



Peculiarities of the organism response to physical load in schoolchildren of the highest grades with insufficient body weight

UDC 796.011.3

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Abstract

Objective of the study was to reveal the results of the study of the level of physical fitness of schoolchildren with insufficient body weight.

Methods and structure of the study. The results of testing to assess the level of development of basic physical qualities are given, a comparative analysis is carried out with the results of testing schoolchildren with normal and overweight. It was found that with a relatively equal general level of physical fitness in schoolchildren with insufficient body weight, compared with schoolchildren with normal body weight, the former have a more pronounced disharmony in the development of physical qualities. A comparison of the reactions of the body to physical activity during physical education lessons in schoolchildren with insufficient and normal body weight is presented. The specific features of the impact of physical education lessons according to the standard school curriculum on the cardiovascular system of schoolchildren with insufficient body weight were revealed.

Results and conclusions. Underweight students in general did not show statistically significant differences in the level of physical fitness compared to students with normal body weight. The mean score on all tests is 4, compared to 4.06 for normal weight students. Overweight students have an average score of 3.34 on all tests. Thus, it can be concluded that underweight does not affect the level of physical fitness to the same extent as overweight.

Keywords: *physical fitness, body weight, underweight, physical activity, individual characteristics.*

Introduction. Human body weight characterizes biochemical, plastic, metabolic, hormonal and many other processes in the body. It is one of the main indicators of human physical development, an important criterion in determining nutritional status. Deviations of a person's body weight from normal indicators are a signal of a deterioration in his physical health.

In the context of physical education, a lot of work is devoted to the physical education of overweight people. In particular, it has been established that excess body weight is associated with a low level of physical fitness and performance [2]. On the other hand, quite a few works reveal the specifics of the physical education of people with insufficient body weight. There are research results proving the presence of specific features of the impact of physical activity on the body

of people with insufficient body weight [3]. However, most of the works reveal this problem from a medical point of view and primarily consider the specifics of the diet with insufficient body weight, without paying attention to physical activity.

When analyzing special literature, it was found that, according to the results of studies, the number of people with deviations in body weight is approximately equal both towards excess and towards underweight [1]. Thus, the relevance of considering the specifics of physical education of people with insufficient body weight, against the background of the lack of research on this issue, becomes obvious.

Objective of the study was to reveal the results of the study of the level of physical fitness of schoolchildren with insufficient body weight.



Methods and structure of the study. The study was conducted at the bases of Educational Institution Lyceum No. 393 and secondary school No. 585 of the Kirovsky district of St. Petersburg in April 2022. The study involved schoolchildren of grades 10-11 ($n=37$), the inclusion criterion was the values of body mass index (BMI) corresponding to insufficient body weight. All study participants were assigned to the main physical culture group.

To assess the level of physical fitness, tests were used to determine the level of development of physical qualities:

- strength - flexion and extension of the arms in the lying position (number of times);
- agility - shuttle run 3×10 m (s);
- endurance - 2000 m run (min);
- speed - 100 m run (s);
- flexibility - bending forward from a lying position on a gymnastic bench (cm).

All tests are included in the physical education program for schoolchildren of grades 10-11 and were evaluated on a 5-point system, taking into account regulatory requirements, in accordance with the sex and age of the respondents. The test results were also analyzed in comparison with the level of physical fitness of students with normal and overweight, assigned to the main physical culture group.

To determine the specific features of the reaction of the organism of schoolchildren with insufficient body weight to physical activity, pulsometry of a lesson in physical culture was carried out. The results of pulsometry of schoolchildren with insufficient body weight were analyzed on the basis of a comparison of the results of pulsometry of schoolchildren with normal body weight.

Results of the study and their discussion. Schoolchildren with insufficient body weight in general did not show statistically significant differences in the level of physical fitness, compared with students with normal body weight. The mean score on all tests is 4, compared to 4.06 for normal weight students. Overweight students have an average score of 3.34 on all tests. Thus, being underweight does not affect fitness levels to the same extent as being overweight.

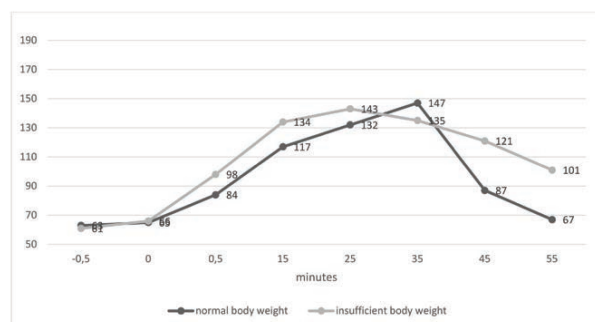
The results obtained could indicate a sufficient training effect of the school program in physical education for students with insufficient body weight and the absence of the need to adjust it to their individual characteristics. However, despite the absence of statistically significant differences with

students with normal body weight in the average score for all tests, there is heterochrony in the level of development of physical qualities in students with insufficient body weight. Thus, statistically significant ($p \leq 0.05$) differences are observed in the level of development of flexibility and speed. At the same time, schoolchildren with insufficient body weight showed higher results in the test for speed (4.3 points compared to 3.9 points for students with normal body weight) and lower in the level of flexibility development (3.6 points compared to 4.4). Also, underweight students performed better than normal weight students on the strength test. In our opinion, this may be due to the specifics of the test itself.

