 \pm 0,02)$, students $(-0,07 \pm 0,02)$, while the average value in the pupils has not changed. The annual change in the index of proportionality of the lower limb length in the first year cadets is reliably higher by 0.12 compared with the pupils ($t = 4,88$ at $r \leq 0,05$) and by 0.19 compared with the students ($t = 6,94$ at $r \leq 0,05$). Also, the same annual change in the index in the pupils was reliably higher by 0.07 than in the students ($t = 3,19$ at $r \leq 0,05$). The average annual change in the index of sexual dimorphism of adolescent first year cadets is $(2,13 \pm 0,17)$. The average annual change in the index values of sexual dimorphism of pupils and students is $(0,11 \pm 0,09)$ and $(0,20 \pm 0,16)$ respectively. The annual change in the index of sexual dimorphism in the first year cadets is reliably higher by 2.02 compared with the pupils ($t = 10,26$ at $r \leq 0,05$) and by 1.93 compared with the students ($t = 8,10$ at $r \leq 0,05$). The average annual change in the index of corpulence (Pigna) in adolescent first year cadets is $(0,01 \pm 0,00)$, in the students $(-0,01 \pm 0,00)$, while the average index in the pupils has not changed. Thus the annual change in the index of corpulence (Pigna) in the first year cadets is reliably higher by 0.01 compared

with the pupils ($t = 2,40$ at $r \leq 0,05$) and by 0.02 compared with the students ($t = 3,81$ at $r \leq 0,05$). Also the same annual change in the index of the pupils was reliably higher by 0.01 than in the students ($t = 2,39$ at $r \leq 0,05$). The average annual change in the index Rees-Eisenck in the adolescent first year cadets is $(-2,56 \pm 0,21)$, in the pupils and students it is $(-0,22 \pm 0,14)$. The annual change in the index Rees-Eisenck in the first year cadets is reliably lower by 2.34 compared with the pupils and students ($t = 9,47$ $t = 5,25$ and at $r \leq 0,05$) respectively. The average annual change in the Pigna index in adolescent first year cadets is $(-1,42 \pm 0,20)$, in the students and pupils it is $(-0,28 \pm 0,20)$ and $(-0,48 \pm 0,12)$ respectively. Thus Pigna index annual change in the first year cadets is reliably lower by 1.14 compared with students ($t = 3,74$ at $r \leq 0,05$) and by 0.94 compared with pupils ($t = 3,98$ with $p \leq 0,05$).

There was no reliable difference in the annual change in the index of body length proportionality in the first year for all groups of young men.

Conclusions. When comparing the annual changes in the indice of harmonious physical development of cadets, pupils and students in the first year of studies, we identified the growth dynamic in most average parameters of the cadets, so that their annual changes were reliably higher than in the pupils and students:

10 out of 11 (90.1%) of values between cadets and pupils, 8 of which were in the cadets' favour (the annual change in body mass index, proportionality of the chest, shoulders, pelvis, upper and lower extremities, and sexual dimorphism and corpulence index (Rohrer)) and 2 were in the pupils' favour (annual change in Rees-Eisenck and Pigna indices);

9 out of 11 (81.8%) values between the cadets and students 7 of which were in the cadets' favour (annual change in body mass index, proportionality of the chest, shoulders, upper and lower extremities, and sexual dimorphism, corpulence index (Rohrer)) and 2 – in the students' favour (annual change in Rees-Eisenck and Pigna indices).

3 out of 11 (27.3%) values between the pupils

and students, all of which were in the students' favour (corpulence index (Rohrer), proportionality of length of the upper and lower limbs).

The annual changes in the index of harmonious physical development of the second year cadets, pupils and students, followed by a comparison of annual changes in the conditions of the educational process in different schools also need further studying.

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