Original Article

# Programming of physical education and health-improving classes for the girls aged 12-13 years

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## ABSTRACT

The research study presents the results of the pedagogical experiment that lasted during 2017-2018 academic year. Altogether 101 girls aged 12-13 years who, for reasons of health, are classified as primary and preparatory medical groups, were involved in the research. The purpose of the research was to determine the appropriate standards of physical fitness of 12-13-year old girls, which provide a stable level of physical health. To achieve this goal, an integrated approach was used using the following research methods: analysis and synthesis of special research and methodological literature and documentary materials; anthropometric methods; determination of the level of physical health; pedagogical testing; physiological methods; methods of mathematical statistics. The article presents the results of correlation relationships of indicators of motor tests and physical health. On their basis, regression equations were estimated to determine the appropriate values of physical fitness of girls aged 12-13 years with an average and below the average level of physical health. Through the use of factor analysis, we identified five statistically independent factors: muscular strength, speed-strength, agility, endurance, and speed. The total contribution of these factors to the generalized variance of the sample is 89.6 %. We selected the most informative motor tests: for assessing muscle strength - shoulder flexor dynamometry ($r = 0.759$ with $p < .01$), speed-strength qualities – standing long jump ($r = 0.800$ with $p < .01$) speed - the difference between the time of shuttle run 3 × 10 m and 30 m ($r = 0.808$ with $p < .01$); endurance - relative performance ($PWC_{150}$) ($r = 0.869$ with $p < .01$) and speed - 5 seconds running in the place at the maximum pace ($r = 0$, $0.860$ $p < .01$). The results have prognostic value for the development of methods of training with a rational correlation of physical activity of various directions for a given age group.

**Keywords:** Programming; Physical condition; Proper rate; Girls.

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## INTRODUCTION

Programming in physical education involves the definition determination of a rational aggregate and volume of means and methods of physical education, the sequence of their use at various stages of the health-improving process, taking into account the age, level of health and fitness. (Andrieieva et al., 2017; Alatzoglou et al., 2017; Galan et al., 2018).

In drawing up the programs, the following factors were taken into account the general laws of learning motor actions and the development of physical qualities, peculiarities of the methods of physical education of the children's contingent (Krusevich, 2007; Broďáni et al., 2017; Bolotin et al., 2017 Pasichnyk et al., 2018; Leonenko et al., 2019). Programming of fitness and health-improving classes is one of the effective levers for managing a person's physical health (Trofimenko et al., 2019).

In the process of managing the physical health of those who are engaged, the leading role belongs to pedagogical control (Sergienko, 2005; Krusevich et al., 2011). The controllability of the system increases with a sufficient frequency of receipt of information from the managed object to the manager and vice versa (Kashuba et al., 2017; Kozhokar et al., 2018), in order to be able to assess the situation in time and make a correction to the pedagogical process. Pedagogical control provides information about the health level, physical performance and fitness, provides feedback on the basis of information about the changes in various systems of the body under the influence of health-improving methods; defines rational influence (means and methods) for the improvement of physical condition (Imas et al., 2018).

The lack of information in the literature on the informativeness of the systems for assessing physical health and biological age does not allow us to make a conclusion about the advantages of one or another diagnostic method and its application in the system of physical education and health-improving activities.

Despite the large number of studies, the programming of physical education and health-improving classes with teenage girls is not sufficiently developed. It is schoolgirls who have significantly worse health indicators than boys and, moreover, this age is the most variable in terms of morpho-functional state.

Analysis of existing approaches to the programming of physical education and health-improving classes showed that, along with numerous data on the impact of physical exercises on the body of those who go in for sport, the issues of the regulation of physical activity are insufficiently developed, and the normative parameters of physical education and health-improving classes for girls of this age are not defined. This fact hinders the effective implementation of a differentiated approach to the programming of physical training and health-improving classes for children. Given the above, this testifies to the relevance of our research.

## MATERIALS AND METHODS

The research study was conducted on the basis of the Specialized School of the I-III stages No. 130 named after Dante Alighieri of the city of Kyiv; the Specialized School of the I-III stages of the physical and mathematical profile No. 6, secondary school of the I-III stages No. 33 of the city of Chernivtsi. Altogether 101 girls aged 12-13 years took part in the study, who, for health reasons, were assigned to the main and preparatory medical groups, in particular 51 girls from Kyiv (n = 51) and 50 girls from Chernivtsi (n = 50).