No statistically significant differences were found in the endurance test, however, for further development of physical education methods for people with insufficient body weight, it is worth paying attention to the lower average test values - 3.8 points, which is an indicator of a low level of endurance development. For schoolchildren with normal body weight, this indicator is at the average level - 4.2 points.

These differences in the level of development of physical qualities indicate a discrepancy between the content of the physical culture program and the individual capabilities of underweight schoolchildren. Or the planning of physical education for these individuals, it is necessary to pay more attention to the complexes of exercises for the development of flexibility and endurance.

When analyzing the results of pulsometry, the average values of the results of measurements of schoolchildren with normal and insufficient body weight were used (see figure). The main attention was paid to the results of measurements at the beginning (15 minutes) and the end (35 minutes) of the main part of the lesson, as well as measurements 10 minutes after the end of the lesson (55 minutes).



Graph of average values of pulsometry of a lesson in physical culture in schoolchildren with normal and insufficient body weight (bpm)



The results showed differences in the impact of physical activity on schoolchildren with insufficient body weight. So, with similar heart rate values 5 minutes before the start of the lesson (61 and 63 beats/min), underweight schoolchildren show a sharper increase in heart rate values at the beginning of the lesson. The difference in heart rate values is less noticeable in the middle of the main part of the lesson, however, by the end of the main part, the heart rate value significantly decreases in underweight schoolchildren. This can be caused either by the specifics of the slower adaptation mechanisms of the body to physical activity, or by the faster onset of the fatigue phase, which affects the effectiveness of physical exercises. This issue requires further study.

Particular attention should be paid to the slow recovery process of the body in schoolchildren with insufficient body weight in the final part of the lesson and 10 minutes after it. Despite the faster start of the decrease in heart rate values during the lesson, by the end of the lesson, in schoolchildren with insufficient body weight, the indicators remain quite high (121 beats/min, compared with 81 beats/min in schoolchildren with normal body weight). There is no complete recovery of heart rate even 10 minutes after the end of the lesson (101 beats/min), which indicates an excessive load in the school physical education program for students with insufficient body weight.

The obtained results of the study allowed to develop a number of methodological recommendations for inclusion in the content, load and organizational components of the physical education program.

1) Content component of the program:

- the use of strength exercises in lessons mainly with the weight of external weights, since own body weight (insufficient) cannot be an objective indicator of the level of strength development, and also in these individuals it is necessary to achieve hypertrophy of muscle tissue;

- an increase in the percentage of exercises in the program for the development of elasticity of the muscular and ligamentous apparatus, which is associated with low indicators of the level of development of flexibility in schoolchildren with insufficient body weight.

2) The load component of the program:

- limiting the intensity of long-term monotonous loads in schoolchildren with insufficient body

weight, to optimize the work of the cardiovascular system during long-term work and the gradual development of the level of general endurance;

- the inclusion of predominant active rest (low-intensity aerobic loads) after high-intensity exercises, due to the peculiarities of the reaction of the cardiovascular system of schoolchildren with insufficient body weight to the load - this will contribute to a more effective recovery of heart rate and will contribute to the development of adaptive mechanisms of the body.

- the most appropriate would be to reduce the volume of exercises within one lesson by increasing the time of their implementation, a smaller number of muscle groups included in the work will reduce the recovery time of the body after exercise, and will also contribute to the development of general and special endurance.

3) Organizational component of the program:

- in the main part of the lesson, in order to achieve the maximum training effect, eliminate monotony in work and quickly onset of the fatigue phase, it is recommended to use mainly interval, variable methods, as well as the organization of classes in the form of a circular training;

- to achieve optimal recovery of the body, it is recommended to increase the duration of the final part of the lesson by reducing the time of the main part.

Conclusions. The theoretical analysis of the problem revealed the absence of scientifically based methods of physical education of schoolchildren with insufficient body weight.

As the study showed, the level of physical fitness of schoolchildren with insufficient body weight is generally satisfactory, however, there are statistically significant differences and disharmony in the level of development of certain physical qualities (flexibility and speed) compared to students with normal body weight. The reaction of the cardiovascular system to physical activity in schoolchildren with insufficient body weight has its own specifics and differs from schoolchildren with normal body weight. A physical education lesson according to a standard program causes unfavorable physiological changes in the work of the cardiovascular system in schoolchildren with insufficient body weight, which in the future may contribute to a decrease in their health, physical fitness and performance levels.

The developed methodological recommenda-



tions for the physical education of schoolchildren with insufficient body weight are based on the identified indicators of the level of their physical development, preparedness and the characteristics of the body's response to physical activity. These recommendations in the future should form the basis for the development of a full-fledged methodology for the physical education of these individuals. The orientation of the methodology should be focused not only on the development of the level of physical fitness and the preservation of the health of schoolchildren, but also contribute to the normalization of body weight.

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