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PERSPECTIVES OF USING ATHLETICS MEANS FOR IMPROVING THE LEVEL OF PHYSICAL HEALTH OF STUDENTS

Tetiana Dukh
Lviv State University of Physical Culture, Ukraine

Ivanna Bodnar
Lviv State University of Physical Culture, Ukraine

Iuliia Pavlova
Lviv State University of Physical Culture, Ukraine

Yaroslav Svysch
Lviv State University of Physical Culture, Ukraine

Olha Pavlos
Lviv State University of Physical Culture, Ukraine

Abstract. *The research aimed at improving the level of physical health with the priority use of athletics exercises. Anthropometric and physiological examinations, methods of determining the level of physical health, methods of mathematical-statistical processing of data were used. A sample of 17–19-year-old students (226 males and 252 females) from Ukrainian universities was tested. The experimental group consisted of 31 males and 33 females, in the control group included 32 males and 31 females. The interventional program consisted of three main units: running, speed-strength and strength activities. The results of scientific research show that only a little part of students had high or higher than the average health. A positive effect through the priority use of athletics means on the parameters of the respiratory, cardiovascular and muscular system both in males and females of EG was established. During the experiment, the level of physical health has grown from the average to above the average in EG students. Among females, 9.1% showed higher than average health level, and 3.2% of males showed a high level, while at the beginning of the experiment there were no students with such levels.*
Keywords: *athletics means, physical development, physical health, students.*

Introduction

Preserving and improving population health, prolonging the period of active healthy life, reducing premature mortality and increasing the average life expectancy are recognized among the priority tasks of the Strategy for Demographic Development. The problem of research and evaluation of motor activity modes remains crucial since motor activity is among the main factors

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determining mortality and morbidity among population, the level of health and quality of life (Bucksch, 2005; Muenning & Woolf, 2007; Bergier et al., 2018).

The studies (Pavlova, Vynogradskyi, & Tulaydan, 2013; Korol, 2014) showed that most of the first-year students from the Uzhorod University (74.3%) belong to the main medical group, that is, they are apparently healthy. But 17.3% already suffer from a variety of diseases, and nearly 2% are exempt from PE classes, or have a disability or are essentially ill. According to the research, the majority of the 1-st and 2-nd-year students from Volyn region of Ukraine belongs to the main medical group (Savchuk, 2011). At the same time, 15–20% of young people already have some deviations in their health condition. The research results of research (Pavlova, Nalyvayko, Vynogradskyi, Okopnyi, & Kit, 2018) showed that the average level of health indicators have 37.2% of students, lower than the average – 20.4%, low – 13.2%, higher than average – 15.6%, high – 12.0%.

Present-day scientific literature is characterized by a large number of publications on the study of the nature of health, the criteria for its evaluation, and the state of health of young people (Apanasenko & Dolzhenko, 2007; Яремко, Вовканич, Гриньків, & Павлова, 2013; Korol, 2014; Ortenburger et al., 2017; Боднар et al., 2018). However, it is very difficult, and sometimes impossible, to compare the results of research, because they are done using different methods, with different age groups under study. Among the examples of such practice is using different parameters (somatic health, morphofunctional indices, the number of diseases per year and the number of days absent because of illness, health self-assessment survey) to evaluate of physical health. At the same time, the issues of ways to attract young people to physical education, to improve physical fitness and health remain unresolved.

The problem of research and increasing of motor activity modes remains relevant, since motor activity is one of the main factors determining health and the level of physical and mental condition of population (Pate, Ross, Dowda, Trost, & Sirard, 2003; Fedewa & Ahn, 2011; Marttinen, Fredrick III, & Silverman, 2018; Román, Vallejo, & Aguayo, 2018). The only way out is to increase the daily motor activity and to include special aerobic exercises of moderate intensity (Haskell et al., 2007; Sallis, Carlson, & Mignano, 2012).

The research objective has been to increase the level of physical health with the priority use of athletic exercises.

Methodology

A sample of 17–19-year-old students (total n=478, 226 males, and 252 females) from Ukrainian universities was tested.

Anthropometric research methods were used to determine the body length, weight, chest circumference. Professional medical scales were used to determine

the body weight. Height was measured with a stadiometer, chest circumference – with a measuring tape. The vital lung capacity was measured by means of spirometry.

The muscle strength was evaluated with a carpal dynamometer.

The Erismann index (chest proportion index) was calculated by Formula 1.

$$EI = CC - 0.5 \times H, \quad (1)$$

where EI – Erismann index,
CC – chest circumference,
H – height

For males, if the index is in the range from 0 to +5.8 cm for males – it corresponds to the normal development of the chest, and the normal range for females is from 0 to +3.3 cm. If the index is less than 0, then the chest is considered to be narrow if more then 0 – wide.

