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## Physical Health Assessment Of 10-16 Year Old Schoolgirls Of The Kharkiv Region Of Ukraine.

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### ABSTRACT

To determine the level of physical health of 10-16 year old girls. Researches were conducted on the basis of educational institutions of Kharkiv. 248 girls at the age of 10-16 years took part in them. Physical health of 10-16 year old girls is investigated; differences in age aspect of indicators of length and body weight, arterial blood pressure at rest, heart rate at rest and after the dosed exercise stress (30 squats in 45 seconds), vital capacity of lungs (VCL), breath holding inspiratory (Stange's test) and the number of lifting of a trunk sitting in 1 minute are surveyed; level of physical health of the studied contingent is established. As a result of the research the "average" level of physical health at 10-16 year old schoolgirls is established.

**Keywords:** physical education, physical health, 10-16 year old girls.

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## INTRODUCTION

In the modern world life and health of the person are admitted as the highest human values. However, it should be noted that a number of adverse social and economic conditions of modern life, including intensification of educational process (Šmída et al., 2017; Kravchuk & Soroka, 2014; Ostapenko, 2014), depression of interest of pupils in physical exercises and, as a result, insufficient motor activity (Aygün Cihan & Cakir-Atabek Hayriye, 2018; Krivoruchko, 2011) have a negative effect on state of health of younger generation.

The analysis of scientific and methodical literature showed the existence of scientific works reflecting state of physical health of various contingents of the investigated. Scientists note the tendency to depression of the level of functioning of indicators reflecting physical health (Galmandjuk et al. 2017; Maslyak et al., 2016; Pomeshchikova et al., 2016; Azhippo et al., 2017; Mameshina, 2016; Kuzmenko, 2017 et al.).

Functional state of cardiovascular and respiratory systems of organism plays an important role in adaptation to exercise stresses and is one of the key indicators of functionality of pupils. At the same time a series of authors is pointed out insufficient functional abilities of cardio-respiratory system of younger generation. So, the researches of Zakhozhiy & Dykyy, 2016, 35-38% of pupils have deviations in state of health and belong to special medical group. The number of pupils of special medical group significantly increased for the last three years. Senior pupils most often have diseases of nervous system, sense and respiration organs. Signs of work stress of cardiovascular system are also tracked at pupils.

Kuzmenko, 2017, established in her researches that indicators of cardiovascular system of pupils of middle school answer the "average" level. Also it was established that indicators improve with age at boys, and at girls on the contrary – worsen. The obtained data indicate the need of corrections of the content of physical education classes.

It is determined by the researches of Masliak & Mameshina, 2016, 2018 that the "average" level of physical health of pupils of 7 classes and the level "below the average" at pupils of 8 classes. It demonstrates that pupils of 8 classes are considered as almost healthy, however they have insufficient adaptation reserves of cardiovascular, respiratory systems, risk to emergence of disturbances of posture, flatfoot and need the correction of the specified deviations by purposeful influence.

It is proved by numerous researches that the level of physical development, motive preparedness, functioning of the main systems of organism of pupils depends on motor activity (Andrieieva et al., 2017; Druz et al., 2017; Keyl, et al., 2014; Aghyppo et al., 2016; Quennerstedt, 2008).

At the same time positive impact of alternative means and techniques of physical education are also proved. Practicians of Pranayama Bkhastrik (Singh Bal. Baljinder 2015), exercises of Bodyflex and Pilates (Kozina et al., 2014.), exercises of cheerleading (Bala & Maslyak, 2011, 2015; Kryvoruchko, Masliak & Zhuravlyova, 2013), rugby-5 (Filenko et al., 2013), exercises of Hatha yoga (Tolchieva, 2015) and many other things belong to them.

Thus, the question of health maintenance and promotion of health is extremely relevant as the high level of functioning of the main systems of organism promotes the best solution of various motive tasks, organism adaptation to physical over-activity. The important part in it is assigned to control and assessment of the level of physical health and its separate indicators that points out the relevance of the elected by us direction of the research.

