

INFLUENCE OF CYCLIC MODERATE INTENSITY WORK ON FUNCTIONAL FITNESS OF 17–21 YEARS OLD STUDENTS WITH “HIGH” CONTENT OF FAT COMPONENT

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Abstract. *Purpose:* determination of run loads purposefulness in aerobic energy supply mode for increasing of functional fitness of 17–21 years old boys with high content of fat component. *Material:* 17 boys of 17–21 years’ age, who did not practice sports, participated in the researches. By their health all boys were belonged to main health group. During 24 weeks training cycle, at different stages of the research (in 8, 16 and 24 weeks from the beginning of training) we registered indicators of aerobic performance and component composition of body mass. *Results:* with trainings’ periodicity of 3 times a week energy losses for one training did not exceed maximal admissible value and exceeded minimal one. Minimal value was not less than 44% from maximal admissible energy losses (energy losses of one training were approximately 50% from maximal admissible). *Conclusions:* run loads in aerobic energy supply mode confidently increase boys’ aerobic potentials after 16 weeks of trainings. With it they do not influence on anaerobic performance. It was found that under influence of such trainings fat component of body mass and visceral fat reduce; muscular component increases. Alongside with it body mass index and main metabolism did not change for 24 weeks of trainings.

Key words: boys, run loads, aerobic performance, anaerobic performance, component composition of body mass.

Introduction

It is known that studying at HEE is accompanied by emotional and mental over-tension, wrong regime of work and rest, ineffective organization of physical education. Considering all listed students’ observation healthy life style becomes especially important. Sufficient motor functioning is an integral component of healthy life style [1, 7]. That is why there appears a problem of creation and application of new health related physical culture technologies in physical education of higher educational establishments’ students [2, 5, 7, 8, 14]. Effectiveness of health related trainings to large extent depend on improvement of organism’s adaptation mechanisms. One of factors, influencing on this process is individual growth of organism, connected with age period of ontogeny [14].

Also dependence between ability to adapt to physical aerobic and anaerobic loads and body mass has been found [3, 15, 16]. For example, with increasing of fat component in organism, indicators of aerobic and anaerobic performance reduce. That is why, application of physical exercises for correction of body mass component composition permits to purposefully improve functional fitness [2, 4, 5, 7, 8, 9, 12, 14]. Alongside with it variable character of physical loads’ influence on functional fitness of persons with different content of fat component has not been researched yet.

Considering the above said creation of new forms of physical education programs and studying of their effectiveness, considering fat content of 17–21 years old boys, condition the urgency of the present research.

Purpose, tasks of the work, material and methods

The purpose of the work is determination of run loads purposefulness in aerobic energy supply mode for increasing of functional fitness of 17–21 years old boys with high content of fat component.

The tasks of the research: to study effectiveness of run loads influence in aerobic energy supply mode on indicators of aerobic and anaerobic performance and on component composition of 17–21 years old students’ body mass.

The methods and organization of the research: in our previous works it was found that aerobic and anaerobic performance of 17–21 years old boys depend on component composition of body mass (with increasing of fat component indicators of both aerobic and anaerobic performance reduce) [3, 15, 16]. We studied possibility of cyclic exercises’ application in aerobic energy supply mode for influencing on functional fitness of boys with “high” content of fat component. At the beginning of experiment we formed group of students (17 persons) with “high” fat component content. For improvement of these students’ functional fitness we used run loads in aerobic energy supply mode. For prevention from these trainings’ negative influence on muscular-skeletal apparatus we took in consideration body mass index (BMI), which exceeded norm in our researches. During 24 weeks (thrice a week) the tested fulfilled run loads. At every training energy losses were 50% from maximal admissible value. In running each

student used monitor of heart beats rate and observed fixed pulse regime – 150 bpm⁻¹. It corresponded the planned intensity of work, which was 60% from maximal oxygen consumption (VO_{2 max}).

Effectiveness of trainings' influence on students' functional fitness was assessed by physical workability (PWC₁₇₀) and maximal oxygen consumption (VO_{2 max}) [6], threshold of anaerobic metabolism – TAM) [13], power of anaerobic a-lactate (Wingate anaerobic test for 10 seconds – WAnT₁₀) and lactate (Wingate anaerobic test for 30 seconds – WAnT₃₀) energy supply processes, by maximum quantity of mechanical work for 1 minute– MQMK) [13, 18], and component composition of body mass [20].

Quantitative content of fat component in boys' organism was assessed by criteria of Gallagher D., McCarthy H. D. and Omron Healthcare [17, 19, 20]. Aerobic performance was assessed by relative value of maximal oxygen consumption. For it we used criteria of Ya.P. Piarnat [11]. By criteria of G.L. Apanasenko we estimated levels of physical health: "safe" level for boys corresponded to relative value of VO_{2 max} not lower than 42 ml·min⁻¹·kg⁻¹. Before experiment level of physical health of the tested students corresponded to level; "below average" by mean value of VO_{2 max rel}. It was lower than "safe" health level. Research results were registered after 8, 16 and 24 weeks from the beginning of experiment.