 

To achieve the set purpose of the research, we have used a complex of interdependent mutually supportive general research and specific methods. The analysis of the scientific and methodological literature was carried out with the aim of theoretical substantiation of the object of research, as well as the synthesis of research approaches to the organization of programming health-improving and physical education classes for the girls aged 12-13 years old. For the study of literary sources, we used such research techniques as aspectological, hermeneutic and critical analysis. The theoretical methods of research and synthesis of modern practical experience the urgency of the research clarify and specify the purposes and directions of the pedagogical experiment, and to develop the content of the comprehensive research program. Girls' health was assessed based on generally accepted criteria for the assessment of individual health. In determining the most optimal method of health assessment in this study, we preferred accessible, informative, non-invasive methods that enable covering a significant group of children during a short period. Therefore, health research was performed with the application of H. L. Apanasenko's express-method of assessment of somatic health level. Assessment of the physical development of girls was carried out by comparing anthropometric (body length and body weight) and physiometric (lung capacity and muscle strength of the hand) indicators with age and regional standards using the classical method. Measurements of the vital capacity of the lungs were performed using a dry spirograph according to the standard technique. The study of the muscle strength of hands was carried out using a hand dynamometer. The functional state of the body systems was assessed using the indices widely used in the practice of age physiology: Ruffier, Robinson, and others that characterize the work of the cardiorespiratory and autonomic nervous systems. Pedagogical research methods included: pedagogical observation, pedagogical testing and a pedagogical experiment that lasted for an academic year.

The results obtained during the pedagogical experiment were processed using the methods of mathematical statistics using: the method of average values; sampling method; analysis of variance, correlation analysis, factor analysis, regression analysis.

## RESULTS

At the beginning of the pedagogical experiment, there was no statistically significant difference by all the studied parameters, between the girls aged 12-13 years of Kyiv and Chernivtsi.

The purpose of this study was to determine the appropriate values of physical fitness indicators in the studied group of girls. Based on the correlation analysis between the indices of motor tests and physical health indicators, the regression equations were calculated separately for the schoolgirls with below-average and the average level of physical health (Table 2).

In the equations, the variable "y" is substituted for the quantitative value of the corresponding indicator of physical health (below average or average level) from the table of physical health level assessment (according to H. L. Apanasenko, 1998). These values in the equations are shown in parentheses. The variable "x" denotes physical fitness indicators, the proper values of which are given with the standard error of the equation in the fifth column.

The equations were calculated for adolescent girls below average and average levels of physical health.

Table 1. Regression between physical fitness (x) and physical health (y) of the girls aged 12-13 years with a low level of physical health.

| № | Indicators | Correlation coefficient | Regression equation | *y* | Proper standard of physical fitness |
|---|---|---|---|---|---|
| | Below the average level of physical health | | | | |
| 1 | Flexion and extension of arms (x) force index (y) | .719 | $x = \frac{y - 31.62}{1.17} \pm 1.97$ | 43 | 10±2 |
| 2 | Standing long jump (x) Robinson index(y) | .521 | $x = \frac{y - 90.21}{0.007} \pm 9.6$ | 91 | 157±10 |
| 3 | Sit-up from the back-lying position (x) Ruffier index, (y) | –.581 | $x = \frac{y - 17.77}{-0.23} \pm 1.67$ | 12 | 25±2 |
| 4 | Running 60 m race (x) Life index (y) | .362 | $x = \frac{y - 14.86}{3.06} \pm 0.40$ | 44 | 9.6±0.4 |
| 5 | Running 1,500 race m (x) Robinson index (y) | .637 | $x = \frac{y - 97.86}{-0.01} \pm 10$ | 92 | 9'45"±10" |
| 6 | Shuttle running 4 × 9 m (*x*) Life index (*y*) | –.687 | $x = \frac{y - 14.2}{2.51} \pm 0.2$ | 44 | 11.9±0.2 |
| 7 | Bending forward (x) ratio of body weight and body length (y) | .355 | $x = \frac{y - 1.03}{0.02} \pm 1.2$ | – 0.9 | 7±0.1 |

Table 2. Regression between indicators of physical fitness (x) and physical health (y) of the girls aged 12-13 years with an average level of physical health.

