

# Characteristics of 16-17-year-old young males' physical development in the process of judo club activities

Grygoriy P. Griban<sup>1</sup>, Vasyl V. Yahupov<sup>2</sup>, Valentyna I. Svystun<sup>2</sup>, Valentyna A. Filina<sup>1</sup>, Oksana P. Kanishcheva<sup>3</sup>, Viktoriia B. Bakuridze-Manina<sup>4</sup>, Iryna S. Oliinyk<sup>5</sup>

<sup>1</sup>ZHYTOMYR IVAN FRANKO STATE UNIVERSITY, ZHYTOMYR, UKRAINE

<sup>2</sup>NATIONAL DEFENSE UNIVERSITY OF UKRAINE, KYIV, UKRAINE

<sup>3</sup>KHARKIV STATE ACADEMY OF PHYSICAL CULTURE, KHARKIV, UKRAINE

<sup>4</sup>DNIPRO STATE MEDICAL UNIVERSITY, DNIPRO, UKRAINE

<sup>5</sup>BOGDAN KHMELNITSKY MELITOPOL STATE PEDAGOGICAL UNIVERSITY, ZAPORIZHZHIA, UKRAINE

## ABSTRACT

**Aim:** To investigate the influence of judo club activities on the physical development indicators of 16-17-year-old young males.

**Materials and Methods:** The research, conducted in 2022-2024, involved 54 young males aged 16-17, who were divided into experimental (EG) and control (CG) groups of 27 each. The physical development was assessed by body weight, hand dynamometry, lung capacity, heart rate, and blood pressure indicators. Cooper, Ruffier, Stange, Genchi, vital, strength, body weight, Robinson, and maximum oxygen consumption indices were calculated.

**Results:** The positive influence of judo club activities on the physical development of 16-17-year-old young males was revealed: all studied indicators significantly improved in the EG young males during the experiment. Judo training sessions had the most effective impact on the indicators characterizing the development of the muscular system and the level of strength qualities. At the end of the experiment, young males of the EG showed significantly better physical development than the CG representatives in terms of strength index (by 6.33 %), static endurance of stronger (by 2.07 s) and weaker (2.03 s) hands. According to the indicators characterizing the state of cardiovascular and respiratory systems, the indicators of young males of both groups were significantly the same.

**Conclusions:** It has been established that judo club activities, which were conducted taking into account the age characteristics of 16-17-year-old young males, create the most favorable conditions for the harmonious physical development of boys, promoting their health and preparing them for future educational and professional activities.

**KEY WORDS:** physical development, health, young males, high schoolers, judo

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## INTRODUCTION

The socio-economic and political crisis in the country's development, martial law, and the aggravation of global problems of our time have given rise to certain negative conditions in the younger generation, such as social anxiety, cruelty, indifference, and, as a result, the spread of alcoholism, drug addiction, and other criminal manifestations in society. One of the ways to overcome such negative phenomena is to provide conditions for the personal growth of high schoolers and, the realization of an active life stance of each of them. This task is impossible without modernizing the educational process of physical education at school [1, 2]. Today, Ukrainian schools are actively searching for new forms, methods, and means of physical education that would help improve the health of high schoolers, their psycho-emotional state, physical development,

and physical as well as moral and volitional qualities. According to experts [3, 4], the basis of new approaches to the modernization of physical education in general secondary educational institutions can be a personality-oriented approach, which provides for the compliance of the forms, means, methods, and conditions of education used with the individual psychological characteristics of high schoolers, as well as the freedom to choose the physical activity that best suits the personal abilities of each of them.

One of the means of physical education for high schoolers, improvement of their physical development, health promotion, and preparation for life-sustaining activities can be different types of martial arts, among which judo occupies an important place [5, 6]. Judo is an effective means of physical training for the younger generation and, therefore, is of great practical impor-

tance; it helps to promote their health; increase the level of physical development and fitness; contributes to the improvement of physical qualities; development of positive motivation and a stable need for exercise and sports [7, 8]. Due to the wide variety of techniques and actions that make up the content of judo training sessions, as well as the great educational, health, and applied value of judo, it is included in the programs of sports competitions of city, regional, national, European and world scales [9, 10]. On the one hand, it is a means of comprehensive physical development available to all and an auxiliary means of developing physical qualities in other sports, and on the other hand, judo is a means of popularizing speed and strength sports and promoting a healthy lifestyle among high schoolers [11, 12]. Despite the existence of a significant number of studies, the problem of physical development of 16-17-year-old high schoolers in general secondary educational institutions through judo remains insufficiently disclosed.

## AIM

The aim is to investigate the influence of judo club activities on the physical development indicators of 16-17-year-old young males.