**The purpose of the research** – to determine the level of physical health of 10-16 year old girls.

## MATERIAL AND METHODS

Researches were conducted on the basis of educational institutions of Kharkiv (Ukraine). 248 girls at the age of 10-16 years took part in them. All children, who participated in the research, were carried to the main and preparatory medical groups.

**Research methods:** theoretical analysis and synthesis of data of scientific and methodical literature, medico-biological methods (anthropometry, spirometry, tonometry, pulsometry, Stange's test), methods of mathematical statistics.

The level of physical health was determined by the technique, which was presented by Polyakov et al., 2006. Quantitative assessment of physical health was carried out according to 5 indexes. For calculation of indexes were defined: length and body weight; vital capacity of lungs (VCL); arterial blood pressure (ABP); time of breath holding on an usual inspiration (Stange's test); heart rate (HR) at rest and after the dosed exercise stress (30 squats in 45 seconds); the number of lifting of a trunk sitting from a dorsal decubitus in 60 seconds. Were defined: 1) mass-growth Quetelet's index 2 which characterizes degree of harmony of physical development and body build. It is calculated by the formula:  $\text{body weight (kg)} / \text{body length}^2 \text{ (m}^2\text{)}$ ; 2) Robinson's index characterizing condition of cardiovascular system regulation. It is calculated by the formula:  $\text{HR (bpm)} \times \text{ABP syst' (mm Hg)} / 100$ ; 3) Skibinski's index which characterizes functionality of system of respiration and organism resistance to the hypoxemic phenomena. It is calculated by the formula:  $\text{VCL (ml)} \times \text{Stange's test (s)} / \text{HR (bpm)}$ ; 4) Shapovalova's index characterizing development of force, speed and high-speed endurance of muscles of a back and a prelum abdominale. It is calculated by the formula:  $(\text{body weight (g)} / \text{body length}) \times (\text{number of lifting of a trunk sitting}/60)$ ; 5) Ruffle's index which characterizes reaction of cardiovascular system to standard exercise stress. It is calculated by the formula:  $4 \times (P1 + P2 + P3) - 200/10$ . Where P1 – HR for 15 s at rest, P2 – HR for the first 15 s of the recovery period after load, P3 – HR for the last 15 s of the first minute of recovery.

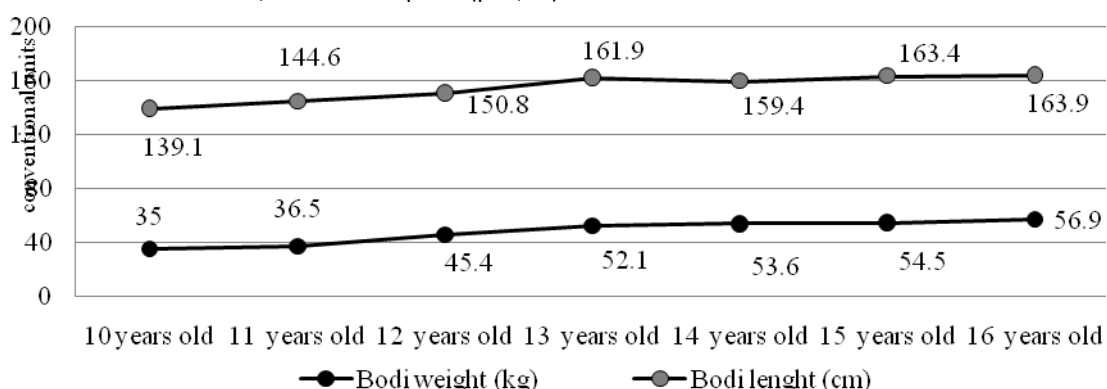
The received results were compared to the scale and estimated by a certain number of points. The level of physical health was determined by score.

