ORIGINAL ARTICLE

# Increasing the level of coordination abilities of young taekwondo athletes aged 13-14 under martial law

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**Abstract**

*Background and Study Aim*: Negative changes in the socio-economic environment in the territory of martial law (Ukraine) have a great impact on the ability to continue the training process for athletes. To a lesser extent, this affects experienced world-class athletes who have the opportunity to continue training in other countries. As for young athletes, they are closely connected with their family. This fact reduces the possibility of their preparation. The purpose of the work is to develop the coordination abilities of taekwondo fighters aged 13-14 under martial law

*Material and Methods*: The study involved young taekwondo players from Ukraine (n=8, age - 13-14 years old), compactly living in the same area. A survey was conducted among experienced trainers (n=10), who had the opportunity to answer the questionnaire through electronic means of communication ( similar to the Likert scale.) Parents gave their consent to the participation of their children in the experiment. Participants were given homework in the form of exercises to develop the ability to maintain balance. The participants performed the Romberg test on the left and right leg with visual control, without control and Yarotsky's test. Participants conducted tests during a specially organized ZOOM video conference. This study was conducted by the Declaration of Helsinki and was approved by the Ethics Committee of University. All participants were aware during the informed consent process that the results of this study may be published.

*Results*: According to the coaches, the most important qualities for taekwondo athletes are speed and coordination. Among the coordination abilities trainers note as the most important the following: the sense of rhythm, the sense of time and distance, balance and vestibular stamina. Equilibrium indicators on an unstable support (Romberg test) have undergone significant positive changes (at $p<0.05$). Although the Yarotsky test indicators had positive improvements, they did not have significant differences (at $p<0.05$).

*Conclusions*: When declaring martial law, it is recommended to pay special attention to the life safety of participants in the education and training process. It is also recommended to use exercises on an unstable support, which are in the nature of imitation percussion and protective actions. This approach leads to a tangible improvement in the balance of young athletes.

**Keywords**: Ukraine, martial law, Likert scale, taekwondo, coordination, equilibrium, unstable support, balance.

## Introduction

Life safety during martial law is the most important condition for the organization and conduct of education and training. To some extent, the restrictive measures associated with the COVID-19 pandemic can be an example for this.

In the study of Asenov [1] is shown the possibilities of holding an online taekwondo competition during the 2020 pandemic. The author argues that such an event can and should be used to maintain motivation among athletes. Such an event cannot completely replace the "real" competition, but is necessary in conditions of social isolation. A slightly different approach is recommended by Dos Santos [2]. The author showed that the achievement of educational and career goals played a role in the motivation and causes of these groups of parents, regardless of program outcomes and student readiness. The studies conducted by Dimitrov [3] allow to conclude that in the context of the COVID-19 pandemic, modern technical means and methods can be successfully used to involve athletes, coaches and officials in sports activities. All authors agree that during the period of restrictive measures it is necessary to take into account the conditions for conducting online classes and use modern means of communication [1, 2, 3, 4].

During the period of restrictive measures, coaches are forced to look for and offer athletes training tasks that they can perform on their own. At the same time, control over the implementation remains with the coach and, to some extent, with the parents of young athletes. The development of


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coordination abilities of young taekwondo athletes according to the homework program can be built in the form of imitations of various athlete's blows.

The study by Sarmet et al. [5] shows that the strength of the thigh muscles is the dominant muscle factor in the effectiveness of strikes. Choi et al. [6] argues that the young age of athletes is characterized by a period of growth. This should be taken into account when applying training for balance, isokinetic moments. Other studies emphasize that maintaining balance when performing strikes (which includes standing on one leg) is an important aspect of athlete training. It is also an important element in achieving success in competitions [7, 8, 9, 10].

In this context, the need to include in homework exercises to develop the ability to maintain balance in various positions of the legs is obvious. So Barcellona et al. [11] believes that the athlete must have specific postural characteristics in terms of balance and postural control. This is also confirmed in the study by Chaabene et al. [12]. The authors consider agility in elite athletes. The connection between dexterity and movement speed, jumping abilities and dynamic balance is emphasized.