| № | Indicators | Correlation coefficient | Regression equation | *y* | Proper standard of physical fitness |
|---|---|---|---|---|---|
| | The average level of physical health | | | | |
| 1 | Flexion and extension of arms (x) force index (y) | .696 | $x = \frac{y - 47.59}{0.03} \pm 1.3$ | 48 | 14±1 |
| 2 | Standing long jump (x) Robinson index(y) | .699 | $x = \frac{y - 52.84}{0.001} \pm 5.4$ | 53 | 160±5 |
| 3 | Sit-up from the back-lying position (x) Ruffier index, (y) | .688 | $x = \frac{y - 31.54}{0.61} \pm 2.1$ | 50 | 30±2 |
| 4 | Running 60 m race (x) Life index (y) | –.397 | $x = \frac{y - 86.33}{-3.43} \pm 0.2$ | 53 | 9.7±0.2 |
| 5 | Running 1,500 m race(x) Robinson index (y) | .773 | $x = \frac{y - 53.52}{-0.001} \pm 5.3$ | 53 | 8'5"±5" |
| 6 | Shuttle running 4 × 9 m (*x*) Life index (*y*) | –.707 | $x = \frac{y - 84.28}{-2.74} \pm 0.2$ | 53 | 11.4±0.2 |
| 7 | Bending forward (x) ratio of body weight and body length (y) | .398 | $x = \frac{y - 0.02}{-0.007} \pm 1.1$ | – 0.05 | 10±1 |

This is due to the fact that in these studies there were no girls with high level of health. Therefore, for high-level schoolgirls, proper standards of physical fitness indicators were extrapolated on the basis of calculated data.

 

The main difference between the developed standards and the existing ones for this age group is that they are designed for the adolescent 12-13-year-old girls of different levels of physical health (Table 3).

Table 3. Control standards of physical fitness of the adolescent girls aged 12-13 years.

| Types of tests | Training standards | | | |
|---|---|---|---|---|
| | | Levels of physical health | | |
| | State tests | Below average | Average | High |
| Running 1,500 m race, sec | 8.00-7.45 | 9.45 | 8.50 | 8.30 |
| Flexion and extension of arms in front lying support, times | 16-17 | 8-12 | 13-15 | 16 |
| Sit-up from the back-lying position, times /1min | 40-41 | 23-27 | 28-32 | 34 |
| Standing long jump, cm | 165-172 | 147-157 | 155-165 | 170 |
| Running 60m, sec | 9.8-9.5 | 9.6 | 9.7 | 9.5 |
| Shuttle running 4 × 9 m, sec | 11.4-11.2 | 11.9 | 11.4 | 11.3 |
| Bending forward from the sitting position, cm | 18 | 7 | 10 | 12 |

The inter-relation of the indicators of motor tests (for example, in the girls with a low level of physical health) with appropriate indices (in the girls with the below the average level of health) will help a teacher (instructor, parents) to determine the weaknesses in children's health and to cope with them by means of physical exercises.

In addition to assessing the level of physical fitness, we have studied the factorial structure of their motor capabilities in order to substantiate rational planning of the physical preparation of the studied contingent of schoolgirls. The development of rational parameters of physical education and health-improving activities for girls 12-13 years old was carried out with the help of the study: a rational ratio of physical activity of various directions for a given contingent of students; pulse modes of physical activity, causing the training effect on girls 12-13 years of different levels of physical health.

The task of the balanced ratio of the exercise load of different directions in the physical education and health-improving activities of adolescent girls aged 12-13 years was performed using the factor analysis (the principal components method). The relevance of using the latter for such tasks has been repeatedly proven (Yarmak, O. et al., 2018).

To determine the level of development of the principle motor qualities of the subjects, we selected authenticated motor tests, that is, validity, feasibility, and objectivity. Altogether 13 tests that determine the different sides of the motor capabilities of girls 12-13 years old were conducted. The most significant of them, as well as the proportion of individual physical qualities in the overall structure of the motor capabilities of these schoolgirls, were distinguished using factor analysis (principal component method) in a sample of 101 girls (table 4).

Based on the results of factorization of the inter correlation matrix of 13 indicators of motor capabilities, we identified: muscular strength, speed-strength qualities, agility, endurance, and speed. The total contribution of these factors to the generalized variance of the sample is 89.6 %.

The first factor - muscular strength (26.0 % of the total variance of the sample) - combined control tests on shoulder flexor dynamometry, which have the highest connection with this factor; on the dynamometry

of the flexors of the hand and the extensors of the trunk; and medicine ball (1 kg) throwing from behind the head in the sitting position, the legs apart.