The heart rate, the systolic and diastolic blood pressure were measured to study the parameters of a cardiovascular system. Three readings were taken at a 5-minute interval for blood pressure measurement and then a mean value was calculated; all the readings were taken in sitting position and on the left arm.

Evaluation of general health level was realized with the G. Apanasenko's method (Apanasenko & Popov, 1998; Pavlova et al., 2018). It is calculated according to anthropometric data, muscle strength, heart rate, and blood pressure etc. The general result was obtained in the points, and the levels were determined from low to high. The general assessment for high level of health is 16–18 points, higher than average level – 12–15 points, average level – 7–11 points, lower than average level – 4–6 points, low level – less than 3 points. Safe health levels begin from 14 points.

Participants of the interventional program were randomly selected from the sample. Each participant voluntarily provided written informed consent before participating. This research was approved by the ethics committee on human experiments in Lviv State University of Physical Culture.

The experimental group consisted of 31 males and 33 females, the control group included 32 males and 31 females. Stated age of all students at the beginning of the experiment was 18 years. The students of the experimental group (EG) were trained under a proposed interventional program with the priority in application of athletic exercises, the control group (CG) was trained according to the current state education program for students (Raevsky, Tretyakov, & Kanishevsky, 2003). PE classes for EG and CG were scheduled twice a week. The general health level was assessed in all participants before and after one year of classes.

The interventional program consisted of three main units: running, speed-strength and strength activities (Table 1). Running activities involved long-distance race, moderate running, running of segments (from 300 m to 800 m). The speed-strength unit included jumping exercises with a combination of running, and running exercises with a combination of strength exercises (squats, static exercises, load exercises). Each exercise in the unit had to be repeated 3–4 times. Jumping exercises included: running with jumps, jumping, and jumping in a squat, which were performed after running exercises. The strength unit included exercises on machines, with the weight of own body and exercises with medicine balls.

The characteristics of subjects were analyzed by mean value (M), mean square deviation (m), a coefficient of variation (V). After testing the normality of data using the Shapiro-Wilk test, intra-group changes in general health level indices were determined using a paired t-test. Additionally, nonparametric Wilcoxon test was used for abnormally distributed data to assess intra-group differences. For all tests, statistical significance was assumed when $p<0.05$.

Table 1 ***The structure of the interventional program***

Units	Athletic means	Duration	Number of repetitions	Heart rate, beats/min
Aerobic endurance	Running of segments (300–800 m)	3–5 min	3–4	140–160
	Cross running (2–5 km)	8–23 min	–	150–160
Strength training	Exercise with a subjects	8–12 sets	3–4	150–160
	Exercise with a partner	8–12 sets	3–4	150–160
	Load exercises	6–8 sets	3–4	160–170
Speed-strength training	Jumping exercise	8–10 sets	–	160–170
	Running for short distances (30–200 m)	10–30 s	2–3	170–180
	Load exercises	4–6 sets	2–3	160–180

Results

Analyzing the initial results of research on the physical development of students, the average height index for male students was 175.9±6.3 cm, while no significant changes were observed in the indices of students from the first to the third year ($p>0.05$). According to the obtained values of Erismann index, more than a half (60.0%) of males have a proportional chest, 36.2% have a wide one and only 3.8% of examined have a narrow chest. Among females, a proportional chest was found in 33.6%, a narrow chest – in 40.2% and a broad chest was found in 26.2% of females.

In terms of cardiac heart rate in a state of rest, it should be noted that students' average values corresponded to 75.4±7.1 beats/min for male and 82.3±7.2 beats/min for females (Table 2).

Table 2 ***Indices of physical development of students***

Indices	M±m (V)	
	Males, n=226	Females, n=252
Height, cm	175.9±6.3 (3.6)	169.3±4.9 (2.9)
Body weight, kg	67.5±6.1 (9.1)	59.9±4.6 (7.7)
Chest girth, cm	93.4±3.40 (3.7)	86.2±5.5 (6.4)
Erismann index, cm	5.4±2.0 (36.8)	1.5±0.8 (35.1)
CHR, beats/min	75.4±7.1 (9.4)	82.3±7.2 (9.3)
Systolic blood pressure, mmHg	123.5±8.0 (8.7)	97.8±10.1 (9.1)
Diastolic blood pressure, mmHg	78.6±6.6 (8.7)	63.8±8.8 (12.2)
Lungs capacity, ml	3396.2±470.2 (8.7)	2101.1±227.9 (8.8)
Dynamometry, kg	31.4±6.3 (13.5)	19.4±3.5 (15.5)

Indices of blood pressure among students were within the normal range.