Thus, the recommendations for the development of coordination abilities of young athletes in the conditions of restrictive measures provide for the implementation of exercises according to individual tasks. In the study by Yoo et al. [7] showed how proprioception training and strength training of the muscles of the lower extremities led to improved athletic performance. The study by Barcellona et al. [11] assessed the impact of a specific training protocol on the posturographic parameters of an elite taekwondo athlete. Chaabene et al. [12] offer directions for evaluating the validity, reliability, and sensitivity of a new agility test in elite taekwondo athletes. According to Pashkov [13], the main factor in the development of coordination abilities of taekwondo athletes aged 12-14 is the ability to maintain static balance. This aspect is also confirmed by other studies [6, 7, 11].

Thus, it can be assumed that under martial law it is quite possible to develop the coordination abilities of young athletes in the form of homework.

The purpose of the study is to develop the coordination abilities of taekwondo athletes aged 13-14 under martial law and homework.

## Material and Methods

*Participants*

The study involved young taekwondo athletes (n=8, age - 13-14 years), living compactly in the same area. A survey was conducted among experienced trainers (n=10), who had the opportunity through electronic means of communication to answer the questions of the questionnaire. Parents gave their consent for their children to participate in the experiment. This study was conducted by the Declaration of Helsinki and was approved by the Ethics Committee of H.S. Skovoroda Kharkiv National Pedagogical University (Ukraine, approval number 09-2022). All participants were aware during the informed consent process that the results of this study may be published.

*Study design*

Questions of the questionnaire concerned the identification of the role of physical qualities for the competitive activity of taekwondo athletes, as well as changes in the balance indicators of athletes under the influence of performing exercises on an unstable support. The questionnaire (analogous to the Likert scale) [14, 15, 16]) was tested for reliability and validity. Such approaches are widely used in the sports practice of taekwondo [4, 17, 18, 19].

The pedagogical study lasted 6 months from April 2022. The training was carried out remotely according to a pre-compiled program using the exercises we proposed on an unstable support. Selected exercises were used at every second training session, lasting at least 15 minutes. Exercises were performed both on two legs (in the right/left stance alternately) and on one leg (right/left alternately). The proposed exercises were imitative in nature of shock and defensive actions of taekwondo athletes. Testing was carried out at the beginning and end of the experiment.

Participants performed the Romberg test [20, 21, 22] (on the left and right legs with and without visual control).

The participants performed the Yarotsky test: the athlete performs rotational movements of the head in one direction at a speed of 2 rotations per 1 second. The stability of the vestibular analyzer is judged by the time during which the subject is able to perform this test while maintaining balance [23].

The participants conducted the tests during a specially organized video communication of the ZOOM conference.

*Statistical analysis*

The internal validity of the questionnaire was determined using the α-Cronbach's test. The reliability of the questionnaire was tested in the primary survey and re-survey. The significance level was taken as $p<0.05$.

## Results

According to the results of the survey of coaches, all respondents were unanimous in their opinion that for the development of coordination abilities of athletes, the best combination of exercises already tested by sports experience with new and non-standard ones would be the best. The opinion of the coaches regarding the rating of the importance of physical qualities for the effectiveness of the