Statistical analysis: materials of the research were processed with use of the program Excel. Were calculated: arithmetic average ( $\bar{x}$ ) – for characteristic of set in separate parameters; standard mistake of average (m) – for definition of deviation of average arithmetic from the corresponding parameters of general totality; reliability of differences (p) – was calculated with the purpose to establish degree of difference of indicators in age aspect by means of the parametrical criteria of Student (t) at significance value not lower than 0,05.

### RESULTS

The analysis of the results, reflecting degree of harmony of physical development and body build (Quetelet's index 2) in age aspect showed that results of measurement of body length are enlarged with age at girls and these differences generally have reliable character ( $p < 0,05 - 0,001$ ). The exception is made by data of 14 year old girls where growth indicators are lower, than 13 year old girls have, however these differences are unreliable ( $p > 0,05$ ) (fig. 1).

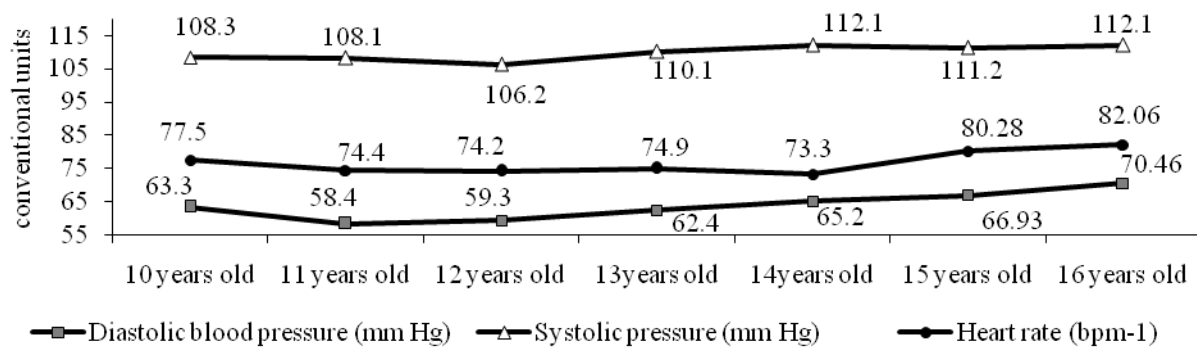
The analysis of the received results of body weight in age aspect (fig. 1) detected, generally reliable augmentation of indicators with age ( $p < 0,05 - 0,001$ ). Results of 13-14 year old girls, between which essential differences aren't detected, are the exception ( $p > 0,05$ ).



**Fig 1: Age comparisons of average values of anthropometric development of 10-16 year old schoolgirls**

When comparing indicators of harmony of physical development and body build (Quetelet's index 2) with the rating scale, presented by Polyakov et al., 2006, it is detected that indicators of 16 year old girls correspond to assessment 2 points, indicators of 10, 12 and 14 year old schoolgirls correspond to assessment 3 points, indicators of 11, 13 and 15 year old girls – 5 points that corresponds to "low", "average" and "high" levels respectively. Thus, results of researches demonstrate that 10-16 year old girls on average have harmonious body build with deficiency of body weight.

The analysis of the results, reflecting condition of cardiovascular system (Robinson's index) in age aspect, showed insignificant increase of indicators of arterial blood pressure with age ( $p>0,05$ ). Indicators of systolic pressure of 12 year old girls are the exception which results are lower, than 10-11 year old girls have and also indicators of diastolic pressure of 10 year old schoolgirls, which are higher than 11–12 year old girls and 16 year old schoolgirls have, whose indicators authentically prevail over indicators of 15 year old schoolgirls ( $p<0,05$ ) (fig. 2).



