

**ECQEMC 2021****The Fourth Annual International Symposium “Education and City: Quality Education for Modern Cities”****HARMONIOUS PHYSICAL DEVELOPMENT OF PRIMARY SCHOOL STUDENTS: IMPACT OF SPORTS**

Dmitry N. Chernogorov (a), Irina V. Ryabova (b)\*, Tatiana A. Sobolevskaya (c),  
Yekaterina S. Kolesnikova (d)

\* Corresponding author

(a) Institute of Natural Sciences and Sports Technologies, Moscow City University, Moscow, Russia, 129226  
chernogorovdn@mgpu.ru

(b) Research Institute of Urban Studies and Global Education, Moscow City University, Moscow, Russia, 129226,  
ryabovai@mgpu.ru

(c) Research Institute of Urban Studies and Global Education, Moscow City University, Moscow, Russia, 129226,  
sobolevskayata@mgpu.ru

(d) Institute of Sports and Physical Education, Russian State University of Physical Education, Sports, Youth and Tourism,  
Moscow, Russia, 105122, petrysyas333@yandex.ru

**Abstract**

Motor activity is one of the essential means of shaping strong health and of a child's harmonious development in the contemporary school. This study is intended to estimate the physical development of children from Moscow primary schools who either attend or not attend sport clubs after lessons. The study findings suggested that the most advantageous sports for harmonious physical development of primary school students are different types of martial arts, sports gymnastics and acrobatics, because rather high results of physical development of static endurance of body muscles were observed. In the group of children attending athletic gymnastics and acrobatics, the high indicators were demonstrated in three of four test exercises. No significant differences were found when testing the balance and strength of finger flexors of children in comparison between groups by sports types, and the intra-group differences are observed in the group of children attending such clubs as football, swimming, karate, aikido and boxing, ballroom dancing, ballet, and cheer leading. The children who did not attend sports clubs after lessons demonstrated medium results in many test exercises. For instance, based on the results of the side plank, handgrip dynamometry and equilibrium tests, more than 40 % of children demonstrated asymmetry, which testifies to the inefficient system of the physical exercise lessons and other active forms of schooling. The study findings allow judging about the benefits and deficits of the teaching techniques and physical exercise arrangements in the studied sports clubs for the primary school students.

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*Keywords:* Physical development, primary school, sports clubs



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## 1. Introduction

Health and harmonious development of children is the key indicator of life quality in a mega-city and is among the main indicators of wellbeing of the state in general. Health is the integral attribute of public progress, the main element that determines the appropriateness and systemic efficiency of the economic society's development and its social policy (Bagirova et al., 2018; Kim, 2013; Komiya et al., 2008; Ryabova et al., 2019; Trufanova et al., 2019). Health of the pediatric population is determined not only by diseases or their absence but also by the harmonious age-matched physical development (Ahmad & Akthar, 2014; Azabagic et al., 2016; Bendíková & Smoleňáková, 2018; Bezzubov et al., 2017a; Galan et al., 2018; Isakova, 2016; Konopleva, 2020; Marko & Bendíková, 2019; Mitova, 2015; Müller et al., 2019; Pravdov et al., 2019; Sobolevskaya et al., 2021). The physical development level indicators make integral part of general medical examination.

In the opinion of the leading age-physiology professionals, the period of 8–10 years is the most progressive and the most sensitive to the impact of different environmental factors. That's why this period of the child's life requires a special attention from teachers and parents. The child's life in that period changes drastically in connection with beginning of school studies: the timetable and the meals schedule changes, the study load increases, the child spends much time at the writing table when doing homework, which has adverse implications for the child's development (Pasichnyk et al., 2018; Sanginov, 2018). Up to 60 % of children and teenagers have inadequate level of fitness (Belyaev et al., 2017; Danilenko & Rudakova, 2021).

Physical activity since the early childhood is widely promoted and spread worldwide, which has positive influence on the children's health statistics. Physical exercises at that age result in balanced development of the muscles, are among the essential means of shaping the musculoskeletal system in children (Chernogorov et al., 2021; Ludwig et al., 2016; Ryabova et al., 2020; Shchepin et al., 2003). Sports as the social institute meets different needs of a personality, first of all, in maintenance of physical health, social wellbeing (Bendíková & Pavlović, 2013; Itoi et al., 2015; Leynova et al., 2016; Vavrushevich, 2017; Voronov, 2018). A person needs such moral and will qualities as self-discipline and responsibility, perseverance, and ambitiousness to be successful in life and work (Itoi et al., 2015; Vavrushevich, 2017). These qualities enable a person to easily adapt to moral and legal standards of the society, to follow them without enforcement, to perform his/her duties with good quality, to seek success and to achieve the set goal (Bendíková, 2018; Gasman et al., 2020).