## MATERIALS AND METHODS

The research was conducted in 2022-2024 based on secondary school No. 20 with enhanced physical training (Zhytomyr, Ukraine) and Zhytomyr Ivan Franko State University. The research involved 54 young males aged 16-17 years (10-11 grades high schoolers), who were divided into the experimental (EG) and the control (CG) groups of 27 each. The young males of the EG were engaged in judo club activities according to the author's methodology, and the young males of the CG were engaged in various sports: volleyball (8 persons), basketball (10 persons), swimming (4 persons), and athletics (5 persons). The number of hours of training sessions in each group was 110 hours over the 9 months of the experiment. The duration of one training session in both groups was 45 minutes. Training sessions in the EG and the CG were held 3 times a week after school hours, in the afternoon.

The content of educational material according to the author's methodology is built following age peculiarities of 16-17-year-old high schoolers (taking into account sensitive regularities of physical qualities development); it includes means, methods, and forms of training; provides regulation of physical activity during the year and separate educational and training session; formation of harmonious physical development; strengthening of physical health and increasing functional capabilities of an organism;

formation of motivation for motor activity, taking into account the interests of high schoolers to express themselves and manifest their potential in educational and training activities.

The author's methodology included: the distribution of high schoolers by levels of their physical fitness; variability of methods and means; a set of general developmental and special developmental exercises; studying the technique of performing judo techniques and combinations of techniques; regulation of the volume and intensity of the load during training sessions; application of group form of training with a differentiated and individual approach; use of various teaching methods; use of special action-oriented games with elements of wrestling; use of pedagogical and operational control over the state of health of high schoolers, their technical and physical fitness. Judo techniques were learned during training sessions, with the components of the technique, amplitude, speed, and the degree of effort in different phases of the technique being mastered. New material was learned in whole or in parts. Training sessions in the EG and the CG were conducted by coaches of the mentioned sports during the hours of club training activities at school.

The following scientific methods were used in the research: analysis and generalization of literature sources, medical and biological methods, pedagogical experiment, and methods of mathematical statistics. The analysis and generalization of literature sources allowed us to define the problem field of the research, to get a general idea of the degree of development of the problem under study, to identify basic data on the following topics: age characteristics of high schoolers, the impact of judo training on the body of young males (25 sources from the scientometric databases PubMed, Scopus, Index Copernicus, and others were investigated). Medical and biological methods were used to assess the physical development of young males in terms of height, body weight, hand dynamometry, vital capacity of the lungs, heart rate, and blood pressure indicators. The following indices were calculated: Cooper, Rufier, Stange, Genchi, vital, strength, body weight, Robinson, and maximum oxygen consumption (MOC) [13]. During the pedagogical experiment, we implemented the author's methodology and tested its influence on the level of physical development of young males aged 16-17 years who were engaged in judo club activities for 2 years (from September 2022 to May 2024). During the researches the authenticity of difference between the indicators of high schoolers by means of Student's t-test was determined. The dynamics of indicators in each of groups was also estimated. The significance for all statistical tests was set at  $p < 0.05$ . All statistical analyses were performed with the SPSS software, version 22, adapted to medical and biological researches. This research followed the reg-

**Table 1.** Characteristics of physical development of 16-17-year-old young males of the EG and the CG before the experiment (n = 54, M ± m)

Indicators of physical development	EG (n=27)	CG (n=27)	t	p
Cooper index, m	1677.5±21.31	1684.7±23.17	0.23	>0.05
Body length, cm	175.4±1.08	176.3±1.02	0.61	>0.05
Body weight, kg	70.9±0.98	71.2±0.91	0.22	>0.05
BMI, kg/m <sup>2</sup>	23.08±0.35	22.91±0.39	0.32	>0.05
Strength index, %	64.23±1.78	63.58±1.82	0.26	>0.05
Vital index, ml/kg	61.12±1.84	61.86±1.82	0.29	>0.05
Static endurance of the stronger hand, s	7.31±0.76	7.46±0.67	0.15	>0.05
Static endurance of the weaker hand, s	6.02±0.72	5.84±0.68	0.18	>0.05
Resting heart rate, bpm-1	72.43±1.15	72.13±1.17	0.18	>0.05
Rufier test, c. u.	13.26±0.45	12.85±0.40	0.68	>0.05
Stange test, s	46.53±1.86	45.57±2.35	0.32	>0.05
Genchi test, s	30.73±0.66	29.83±0.54	1.06	>0.05
Robinson index, c. u.	86.91±1.23	86.55±1.16	0.21	>0.05
MOC, ml·min <sup>-1</sup> ·kg <sup>-1</sup>	28.9±0.56	30.3±0.64	1.65	>0.05

Legend: t – Student's t-test value; p – authenticity of difference between the indicators of the EG and the CG.