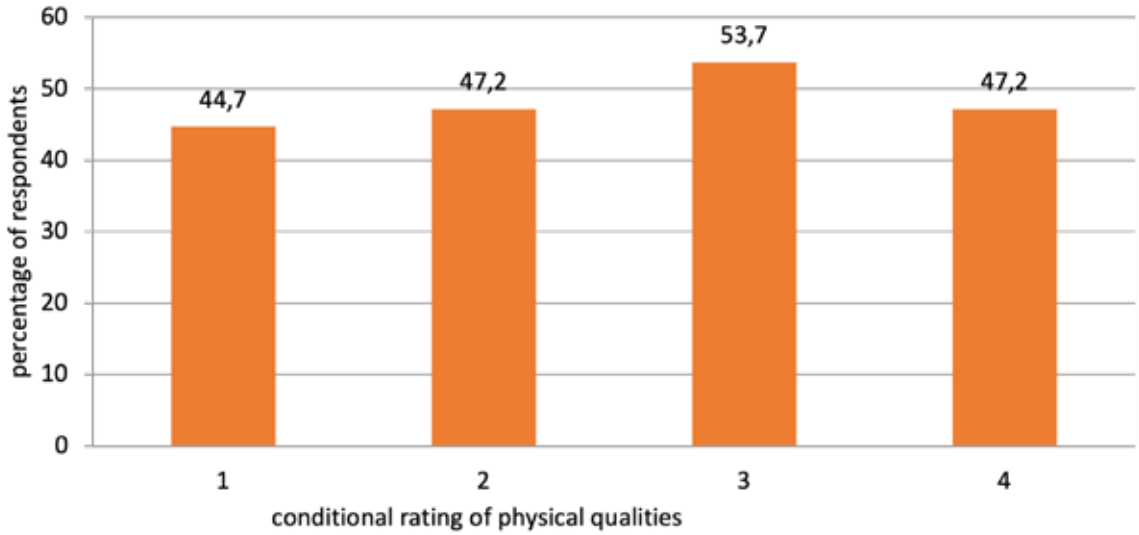


**Figure 1.** Conditional rating of the importance of physical qualities for the effectiveness of competitive activities of taekwondo athletes (according to the results of a survey of coaches): 1 - coordination and speed; 2 - coordination abilities; 3 – speed, endurance and flexibility; 4 - strength

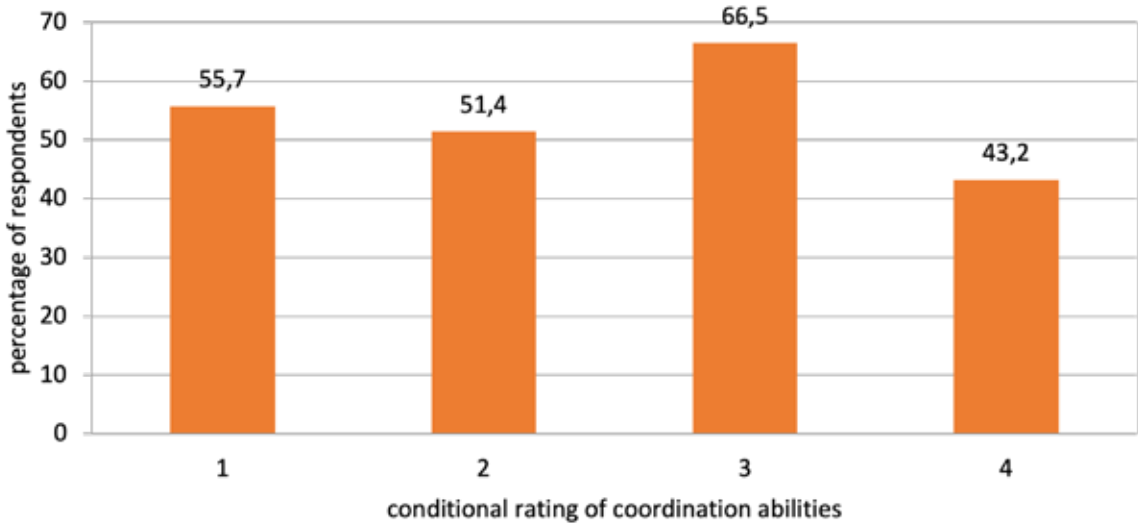


**Figure 2.** Conditional rating of the importance of coordination abilities of taekwondo athletes for effective competitive activity (according to coaches): 1 – sense of rhythm; 2 – sense of time and distance; 3 – balance and vestibular stability; 4 – orientation in space.

athletes' competitive activity was established: 44.7% - dexterity and speed; 47.2% coordination abilities; 53.7% - speed, endurance and flexibility; 47.2% - strength (Fig. 1).