## 2. Problem Statement

There is a trend towards school students' health deterioration in many high-tech cities like Moscow. In this respect, physical education of primary school students should be in focus.

The children's physical development assessment system is based on quantitative and qualitative fitness indicators. Objective data seems to be used for assessing physical development. According to this data, we may suggest that the school students who met the test requirements have a better health, i. e. higher working ability than those who failed the test (Krutsevich et al., 2019). This test system was elaborated based on professionals' recommendations or average test indicators, according to age and

gender differences. On the other hand, such system is not absolutely justified because the average does not always reflect the functional status and the physical development (Mikhailov et al., 2020). Besides, this system should rely on the results achieved by the children regularly involved in physical exercise and sports because physical exercises alone are not very effective.

As all sports are classified by different motor actions, there is no understanding now which criteria should be used to assign the child to some particular sports suitable for his/her physical development. There are no criteria for selection and recruitment of children to school sports clubs that would help preserve their health.

Given the above, we believe that the discussion on how to select a suitable sport for a primary school student must be based on comprehensive, harmonious development and improvement of fitness (Bezzubov et al., 2017b; Hidetoshi, 2013).

### **3. Research Questions**

The study of school students' physical education and fitness is an urgent issue in the studies intended to improve quality of the school education and to preserve health.

Balga's et al. (2019) studies suggested that the physical education system contributes to the individual physical development. Physical and sports education is a specific subject because it focuses on not only physical, functional, motor development but also on psychological and intellectual improvement of school students, and shaping the positive attitude to not only this subject but to the physical activity and sports in general is one of its principal goals (Balga et al., 2019).

The fitness assessment system must rely on not only fitness indicators but physical development indicators, too. The study of how different sports influence physical development of primary school students from the point of view of harmonious development are the essential issue for selection of suitable sports in order to shape the muscular framework and the correct posture. The data yielded by the study suggests which physical activity types are beneficial and which are harmful to primary school students, as well as enable us to elaborate model parameters of the physical education level which are necessary to select the sports. The comparative parameters enable us to judge on the types of physical development disorders under the influence of the selected motor actions and on the program content quality in a sports club work, including the teaching methods.

### **4. Purpose of the Study**

This study is intended to estimate the physical development of children from Moscow primary schools who either attend or not attend different sport clubs after lessons.

### **5. Research Methods**

The study involved 220 school students of the 2nd–4th grades from two Moscow schools. The average age of children was  $8.76 \pm 0.77$ , they weighed  $33.6 \pm 8.0$  kg and were  $137.1 \pm 7.8$  cm high. The gender ratio was as follows: 42.6 % girls, 57.4 % boys. The conducted interviews suggested that 173 of

total respondents attended a sports club, and 47 of them didn't, and their physical activity was confined to physical education lessons at school twice a week.

The study was held in April 2019 and included measuring the height, weight, static endurance of body muscles, equilibrium when standing on one leg, and handgrip dynamometry of both hands. The test findings were recorded in the report and then mean values and standard deviation were calculated. Then, using the online Web service, the intra-group validity by Student's t-test and the inter-group validity by Kruskal Wallis test were calculated.

## 6. Findings

Table 1 shows age and height/weight indicators of the students who attended/ did not attend different sports clubs after school.

The average age of the sports clubs attenders and non-attenders ranged from 8.4 to 9.1 and the average height ranged from 125.6 cm to 143.1 cm in the study period. The weight ranged from 25.7 kg to 38.4 kg on average in groups. The lowest mean value in terms of age, height and weight is observed in the group of students attending the sports club of figure skating. Despite the obtained data, the body mass index (BMI) conforms to the World Health Organization's (WHO) standard. Children practising volleyball and basketball have the highest weight and height results on average for the group. The highest mean group result in own weight is observed in school students going in for swimming.