Effectiveness of run trainings depends on their periodicity and loads of every training, which shall not exceed maximal admissible energy loss (E_{max}) and exceed minimal (E_{min}). For calculation of minimal (E_{min}) and maximal admissible (E_{max}) values, as well as for determination of run duration with such energy losses we used indicator VO_{2 max} [12].

For prompt calculation of individual indicators of aerobic performance, energy losses in run at certain heart beats rate, for assessment of students' organism aerobic performance we used author's computer program "Health calculation". Using the inserted data the program gives results of calculation of absolute and relative indicators of organism's aerobic performance (PWC₁₇₀ i VO_{2 max}); level of organism's aerobic performance (by criteria of Ya.P. Piarnat) [11]; maximal admissible (E_{max}) and minimal (E_{min}) energy losses values; heart beats rate (HBR). Intensity of run work is calculated by formula of O.A. Pyrogova [10], considering the planned one training energy losses, maximal admissible (t_{max}) and minimal (t_{min}) duration of run.

Statistic processing of the data of the research was conducted with the help of mathematical statistic methods. We determined mean arithmetic value (x), mean square deviation (σ) and error of mean arithmetic (±S). T criterion of Student was used for determination of confidence of results' difference.

The materials of this work comply with legal and ethic standards of researches that is confirmed by bio-ethic committee of *Vinnitsa State Pedagogical University* (minutes №1 dt. October 8 2015). Besides, we received written consents of parents for testing of students.

Results of the researches

Under influence of trainings the tested boys' absolute and relative indicators of aerobic performance increased (see table 1). After 24 weeks of trainings absolute value PWC₁₇₀ confidently increased by 15.16% (p<0.01). Relative indicators PWC₁₇₀ confidently increased after 16 weeks by 10.6%, (p<0.01) and after 24 weeks – by 16.79% (p<0.001).

Under influence of trainings, absolute indicator VO_{2 max} increased by 9.27% (p<0.01) after 24 weeks. In contrast to absolute indicator, relative indicator VO_{2 max} increased by 6.9 % (p<0.001) after 16 weeks and by 10.9% (p<0.001) after 24 weeks.

Confident increase of absolute and relative indicators TAM of the tested persons was registered only after 24 weeks of trainings. TAM_{abs} increased by 13.18% (p<0.001). Relative indicators TAM increased, in average, by 14.86% (p<0.001).

In spite of absolute and relative values of indicators PWC₁₇₀, VO_{2 max} and TAM confident increasing, level of physical health (by Ya.P. Piarnat and G.L. Apanasenko) did not change confidently.

Training during 24 weeks did not change significantly anaerobic performance by indicators of maximal external mechanical work during 1 minute (MQMK), power of a-lactate processes (WAnT₁₀) and power of anaerobic lactate energy supply processes (WAnT₃₀).

Table 1. Influence of run loads program of aerobic orientation on indicators of aerobic and anaerobic performance of 17–21 years old boys

Indicator	Mean values, $x \pm S$			
	Before trainings	After 8 weeks	After 16 weeks	After 24 weeks
PWC ₁₇₀ , kgm·min ⁻¹	975.08 ±41.51	1015.03 ±33.77	1073.34 ±37.53	1149.31 ±45.07**
PWC ₁₇₀ , kgm·min ⁻¹ ·kg ⁻¹	11.55 ±0.34	12.14 ±0.25	12.92 ±0.29**	13.88 ±0.38***
VO _{2max} , ml·min ⁻¹	2897.63 ±70.58	2965.55 ±57.47	3064.67 ±63.7	3193.83 ±76.61**
VO _{2max} , ml·min ⁻¹ ·kg ⁻¹	34.42 ±0.49	35.53 ±0.36	36.97 ±0.31***	38.63 ±0.47***
TAM, W	178.24 ±6.87	187.06 ±6.27	188.82 ±5.57	205.29 ±4.87***
TAM, W·kg ⁻¹	2.12 ±0.06	2.25 ±0.08	2.28 ±0.09	2.49 ±0.08***
MQMK, kgm·min ⁻¹	2372.12 ±79.39	2465.14 ±77.30	2457.01 ±72.98	2529.95 ±75.07
MQMK, kgm·min ⁻¹ ·kg ⁻¹	28.42 ±1.05	29.54 ±1.03	29.63 ±0.99	30.59 ±1.04
WAnT ₁₀ kgm·min ⁻¹	4814.58 ±119.78	4904.21 ±177.97	4974.6 ±177.97	4992.55 ±179.00
WAnT ₁₀ kgm·min ⁻¹ ·kg ⁻¹	57.53 ±1.88	58.59 ±1.88	58.82 ±1.88	60.18 ±1.67
WAnT ₃₀ kgm·min ⁻¹	3405.51 ±138.51	3434.91 ±132.03	3505.21 ±139.21	3602.99 ±135.31
WAnT ₃₀ kgm·min ⁻¹ ·kg ⁻¹	40.76 ±2.44	41.12 ±2.37	42.24 ±2.23	43.53 ±2.09

Notes: Confidence of differences in indicators of output data: * – $p < 0.05$; ** – $p < 0.01$; *** – $p < 0.001$.