**Table 2.** Characteristics of physical development of 16-17-year-old young males of the EG and the CG after the experiment (n = 54, M ± m)

Indicators of physical development	EG (n=27)	CG (n=27)	D	t	p
Cooper index, m	2881.7±22.45	2825.6±23.17	56.1	1.74	>0.05
Body length, cm	176.9±0.97	177.1±0.95	0.20	0.15	>0.05
Body weight, kg	71.4±0.86	72.1±0.89	0.70	0.57	>0.05
BMI, kg/m <sup>2</sup>	22.87±0.31	22.89±0.33	0,02	0.04	>0.05
Strength index, %	73.57±1.64	67.24±1.74	6.33	2.65	<0.05
Vital index, ml/kg	66.54±1.92	65.91±1.89	0.63	0.23	>0.05
Static endurance of the stronger hand, s	14.70±0.63	12.63±0.65	2.07	2.29	<0.05
Static endurance of the weaker hand, s	11.80±0.59	9.77±0.64	2.03	2.33	<0.05
Resting heart rate, bpm-1	67.60±0.86	69.08±0.97	1.48	1.14	>0.05
Rufier test, c. u.	7.72±0.31	8.31±0.36	0.59	1.24	>0.05
Stange test, s	58.17±1.54	55.46±1.84	2.71	1.13	>0.05
Genchi test, s	37.24±0.53	35.61±0.55	0.63	0.82	>0.05
Robinson index, c. u.	81.12±1.07	82.90±1.11	1.78	1.15	>0.05
MOC, ml·min <sup>-1</sup> ·kg <sup>-1</sup>	39.8±0.39	38.8±0.52	1.00	1.54	>0.05

Legend: D – the magnitude of the difference in the indicators of the EG and the CG; t – Student's t-test value; p – authenticity of difference between the indicators of the EG and the CG.

ulations of the World Medical Association Declaration of Helsinki – ethical principles for medical research involving human subjects. Consent to voluntary participation in the survey was obtained from all the respondents involved in the research.

## RESULTS

Characteristics of physical development of 16-17-year-old young males of the EG and the CG before the experiment are given in Table 1. Analysis of Table I showed that the EG and the CG have no significant difference

(p > 0.05) in all indicators of physical development. At the same time, the majority of indicators in young males of both groups were at a low level or below average.

The analysis of indicators of physical development in young males of the EG and the CG after the experiment testifies that by indicators characterizing the development of the muscular system and a level of strength qualities, in the young males of the EG physical development was significantly (p < 0.05) better than in the CG representatives (Table 2). Thus, after the experiment, the EG young males have significantly better indicators in terms of their strength index (by 6.33 %), and static

endurance of a stronger hand (by 2.07 s) and a weaker hand (2.03 s) than in the CG representatives. This proves the effectiveness of judo training, compared to other sports, in improving the physical development of 16-17-year-old young males. Instead, according to the indicators characterizing the functional state of the cardiovascular and respiratory systems, the indicators of young males of both groups were significantly the same after the experiment ( $p > 0.05$ ). It should be added that during the experiment there was a significant ( $p < 0.05$ ,  $p < 0.001$ ) improvement of all studied indicators of physical development in both groups of young males. Most of the indicators that were evaluated, in particular Cooper, strength, vital, Robinson indices, Rufier, Stange, Genchi, and MOC tests, correspond to average and above average levels after the experiment.

The conducted research allows us to assert that club extracurricular training sessions in any sport, provided that young males make a conscious motivated choice of a sport for training, contribute to the improvement of certain indicators of physical development of 16-17-year-old young males. Thus, according to the results of our research, it was found that sports games, athletics, swimming, and, of course, judo, have a positive effect on the indicators of the muscular system, as well as on the cardiovascular and respiratory systems. However, judo training sessions, given the specifics of this sport, have a greater impact on the development of strength qualities in 16-17-year-old young males than in other sports.

## DISCUSSION

In recent years, Ukraine has seen a negative trend in the dynamics of health indicators, including those of schoolchildren, which has led to an increase in the number of scientific studies [14, 15] that point to the low physical fitness of high schoolers, a lack of motor activity, a decline in their physical development and the growth of bad habits. At the same time, many scientific papers [16] reflect attempts to update and improve their physical education process and offer various approaches to the construction and organization of both fixed and extracurricular forms of physical education, i. e. its modernization. In connection with the reform of education in Ukraine, the creation of the New Ukrainian School (NUS), radical changes are taking place in all types of activities, including physical education and sports activities. In addition, due to the transition to a twelve-year education system, which is caused by an increase in the knowledge that high schoolers need to acquire in the course of their schooling, it is necessary to reconsider the attitude to regular sporting and mass