**Table 1.** Main parameters of the school students attending and not attending different sports clubs

Sports clubs	Age, years	Height, cm	Weight, kg	BMI
Artistic gymnastics and acrobatics (n-16)	8.5±0.9	135.2±1.8	30.9±1.8	16.9±2.0
Figure skating (n-15)	8.4±0.8	125.6±5.2	25.7±3.2	16.4±2.3
Ballroom dance, ballet, cheerleading (n-38)	9.05±0.8	138.4±8.7	33.4±7.8	17.3±2.6
Volleyball and basketball (n-18)	9.1±0.7	143.1±6.9	36.4±9.8	17.6±3.2
Football (n-36)	8.5±0.7	137.3±6.6	31.5±5.7	16.6±2.1
Unarmed self-defence and judo (n-15)	8.6±0.7	135.6±5.9	33.1±6.9	17.9±3.3*
Karate, aikido, and boxing (n-17)	8.7±0.7	139.3±8.7	33.7±7.6	17.3±2.5
Swimming (n-18)	8.7±0.7	139.6±7.7	38.4±10.7	19.5±4.3*
Don't attend any sports clubs (n-47)	8.7±0.8	137.4±7.6	33.9±8.3	17.8±3.5*

\* — according to WHO standards, the body mass indicator is in the overweight range.

In the groups of children who do not attend sports clubs and those who attend swimming, sambo and judo, overweight is recorded in BMI. In connection with major physical exertion on muscles in such sports as wrestling, it is normal, whereas in children not going in for sports after classes and engaged in swimming, such indicator can be regarded as deviation.

Table 2 contains the school students' results in such indicator as static endurance of large body muscles of the primary school students attending different sports clubs after lessons and the children practising physical exercise as part of school curriculum only.

**Table 2.** The study of static endurance of body muscles of children attending and not attending different sports clubs

Sports clubs	“Boat” exercise, arms at hips (static endurance of back muscles), seconds	Holding of legs at 45° angle in the supine position (static endurance of abdominal muscles), seconds	“Side Boat” exercise, arms at hips (static endurance of abdominal lateral muscles), seconds	
			Right	Left
Artistic gymnastics and acrobatics (n-16)	58.6±49.2**	28,5±16,6	33.3±24.6**	34.3±27.7**
Figure skating (n-15)	35.7±14.6	28.5±17	11.3±5.9*	11.7±3.4*
Ballroom dance, ballet, and cheerleading (n-38)	31,7±19,8*	22.9±16.1	14.6±11.3	15.6±11.5
Volleyball and basketball (n-18)	18.8±6.9**	13±4.8**	9.4±5.02**	10.1±5.4*
Football (n-36)	29.3±16*	17.8±14.3*	17.4±16	14.2±13.2
Unarmed self-defence and judo (n-15)	43.7±31.1	30.6±30*	31.4±30.8*	23.9±15.8
Karate, aikido, and boxing (n-17)	39.3±18.8	24.4±18.2	21.4±16.6	22.2±15.8
Swimming (n-18)	40.9±18.2	21.7±14.3	21.8±14.3	21±11.2
Don't attend any sports clubs (n-47)	40±21.6	24.5±14.6	20.8±14.5	18.7±11.6

\* the differences between results in the muscle group development are significant at  $p \leq 0.05$ .

\*\* the differences between results in the muscle group development are significant at  $p \leq 0.01$ .

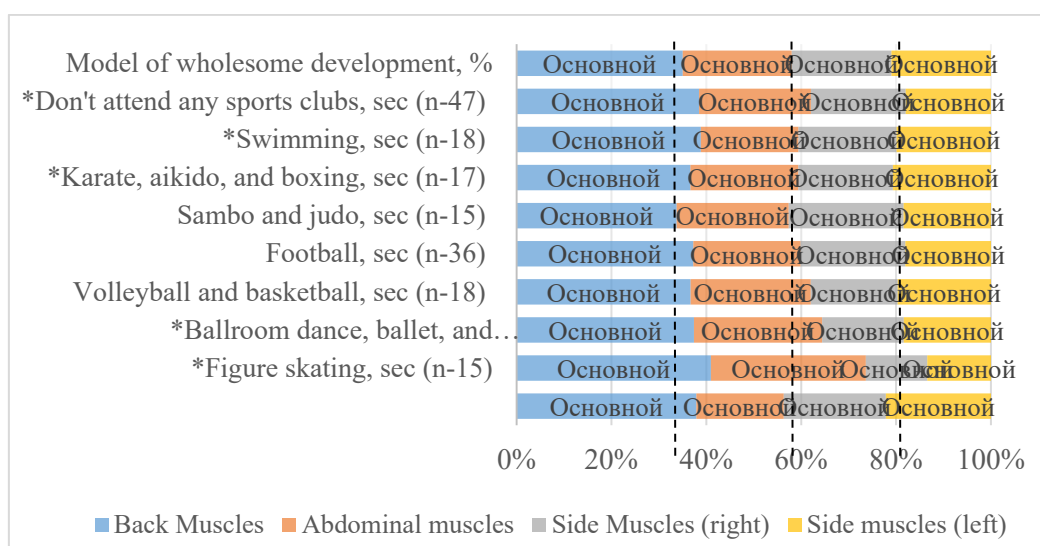
In the test exercise of keeping the “boat” position when lying on thighs, with arms at hips, with legs' fixation, the lowest mean value is seen in children attending volleyball and basketball (18.8 seconds) clubs, and the highest mean value in children attending sports gymnastics and acrobatics (58.6 seconds), which is 3 times higher. Mean values within 41±2 seconds are observed in those not attending any sports clubs and those attending such sports as sambo, judo, karate, aikido, boxing and swimming. In inter-group calculation of differences in the groups going in for sports gymnastics, acrobatics, basketball and volleyball, there is a high validity of differences ( $p \leq 0.01$ ) compared to the mean results of other groups. In groups engaged in ballroom dancing, ballet, cheerleading, and football, the test results are valid at  $p \leq 0.05$  from other tested groups. The obtained results allow for assessment of the development of static endurance of the large spinal muscles and the degree of psychological fitness, because the will qualities and patience must be demonstrated to retain this position.