The results of lungs capacity are within the range of 3396.2±470.2 ml (males) and 2101.1±227.9 ml (females). According to the results of dynamometry, the strength index among males corresponds to a satisfactory level for this age group. However, among females, this index is below the norm and corresponds to an unsatisfactory level.

The majority of males (50.0%) possessed the average level of health (Figure 1). These data were typical only for 12.7% of females. Practically no participant had a high level of health indices. Higher than average health indices were observed only in 7.5% of males and 0.4% of females. The low-level parameters had every third participant (29.4% males and 33.2% females).

By analyzing the tendency of general assessment of physical health of males in EG we revealed statistical changes ($p<0.01$) (Table 3). During the experiment, EG males improved from lower than average level of physical health to the average one, and CG males had significantly stable health indices ($p>0.05$), but physical health of males in this group corresponds to below the average. As it can be observed, statistical intergroup differences in the level of physical health of males were revealed ($p<0.01$). Females of EG and CG experienced a probable improvement in the indices ($p<0.05$) and, on the whole, the indices corresponded to the below the average level.

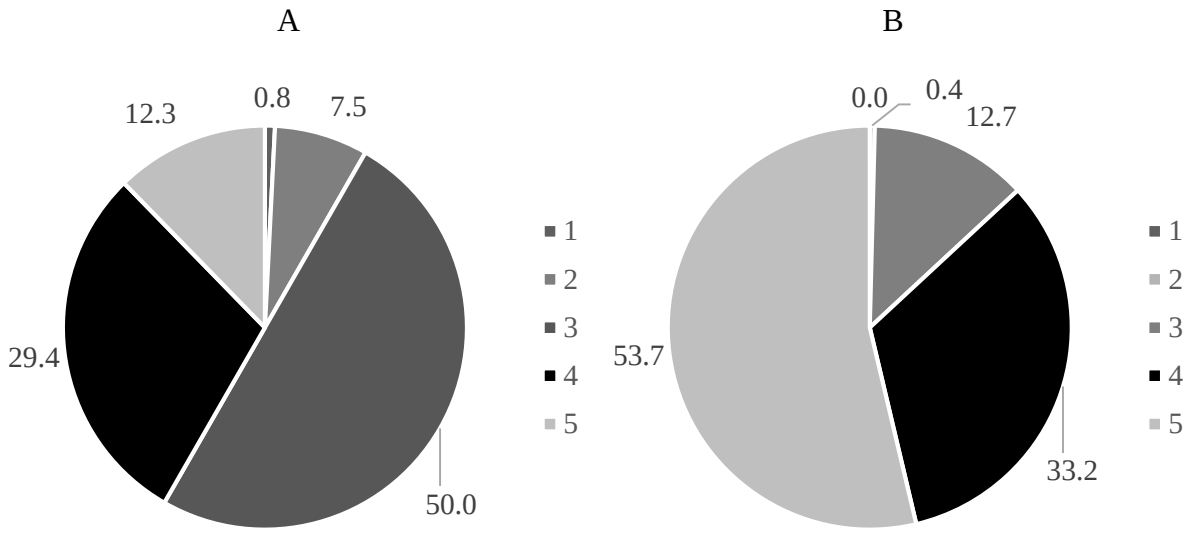

Figure 1 ***The amount (%) of students with different level of physical health:***
1 – high; 2 – higher than average; 3 – average;
4 – lower than average; 5 – low
A – males (n=226), B – females (n=252)

Table 3 ***Evaluation of general health level***

Level of physical health	EG		p_{EG}	CG		p_{CG}
	At the beginning	At the end		At the beginning	At the end	
Males						
Low, amount of students (%)	51.6	6.5		40.6	40.6	
Lower than average, amount of students (%)	38.7	22.6		43.8	31.3	
Average, amount of students (%)	9.7	64.5		15.6	28.1	
Higher than average, amount of students (%)	–	3.2		–	–	
High, amount of students (%)	–	3.2		–	–	
General assessment of health, points	3.06±2.34	7.84±3.03	0.005	3.56±2.93	4.13±2.02	0.44
Females						
Low, amount of students (%)	60.6	21.0	0.007	67.7	58.1	
Lower than average, amount of students (%)	21.2	36.3		25.8	29.0	

Average, amount of students (%)	18.2	33.6		6.5	12.0	
Higher than average, amount of students (%)	–	9.1		–	–	
High, amount of students (%)	–	–		–	–	
General assessment of health, points	3.20±1,02	6.12±1.90	0.007	3.32±1.85	5.01±2.3	0.04

Discussion

An assessment of the functional state of body and its reserve capacities is important for determining the effectiveness of physical education classes (Bucksch, 2005; Pavlova et al., 2018). A good functional state can be considered as a prerequisite for high physical working efficiency and the potential ability of the body to adapt to physical activity. What is more, students' physical fitness and body functional state are highly correlated with the quality of life (Pavlova et al., 2013). Physical activity provides different physical and mental health benefits; however, adolescents do not mainly meet the recommendation of at least 60 minutes per day of moderate or vigorous physical activity (Sallis et al., 2012).