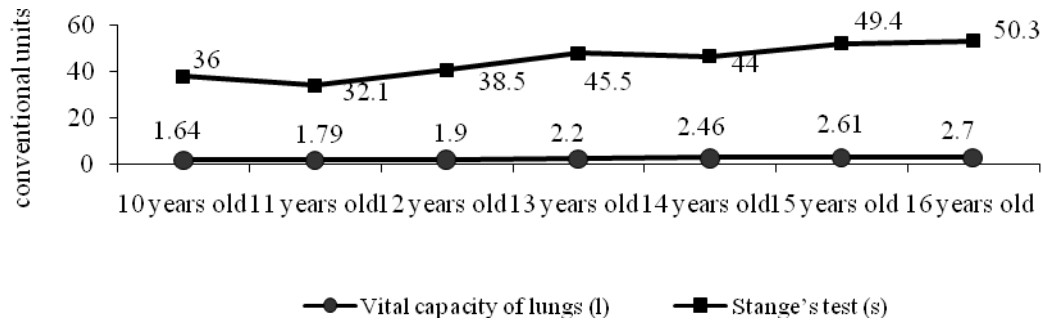
**Fig 2: Age comparing of average values of functioning of cardiovascular system of 10-16 year old schoolgirls**

Considering the received results of heart rate, it is revealed, generally absence of authentic differences in indices ( $p>0,05$ ) with the general tendency to lowering of results with age (fig. 2). Indicators of 15-16 year old girls, which are authentically prevailing over data of 14 year old girls, are the exception ( $p<0,05$ ).

Comparing the received results of Robinson's index to the rating scale, provided by Polyakov et al., 2006, it is defined that they correspond to assessment 3 points – the "average" level of regulation of cardiovascular system at 10-16 year old girls.

Researching the received results of functional capabilities of breathing system and resistance of organism to the hypoxemic phenomena (Skibinski's index) in age aspect (fig. 3), it is revealed that indicators of vital capacity of lungs increase with age and these distinctions are generally reliable ( $p<0,01 - 0,001$ ). Results of 11-12 year old girls, where differences in indicators are unreliable, are the exception ( $p>0,05$ ).

The analysis of the indicators, reflecting resistance of organism to the hypoxemic phenomena (Stange's test) in age aspect (fig. 3), revealed, generally authentic increase in results with age ( $p<0,05 - 0,001$ ). Indicators of 11 year old girls, results of which are below, than 10 year old girls have and also results of 14 year old girls, which data are lower, than 13 year old schoolgirls have, however these distinctions are unreliable ( $p>0,05$ ).



**Fig 3: Age comparisons of average values of functioning of respiratory system of 10-16 year old schoolgirls**

When comparing indicators of functionality of breathing system and resistance of organism to the hypoxemic phenomena (Skibinski's index) with the rating scale, presented by Polyakov et al., 2006, it is revealed that indicators of 15-16 year old girls correspond to assessment 2 points, indicators of 10-12 and 14 year old schoolgirls correspond to assessment 3 points, 13 year old girls – 4 points.

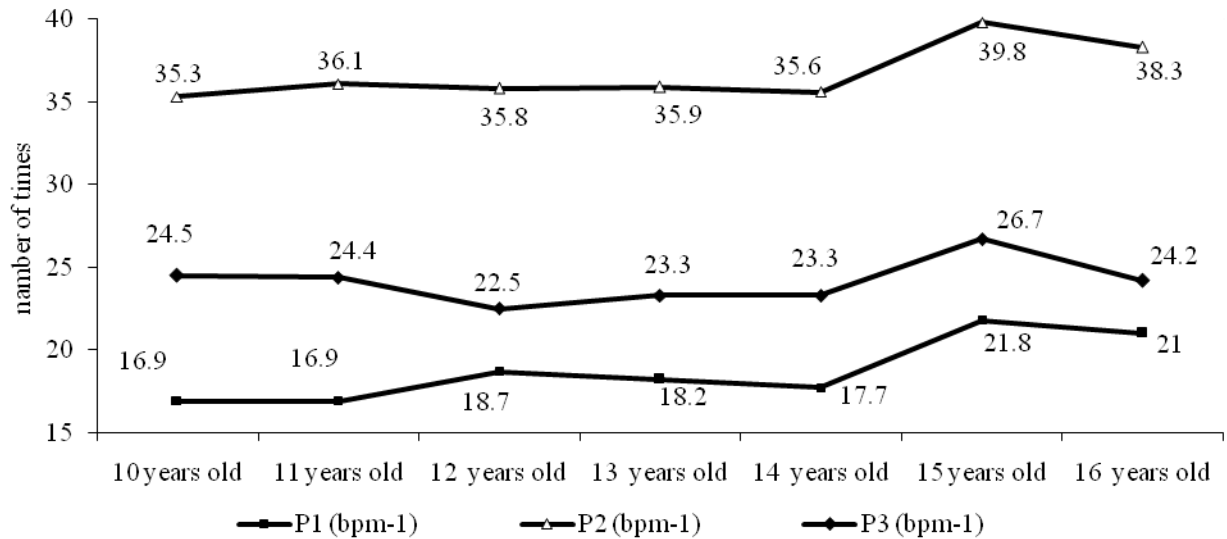
Thus, the level "below the average" of functionality of breathing system and resistance of organism to the hypoxemic phenomena is observed at of 15-16 year old schoolgirls, the "average" level - at 10-12 and 14 year old girls, and 13 year old girls have – the level "above the average".