In the second factor - speed-strength qualities (the contribution to the generalized variance of the sample is 19.0 %) - a standing high jump (the leading indicator) and a standing long jump.

The third factor - agility (specific gravity 18.0 %) - is represented by the difference in the running time of 3x10 m and 30 m.

The fourth factor - endurance (contributing to the total variance of the sample of 16.3 %) - has high correlations with relative performance (PWC150), maximum oxygen consumption ($VO_2$) and the result of running against the wall at a rate of 70% of the maximum. The leading indicator in the fourth factor is the relative $PWC_{150}$.

The fifth factor – speed – accounts for 10.3 % of the total sample variance. It combined the pace of movement (running in place for a duration of 5s) and the result in running 30 m. The first indicator has more factor loadings.

Table 4. Factor structure of physical fitness of the schoolgirls aged 12-13 years.

| № | Indicators | Factors | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1. | $PWC_{150}$, kgm·min$^{-1}$ | 0.029 | 0.341 | 0.012 | 0.869 | 0.146 |
| 2. | $VO_2$ max, ml·min$^{-1}$ | -0.122 | 0.034 | 0.036 | 0.863 | 0.140 |
| 3. | Hand flexor force, kg | 0.747 | 0.047 | -0.102 | 0.067 | 0.109 |
| 4. | Shoulder flexor force, kg | 0.759 | 0.200 | -0.029 | 0.138 | 0.005 |
| 5. | Strength of the body extensor, kg | 0.654 | 0.030 | 0.261 | 0.015 | 0.168 |
| 6. | Standing long jump, cm | 0.044 | 0.683 | 0.263 | 0.106 | 0.111 |
| 7. | High jump, cm | 0.078 | 0.800 | -0.122 | 0.068 | 0.014 |
| 8. | Medicine ball (2 kg) throw for distance | 0.639 | 0.045 | 0.210 | 0.012 | 0.113 |
| 9. | Running for 5 s (max) | 0.002 | 0.157 | -0.156 | -0.219 | 0.860 |
| 10. | Running 70% of maximum | 0.067 | -0.318 | 0.284 | 0.634 | 0.479 |
| 11. | Spinal mobility | 0.586 | -0.074 | -0.073 | 0.041 | -0.073 |
| 12. | The difference in running time of 3x10 m and 30 m | -0.057 | -0.145 | 0.808 | 0.094 | -0.242 |
| 13. | Running 100 m, sec | -0.189 | -0.336 | -0.730 | 0.052 | -0.418 |
| | Specific gravity, (%) | 26.0 | 19.0 | 18.0 | 16.3 | 10.3 |
| | % to total volume | 29.1 | 21.2 | 20.0 | 18.3 | 11.4 |

Thus, from among the studied tests of the motor abilities of girls aged 12-13 years old, the most statistically informative are: for assessing muscle strength – dynamometry of shoulder flexors, speed-strength qualities – a high jump from a spot; speed - the difference between the time of shuttle running 3 × 10 m and 30 m; endurance - relative performance ($PWC_{150}$) and speed - 5 seconds running in the place at the maximum pace. These tests can be used as objective criteria for qualitative changes in physical fitness of schoolgirls aged 12-13 years old in the process of experimental research.

A hypothetically rational option for planning physical fitness for girls aged 12-13 years old is: for the development of muscle strength to spend 29 % of the time, which is planned for physical training; for

 

example, within a month or half a year; for the development of speed-strength qualities and agility - by 20-21 %, for endurance - 18 % and for speed – 14 %.

For health-improving exercise, in addition to knowledge about the rational balance of physical exercise of various directions, it is important to know about the choice of pulse modes in the process of these exercises, which determine the drilling (health-improving) and useful impact.

## DISCUSSION

Selection of adequate managerial influences is associated with the procedure of programming classes based on pedagogical control data. In drawing up programs for physical training and health-improving classes, it is necessary to take into account the general laws of learning motor actions, especially the methods of physical education and health-improving classes with a child contingent. It implies determining the standards of physical development and physical fitness; assessing the degree of deviation of personal parameters from the standard; determining effective ways to correct these deviations; choosing the rational locomotor activity, selecting optimal parameters of physical exertion during training practice, etc. Several of the authors recommend the use of pedagogical observations, motor skills studies using measuring devices, programs containing test tasks and control exercises.