Table 2. Influence of run loads program of aerobic orientation on component composition of 17–21 years old boys' body mass

Indicator	Mean values, $x \pm S$			
	Before trainings	After 8 weeks	After 16 weeks	After 24 weeks
Body mass, kg	83,83 ±1,11	83,48 ±1,08	82,92 ±1,10	82,71 ±1,11
BMI	24,65 ±0,09	24,55 ±0,17	24,38 ±0,16	24,32 ±0,14
Fat content, %	23,35 ±0,40	22,78 ±0,31	21,93 ±0,42*	21,88 ±0,42*
Skeletal muscles, %	38,43 ±0,19	38,85 ±0,26	39,28 ±0,26*	39,33 ±0,25*
Visceral fat content	7,71 ±0,28	7,12 ±0,21	6,94 ±0,28	6,53 ±0,28*
Main metabolism, kcal	1854,12 ±17,34	1836,18 ±19,99	1817,47 ±15,32	1805,12 ±18,31

Note. Confidence of differences in indicators of output data: – $p < 0,05$.

Characterizing of changes' dynamic in component composition of body mass in the process of trainings (see table 2) we found that percentage of fat mass in students' organism reduced by 6.08% ($p < 0.05$) after 16 weeks of trainings and by 6.3% ($p < 0.05$) after 24 weeks. With it content of muscular component of body mass increased by 2.16% after 16 weeks and by 2.3% after 24 weeks of trainings. After 24 weeks, under influence of trainings, level of visceral fat reduced by 15.3%, ($p < 0.05$). However we did not register confident changes of body mass, BMI and main metabolism.

Discussion

So, run loads in aerobic energy supply mode can be used for improvement of 17-21 years old boys' functional fitness. Considering dependence of functional fitness of such age boys on fat content (with increasing of fat content functional fitness worsens) the purposefulness of such trainings of boys with excessive fat component becomes obvious.

Correction of functional fitness shall be realized through improvement of aerobic metabolic processes, which determine effectiveness of muscular work. Effectiveness of such work is conditioned by chosen means of physical education, by periodicity of trainings and volume of loads. For improvement of boys' functional fitness we chose run of moderate intensity in aerobic energy supply mode. With trainings' periodicity of 3 times a week energy losses at one training did not exceed maximal admissible level and exceeded minimal one. Minimal admissible level was 44% from maximal admissible energy losses (energy losses at one training were 50% from maximal admissible). There is information that effectiveness of trainings in aerobic mode can be ensured by less periodicity and less energy losses [10]. Results of our researches do not confirm this opinion [12, 14]. Our training program facilitates increase of 17–21 years old boys' aerobic potentials by indicators $VO_{2\max}$ and TAM. They do not influence on anaerobic performance. This performance was assessed by power of anaerobic a-lactate and lactate energy supply processes as well as by capacity of lactate energy supply processes. Under influence of such trainings fat component of the tested reduced. It is a risk factor, meaning reduction of organism's functional potentials.

Conclusions

Run loads in aerobic energy supply mode of 50 % from maximal admissible energy losses value with periodicity of 3 times a week confidently increase aerobic potentials of boys with "high" fat content, videlicet: power of aerobic energy supply processes by indicator $VO_{2\max}$, after 16 weeks of trainings and later (after 24 weeks of trainings) – capacity of aerobic energy supply processes by indicator TAM, with it not influencing on anaerobic performance.

Under influence of such trainings fat component content decreased after 16 weeks of trainings and level of visceral fat reduced after 24 weeks of trainings. With it muscular content of 17–21 years old boys increased. However, BMI and main metabolism did not change after trainings cycle.

The further researches: it is planned to study influence of trainings in mixed energy supply mode on functional fitness of students with "high" content of fat component.

Acknowledgement

This work has been fulfilled in compliance with plan of scientific-research works of department of physical education and physical rehabilitation medical-biological principles *Vinnitsa State Pedagogical University by topic 9027 "Optimization of perfection of students' and pupils' functional fitness by physical loads of different kinds"* (registration number– 0113U007491).

Conflict of interests

The authors declare that there is no conflict of interests.

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Cite this article as: Furman Y.M., Brezdenyuk O.Y.
Influence of cyclic moderate intensity work on functional
fitness of 17–21 years old students with “high” content of fat
component. *Pedagogics, psychology, medical-biological
problems of physical training and sports*, 2015;11:55–60.
<http://dx.doi.org/10.15561/18189172.2015.1108>

The electronic version of this article is the complete one and can be
found online at: <http://www.sportpedagogy.org.ua/html/arhive-e.html>

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Received: 18.08.2015
Accepted: 01.09.2015; Published: 02.09.2015