Analyzing the received results on Shapovalova's index in age aspect, reliable increase in results is defined with age ( $p < 0,05 - 0,001$ ). Indicators of 11-12 and 12–13 year old schoolgirls are the exception, where differences in results are unreliable ( $p > 0,05$ ).

Comparing the obtained data on Shapovalova's index with the rating scale, it is revealed that results of 10, 15-16 year old girls corresponds to assessment – 1 point, 11-14 year old schoolgirls – 3 points. Thus, the "low" level of manifestation of force, speed, high-speed endurance of muscles of a back and an abdominal tension is noted at 10, 15-16 year old girls, and 11–14 year old girls have – the "average" level.

At the research of the received indicators, reflecting extent of reaction of cardiovascular system to standard physical activity (Ruffle's index), multidirectional non-system character of change of results is revealed with age (fig. 4).

When comparing indicators of Ruffle's index with the rating scale, presented by Polyakov et al., 2006, it is revealed that results of the studied at the age of 11, 13–14 years correspond to assessment 3 points, 10 and 12 years old – assessment 4 points, 15–16 years old – assessment 1 point. Thus, the "average" level of cardiovascular system reaction on standard physical activity is observed at 11, 13–14 year old girls, at the studied of 10 and 12 years old – the level "above the average", and 15–16 year old girls have – the "low" level.



**Fig 4: Age comparing of average values of reaction of cardiovascular system to standard physical activity of 10-16 year old schoolgirls (P<sub>1</sub>-heart rate is over 15" at rest; P<sub>2</sub> – heart rate for the first 15" of the first minute of recovery; P<sub>3</sub> – heart rate for last 15" of the first minute of recovery)**

Determining the level of physical health of 10-16 year old schoolgirls by indicators of indexes of Robinson, Ruffle, Skibinski, Quetelet 2 and Shapovalova (tab. 1), we set generally the "average" level of physical health at girls. It is necessary to mark that the "average" level is observed at 10-14 year old schoolgirls, and 15–16 year old girls have – "below the average" level of physical health.

**Table 1: Physical health assessment of 10-16 year old schoolgirls**

Age	Level	Points
10 years	«Average»	15
11 years	«Average»	17
12 years	«Average»	16
13 years	«Average»	18
14 years	«Average»	15
15 years	«Low»	12
16 years	«Low»	10

**DISCUSSION**

The analysis and generalization of scientific and methodical literature showed that the question, which is devoted to studying the level of physical health or its separate components, was considered by many authors. Results of their researches testify to steady tendency to depression of state of health of younger generation.

As a result of the conducted researches, the "average" level of physical health is detected at 10-14 year old schoolgirls, and 15–16 year old girls have – "low". It indicates tendency to depression of the level of physical health of schoolgirls with age.