The researchers in their works tried to minimize the number of studied model indicators of a person's physical condition, determining their informativeness regarding the physical health of the individual. According to the authors (Krusevich, 2006; Sergiєnko, 2014; Yarmak et al., 2017), the most informative indicators characterizing the physical health of a person is the relative value of the maximum oxygen consumption ($VO_2$), and when choosing a complex of physiological tests, it is necessary to take into account their correlation with the maximum aerobic efficiency.

Some researchers (Romanenko, 1999, 2005**;** Martins et al., 2015) believe that in justifying the parameters of classes, it is necessary to focus on lagging motor qualities. In this case, the selection of methods is determined by the degree of deviation of individual parameters from the appropriate standards.

In foreign literature, we found no restrictions on the development of physical qualities in different age periods from 7 to 17 years. The authors point to the properties of the training methods (Bar-Or et al., 2009; Ramírez et al., 2017; Sánchez-Jover et al., 2017). In the national literature, the sensitive periods are used as reference points to determine the orientation of physical loads; in different authors, they may not coincide. It is probably due to the fact that the recommendations on the direction of methods in programs for physical education focus on the average health level, rather than on the model of a healthy student (Vaskan et al., 2018). It involves the use of the traditional standard-normative method that does not take into account the individual characteristics of children. The applied individual normative approach is designed to comply with the standards for the improvement of lagging qualities. Although some authors (Sergiєnko, 2014) consider it unacceptable in the mass recreational physical education through its laboriousness, a group of researchers proved its rationality and accessibility to perform both in work with an adult and child contingent (Bodnar, 2015). Its realization connected to the development of individual programs for their application, both in class time and in extra-curricular forms.

Systematization of physical training methods and direct introduction by the author V.V. Zaitseva identifies two more methods that determine the direction of the choice of means in recreational physical culture - typologically normative and type-specific. The essence of the first is based on a targeted impact

on those lagging behind the average population standard in this somatotype group. The second method involves the selection of the load orientation in accordance with the genetic predispositions of schoolchildren; at the initial stage of recreational exercises with a low level of physical fitness, they will have a positive transition to other qualities (Andrieieva et al., 2017). According to V.A. Romanenko, the most rational in recreational training is a typologically regulatory method, focused on the development of lagging motor quality, taking into account the typological characteristics of the individual, provided the use of not moderate, but submaximal loads with periodic addition of maximum. Attention is drawn to the fact that the level of loads is determined by the purpose of the classes, which may consist in the prevention of diseases, the increase of the body's resistance to various stressful influences, the achievement of a given level of physical performance and so on.

In some publications (Bodnar et al., 2018) it is proposed to determine the orientation and volume of exercises in health-improving programs, taking into account the level of physical condition. To determine the specific loads, we should take into account the peculiarities of adaptation, the state of health, the level of physical performance to the loads of different intensity.

The results of our research confirmed and supplemented the already well-known developments in the aspect of the studied issue.

The results of our research confirmed the data (Tomenko et al., 2017; Yarmak et al., 2018) on the study of physical fitness and the manifestation of the relationship of individual motor qualities with health indicators. We have supplemented the authors' opinion about the role of aerobic performance in ensuring the viability of the body. In this regard, the main focus of classes should be on the development of general endurance, which increases the nonspecific resistance of the organism to adverse environmental conditions.

## CONCLUSIONS

In the course of the pedagogical experiment, a quantitative relationship was established between the indicators of physical health and physical fitness, which is important for assessing the impact of physical fitness indicators on the level of physical health of schoolgirls. On this basis we have developed standards of physical fitness, which take into account the health status of girls. Using the methods of mathematical modelling, regression equations were calculated to determine the appropriate values of physical fitness of the girls aged 12-13 years with an average and below the average level of physical health. Most of the factor loadings have indicators that characterize the level of physical performance and maximum oxygen consumption ($r = 0.869$ with $p < .01$ and $r = 0.863$ with $p < .01$). We identified the most informative motor tests: 5 seconds running in the place at the maximum pace ($r = 0$, $0.860$ $p < .01$), the difference between the time of shuttle running 3 × 10 m and 30 m ($r = 0.808$ at $p < .01$); standing long jump ($r = 0.800$ with $p < .01$); dynamometry of shoulder flexors ($r = 0.759$ with $p< .01$).

These tests can be used as objective criteria for qualitative changes in physical fitness of the schoolgirls aged12-13 years in the process of experimental research.

 

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