The data show that most female students have a disharmonious physical development of the chest (Боднар et al., 2018). It is likely that the reason for the significant lagging of the indices of chest physical development of female from those of male is due to less developed muscles of the upper shoulder girdle and less physical activity in their free time (Pavlova, Vynogradskyi, Kurchaba, & Zikrach, 2017).

According to the results of dynamometry, the strength index among males corresponds to a satisfactory level for this age group. However, among females, this index is below the norm and corresponds to an unsatisfactory level. Physiologically, females have lower strength abilities than males, and especially muscles of the upper shoulder girdle.

Having analyzed the cardiovascular system of students in terms of cardiac heart rate in a state of rest, it should be noted that students' average values indicating signs of tachycardia, which is significantly expressed among females (82.3±7.2 beats/min). Indices of blood pressure, the lungs capacity correspond to the satisfactory level among male students and were within the normal range. As to the female students, the results of blood pressure indicate hypotonic symptoms.

We have observed that the physical state of students was low, our results are comparable with the study (Borras, Herrera, & Ponseti, 2017), in which the data indicate the need to increase the physical level of Spanish youth.

Experts have proved (Apanasenko & Popov, 1998) that for the development of functional abilities of cardiovascular and respiratory systems, running exercises

of different volumes and intensity are recommended. Research results (Dukh & Lemeshko, 2016) suggest that running at 30 m distance is the most effective means for normalizing the difference between systolic and diastolic blood pressure (r =-0.618) in 18–19-year-old females, and cyclic exercises of large volumes at that age should be used to improve general efficiency. The relation between aerobic exercise and students' cognitive health and in particular creative potential has been shown (Román et al., 2018). Aerobic exercises have been shown to produce specific physiological changes in brain and positively affect cognitive performance (Best, 2010).

Besides, exercises aimed at the development of dynamic force and strength endurance allow effectively improving the mechanisms of physical activity perception and recovery of the body after it (Blair, Cheng, & Holder, 2001). According to the result of the meta-analytic procedure (Hausenblas & Fallon, 2006) persons engaged in physical training had a higher body satisfaction, and exercise intervention participants reported a more positive body image post-intervention compared to the non-exercising control group.

Analysis of general indices of somatic health showed a positive growth, both in EG and in CG in the process of PE activities. At the beginning of the experiment, almost a third of females in both groups were characterized by unsatisfactory levels of somatic health. According to the results of studies (Chen, Kim, & Gao, 2014; Buková, Zusková, Szerdiová, & Küchelová, 2017), most indicators of the morphofunctional state of students demonstrate a tendency to reduce their opportunities. The results of our study suggest that the lowest health indicators are: respiratory and cardiovascular system indices. In the third year the males' adaptation of the cardiovascular system to physical activity reduced ($p<0.05$), whereas significant differences of females during 3 years of study were observed ($p>0.05$). Among the surveyed, a half (50.0%) is characterized by stress adaptation mechanisms of the cardiovascular system (Dukh & Lemeshko, 2016). During medical examination of first-year students was installed that 36–62% have problem of health condition. Nearly 14–21% of students could be classified as the special medical group, 12–18% as the preparatory group, 58–65% belong to the main medical group (Боднар et al., 2018).

In the course of the experiment, we have identified a positive effect of the means of athletics. The percentage of low-health students has decreased substantially in the EG by 51.6% to 6.5% (for males) and 60.6% to 21.0% (for females). The number of males and females of EG with average health increased significantly. In CG, the percentage of males with a satisfactory level of health has doubled.

We should note that in the course of the experiment and after its completion, there was a significant increase in the number of females with average health indices, which indicates the positive impact of athletics means. The results of

health assessment in CG indicate a decrease in the percentage of females with below the average health level by almost 10%.

Conclusions

The results of scientific research indicate a tendency to decrease in the level of health and physical fitness of students. Only a small part of students had high or higher than average health. According to the results of the experiment, the positive effect through the priority use of athletics means on the parameters of the respiratory, cardiovascular and muscular system in both males and females of EG was established. During the experiment, the level of physical health has grown from the average to above the average in EG students. Among females, 9.1% showed higher than average health level, and 3.2% of males showed a high level, while at the beginning of the experiment there were no students with such levels. The number of students in CG with average health level has doubled, which indicates the positive impact of systematic physical activity.

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