Considering indicators of length and body weight, it is established that they are increased with age and these differences generally have reliable character ( $p < 0,05 - 0,001$ ). It demonstrates to natural biological developments of organism and will be compounded with data of Zemtsova, 2008; Zilov & Smirnov, 2008. At the same time comparison of exponents of harmony of physical development and body build (Quetelet's index 2) with the rating scale, showed that 10-16 year old girls on average have a harmonious body build with

deficiency of body weight. It will be compounded with data of the research of Oksom et al., 2008 who notice that tendency to deficiency of body weight is observed on the ratio of length and body weight.

The lack of reliable differences in indicators ( $p>0,05$ ) with the general tendency to depression of results is detected generally with age in indicators of heart rate. Indicators of 15-16 year old girls, which are authentically prevailing over data of 14 year old girls ( $p<0,05$ ), are the exception. It meets age standards and is explained by incompleteness of development of cardiovascular system of the studied population. According to Zilov & Smirnov, 2008, heart circle augmentation actively occurs at the age of 13-17 years. Growth rate of the main vessels in comparison with heart is slow. The final sizes and shape of blood vessels are formed up to 14-18 years (Sapin & Sivoglazov, 2004).

Considering the indicators, which were received as a result of calculation of indexes of Ruffle and Robinson, it is established the insufficient level of functioning of cardiovascular system. So, multidirectional non-systemic character of change of results is revealed with age at the research of the received indicators reflecting extent of reaction of cardiovascular system to standard exercise stress (Ruffle's index). Indicators of the studied at the age of 11, 13-14 years correspond to assessment 3 points, 10 and 12 years old – assessment 4 points, 15-16 years old – assessment 1 point. Thus, the "average" level of reaction cardiovascular system on standard exercise stress is observed at 11, 13-14 year old girls, at the studied at the age of 10 and 12 years – "above the average", and 15-16 year old girls have – "low". Comparing the received results of the index of Robinson to the rating scale, it is defined that they correspond to assessment 3 points – the "average" level of cardiovascular system regulation at 10-16 year old girls. The received results will be compounded with data of Kuzmenko 2017, according to which indicators of cardiovascular system of pupils of middle school answer the "average" level and Oksom et al., 2008 who note by low opportunities of cardiovascular system of organism of girls of the advanced school age. Series of authors Tarasyuk et al., 2008; Sapin & Sivoglazov, 2004, Kozina et al., 2014, Podrigalo et al., 2016, 2018 specify that functions of cardiovascular system are closely connected with motive activity of organism. Systematic physical exercises and physical work increase functionality of heart. The trained organism is characterized by profitability of work of heart, increase of its reserve opportunities, rising of working capacity and endurance.

Estimating the level of functionality of breathing system and resistance of organism to the hypoxemic phenomena (Skibinski's index), it is detected the level "below the average" at the studied of 15-16 years, the "average" level – at 10-12 and 14 year old schoolgirls and the level "above the average" – at 13 year old girls. With this Blinkov et al., 2008, Polyakov et al., 2006, Masliak, 2015, Podrigalo et al., 2018 notice that physical exercises and muscular activity improve functioning of respiratory system. It is shown by intensifying of depth of respiration, improvement of ventilation of lungs, augmentation of vital capacity of lungs and gas exchange in them, delivery of oxygen to tissues is enlarged as a result. Physical exercises are prophylaxis of diseases of lungs and bronchi.

Results of the research indicate that in general the studied contingent are considered as almost healthy, however they have insufficient adaptation reserves of cardiovascular, respiratory systems that demands innovative approaches to the organization and carrying out various forms of sports-recreational activity.

### CONCLUSIONS

As a result of the research the "average" level of physical health at 10-16 year old schoolgirls is established.

*Further researches in this direction can be conducted by determination of influence of exercises on physical health of 10-16 year old girls.*

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**Conflict of interests:** The authors note that there is no conflict of interests.

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