In the test exercise of holding raised legs at 45° in the supine position, hands down, the highest mean values in the range of 30.6 seconds to 28.5 seconds are observed in children attending sambo, judo, sports gymnastics and acrobatics, figure skating clubs. The lowest mean value in the same exercise is observed in the children visiting basketball and volleyball sports clubs (13 seconds). In the same group, the high validity was recorded at  $p \leq 0.01$  vs the results for other groups. In the groups of children attending football, sambo and judo groups, the validity at  $p \leq 0.05$  was obtained. This test exercise enabled us to estimate the static endurance of abdomen muscles that must be as developed as spinal muscles. However, the abdominal muscle development is twice as low as the spinal muscle development in those attending sports gymnastics and acrobatics, which testifies that the training process focuses on the spinal muscles.

In the test exercise of holding the side boat pose, arms at hips in the hanging position, with the legs fixed, for static endurance of the left and right part of the body, the high results were seen in the group of children attending sports gymnastics and acrobatics (33.3 seconds and 34.3 seconds, respectively), in the inter-group calculation these results are observed in the significance area at  $p \leq 0.01$ , which is valid. The group of children attending basketball, volleyball and figure skating clubs demonstrated low result. When calculating the validity criterion, significant differences are seen in this group of children at  $p \leq 0.05$  vs other groups' results. Asymmetrical development of the right and left part of the body is observed in children not going in for sports and in those attending football, sambo and judo clubs. Whereas low endurance of body muscles is quite understandable for children not attending sports clubs, low indicators for children attending sports clubs testify to a wrong training process and to uneven impact on development of the body muscles.

Figure 1 shows the results of test exercises for static endurance of body muscles, with distribution by percentage ratio. Major differences ( $p \leq 0.05$ ) were observed in the groups of children attending figure skating, ballroom dancing, ballet and cheerleading, karate, aikido and boxing, swimming, and in the group of children not attending any sports clubs, when calculating the difference (back/abdomen—right and left part) by the Kruskal Wallis test, which points to disharmonious development of the body muscles.

The results obtained in groups of other children, in whom significant intra-group differences were not found, were regarded by us as homogeneous, which points to a harmonious development. Based on these results, by determining the mean value for each test exercise among the groups, we elaborated the harmonious development model that expresses the percentage ratio in development of static endurance of the body muscles.



\*\* the differences between results in the muscle group development are significant at  $p \leq 0.01$ .

**Figure 1.** The ration of development indicators of body muscles in children attending and not attending different sports clubs, as %

Table 3 shows the results of the equilibrium function test in the primary school students who attend and do not attend different sports clubs. The obtained results in all study groups of children are at the same level during the inter-group calculation of the validation criterion. High mean values are observed in the group of children attending karate, aikido, boxing and figure skating clubs within 70 seconds on both legs, and low values, in volleyball and basketball clubs (42.7 seconds and 33.5 seconds on the right and left leg, respectively).