participation events. After all, an increase in mental load for the full perception of educational material can be achieved through regular, rationally organized physical exercises and sports [17]. Some scientists [18] focus on current areas of improvement in the system of physical education of high schoolers. It is important to take into account age peculiarities and anatomical, physiological, and sensory regularities of physical qualities and abilities development in high schoolers of general secondary education institutions in the process of planning educational and training sessions. To develop and improve the physical qualities of high schoolers, in particular strength, various means are used, among which martial arts, in particular judo, play an important role [19, 20]. The development of strength abilities in high schoolers occurs in the period from 9 to 18 years, but the highest growth rates are observed from 16 to 17 years. During training or competitive judo matches, high schoolers are in direct physical contact most of the time, forcing the neuromuscular system to work in a dynamic mode and significant tension. Under such conditions of training or competitive fights, a high level of speed and strength abilities develops [21]. Scientists [22] have found that as a result of systematic judo training, the volume of the heart muscle gradually increases, the network of blood vessels expands; changes occur in the blood composition (the number of red blood cells, hemoglobin increases); chest circumference and lung capacity increase; the activity of the central nervous system and mental performance improves; the intensity and concentration of attention increase, physical qualities, especially strength abilities, develop and improve.

As noted by scientists [23], the main means of solving the problems of strength training in judo sessions are various special preparatory exercises performed with a partner and separately, using shock absorbers, rubber harnesses, and weights. They are selected taking into account one or more motor elements of the chosen technical and tactical technique or combination. It is also possible to use separate training and competitive fights with an emphasis on the strength effect. Having in service highly effective methods of influence on an organism, it is possible to considerably reduce terms of development of strength abilities and, accordingly, to carry out more flexible management of the educational and training process [24]. In the process of judo training sessions, according to scientists [25], the following methods aimed at the development of strength abilities are most widely used: the method of maximum effort, the method of dynamic effort, the repeated method, the method of circular training, the game method, the sensory method, the "shock" method, the method of isometric effort, the competitive method, the accel-

eration method, the variable method. The choice of a particular method is determined by the purpose and tasks of the educational and training session taking into account the individual level of development of physical qualities and strength abilities of high schoolers. Our research has shown that club training sessions of any sport promote improvement of certain indicators of physical development in 16-17-year-old young males, however, judo activities, in comparison with other sports, more effectively influence the development of strength qualities of 16-17-year-old young males.

## CONCLUSIONS

The positive influence of judo club activities on the physical development of 16-17-year-old young males was revealed: all studied indicators significantly improved in the EG young males during the experiment. However, judo training sessions had the most effective impact on the indicators characterizing the develop-

ment of the muscular system and the level of strength qualities. At the end of the experiment, young males of the EG showed significantly ( $p < 0.05$ ) better physical development than the CG representatives in terms of strength index (by 6.33 %), static endurance of stronger (by 2.07 s) and weaker (2.03 s) hands. According to the indicators characterizing the state of cardiovascular and respiratory systems, the indicators of young males of both groups were significantly the same ( $p > 0.05$ ).

It has been established that judo club activities, which were conducted taking into account the age characteristics of 16-17-year-old young males, create the most favorable conditions for the harmonious physical development of boys, promoting their health and preparing them for future educational and professional activities.

## PROSPECTS FOR FURTHER RESEARCH

It is planned to investigate the influence of judo club activities on the level of physical fitness of 16-17-year-old young males in comparison with other sports.

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## CONFLICT OF INTEREST

The Authors declare no conflict of interest

## CORRESPONDING AUTHOR

### Grygoriy P. Griban

Zhytomyr Ivan Franko State University  
40 Velyka Berdychivska St, 10008 Zhytomyr, Ukraine  
e-mail: gribang@ukr.net

## ORCID AND CONTRIBUTIONSHIP

Grygoriy P. Griban: 0000-0002-9049-1485 [A](#) [B](#)  
Vasyl V. Yahupov: 0000-0002-8956-3170 [E](#)  
Valentyna I. Svystun: 0000-0002-7934-023X [D](#)  
Valentyna A. Filina: 0000-0002-1244-0543 [B](#) [D](#)  
Oksana P. Kanishcheva: 0000-0002-5030-5318 [C](#)  
Viktoriiia B. Bakuridze-Manina: 0000-0002-2108-814X [C](#) [F](#)  
Iryna S. Oliinyk: 0000-0003-1888-1187 [F](#)

[A](#) – Work concept and design, [B](#) – Data collection and analysis, [C](#) – Responsibility for statistical analysis, [D](#) – Writing the article, [E](#) – Critical review, [F](#) – Final approval of the article

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