**Table 3.** The equilibrium function results of those attending and not attending sports clubs

Sports clubs	Romberg test, seconds		Validity, p
	On the right leg	On the left leg	
Artistic gymnastics and acrobatics (n-16)	61.2±37	62,8±44,9	≥0.05
Figure skating (n-15)	69,2±59,5	72,8±56,3	≥0.05
Ballroom dance, ballet, and cheerleading (n-38)	60,7±41,2	59±40.9	≥0.05
Volleyball and basketball (n-18)	42,7±32,4	33.5±17	≥0.05
Football (n-36)	45,9±37,2	55,3±43,3	≤0.05
Sambo and judo (n-15)	56,7±39,8	68.3±45	≥0.05
Karate, aikido, and boxing (n-17)	70,5±45,2	72,3±46,7	≥0.05
Swimming (n-18)	66,4±38,8	65,3±37,3	≥0.05
Don't attend any sports clubs (n-47)	60±38.1	60,4±42,1	≥0.05

Let's note that the significant differences were recorded at  $p \leq 0.05$  in the group of children attending the football club, which can be regarded as asymmetry.

The findings of the finger flexor force tests are shown in Table 4. The testing was carried out using the wrist dynamometer. The tested persons drew hands aside and clenched fingers as tightly as possible. The maximum mean value of the finger flexor force in the right and left hand was recorded in children attending the volleyball and basketball clubs (18.1 kg and 17.5 kg, respectively). Children not attending sports clubs and those attending sports gymnastics and acrobatics, figure skating, ballroom dancing, ballet and cheerleading clubs, demonstrated the minimum result. The indicators were recorded within 14.5±0.04 kg and 13.65±0.15 kg for the right and the left hand, respectively.

**Table 4.** The handgrip dynamometry results in those attending and not attending sports clubs

Sports clubs	Handgrip dynamometry, kg		Validity, p
	Right hand	Left hand	
Artistic gymnastics and acrobatics (n-16)	14.3±3.0	13.5±2.0	≥0.05
Figure skating (n-15)	14.2±2.8	13.7±2.5	≥0.05
Ballroom dance, ballet, and cheerleading (n-38)	14.9±4.6	13.8±3.9	≤0.05
Volleyball and basketball (n-18)	18,1±5,3	17,5±4,9	≥0.05
Football (n-36)	15,9±3,3	14,7±3,4	≤0,01
Sambo and judo (n-15)	16,3±2,6	15,9±2,8	≥0.05
Karate, aikido, and boxing (n-17)	16,4±2,8	14,6±2,7	≤0,01
Swimming (n-18)	16,4±3,9	15,1±3,8	≤0,01
Don't attend any sports clubs (n-47)	14±5	13,5±4,5	≥0.05

In the groups of children visiting sports clubs of ballroom dancing, ballet and cheerleading, football, karate, aikido and boxing, swimming, there is an intra-group validity in terms of mean indicators of the right and left arm force, which testifies to asymmetrical development.

The study findings enable us to judge on the training quality and selection of the set of means for practising the selected sports. The inclination of physical exercise in many studied sports clubs for primary school students was found to be characteristic of the special focus that is necessary for competitions.

The primary school children usually reach the age, when they can start practising most sports, at the initial training stage which means a harmonious physical development. The physical exercise should be directed to the general fitness that will help strengthen the locomotor system and muscles and to transit to specialization. But as the study findings suggest such objectives are not addressed neither on the physical education lesson, nor in sports clubs. When analyzing the structure of the Ph. E. lessons in the primary school, we discovered that more than 70 % in Ph. E lessons is spent on sports games, and there is no load that helps develop and strengthen the locomotor system. In sports clubs, training focuses on development of the single physical quality and the selected movements responsible for that sports. Physical exercise was found to focus on the competitions in many studied sports clubs for primary school students. However, children need physical exercise that ensure harmonious physical development at this age. The physical exercise should be directed to the general fitness that will help strengthen the locomotor system and muscles and to transit to specialization.

Thus, we can conclude that the physical training system in a school student's daily regimen does not meet the requirements to upbringing and harmonious physical education of a child in the modern school. In our opinion, the sports results and positive emotions are necessary but must not be harmful to health.

## 7. Conclusion

Based on the obtained results, we can conclude that mostly the children attending the sports clubs of sports gymnastics and acrobatics get the physical exercise that matches their age, which results in their harmonious development. This group also includes the children going in for wrestling and figure skating but subject to minor adjustment of the physical exertion and its means.

The test results point to more than 60 % of children with deviations from the model indicators of harmonious physical development of the body muscles, including asymmetrical development of body parts (at  $p \leq 0.05$ ). The obtained data lead to the conclusion that the physical education system in Moscow schools is not very efficient.

To address this problem, we need to elaborate a new approach to the physical exercise system at school, in particular, to develop sets of static and dynamic exercises focused on comprehensive physical development and to introduce them into the physical education program for the primary school students. The contemporary Moscow school also needs multimedia aids with the ready-for-use complexes of various exercises to enhance efficiency of such work during Ph. E. lessons and after lessons.



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