The coaches' opinion regarding the importance of various coordination abilities for the competitive activity of taekwondo athletes: 55.7% - sense of rhythm; 51.4% - sense of time and distance; 66.5% - the ability to maintain balance and developed vestibular stability; 43.2% - the ability to navigate in space (Fig. 2).

The analysis of the results of balance tests showed that in all tests there is an improvement in indicators (Table 1). In the results of the Romberg test with open eyes, there is an improvement of 3.27 s (at $p<0.05$) on the right leg, and 2.6 s (at $p<0.05$) on the left leg. Balance indicators on the left leg with closed eyes improved by 2.85 s (at $p<0.05$), on the right leg - by 2.35 s (at $p<0.05$) after the study.

Although the results of the Yarotsky test had an improvement of 2.3 sec., they did not have reliability (at $p<0.05$).

## Discussion

It follows from our study that in the conditions of limited freedoms of young athletes and martial law, the development of coordination abilities must be carried out in the form of homework. This is an

**Table 1.** Balance indicators of taekwondo athletes of 13-14 years old according to the results of pedagogical experiment (n=8) ($\bar{x}\pm m$)

| Tests | | At the beginning of pedagogical experiment | At the end of pedagogical experiment | t | p |
|---|---|---|---|---|---|
| Romberg test on the right leg | with open eyes, sec | 32.311.23 | 35.581.38 | 1.77 | < 0.05 |
| | with closed eyes, sec | 20.271.01 | 22.620.91 | 1.73 | <0.05 |
| Romberg test on the left leg | with open eyes, sec | 33.931.02 | 36.531.01 | 1.81 | < 0.05 |
| | with closed eyes, sec | 20.450.92 | 23.321.12 | 1.98 | < 0.05 |
| Yarotsky test, sec | | 21.161.03 | 23.461.03 | 1.57 | < 0.05 |

important conclusion in understanding the creation of life-safe conditions for exercise. Unfortunately, we have not found in modern research a solution to the problem of training athletes under martial law. At the same time, this study confirmed the results of other authors, who considered solving the problems of training athletes under the restrictions of the COVID-19 pandemic [1, 3, 24, 25, 26]. We agree that the restriction of freedom of movement imposes special requirements on the preparation of athletes: performing exercises at home or outdoors on an individual assignment.

Our study confirms the data from previous observations [7, 8, 9, 10] that exercises to maintain balance play an important role in the development of coordination abilities of young athletes. Other studies showed that taekwondo helped develop motor skills of agility, coordination and balance [6, 7, 27].

Balance and coordination in taekwondo are closely related to the execution of strikes while standing on one leg. The study by Busko [28] showed that there was a strong correlation between maximum impact force and maximum joint torque. The results of the study by Kwon et al. [29] show that the use of 30-second continuous kicks at maximum speed, 50m running, and standing long jumps are components for determining anaerobic power in taekwondo athletes. Therefore, we can assume that these exercises are well suited as homework for young athletes. In the study of Castro-Garrido [30] is analyzed the effect of the three conditions of post-activation potentiation exercises on kicking frequency, fatigue rate, and jump performance in beginner taekwondo athletes. It was determined that post-activation potentiation exercises did not improve exercises on kicking frequency, fatigue rate and jump performance in taekwondo athletes. However, these exercises did not have a negative effect on fatigue rate and can be used by athletes.

We believe that our results have important implications for the development of training programs for young taekwondo athletes in the context of martial law-related freedom restrictions. Ultimately, such programs should provide the greatest possible safety for young athletes and create hope for a successful future. Clearly, further research will need to be done to account for other variables in the training of young athletes under martial law.

## Conclusions

It is recommended to use exercises on an unstable support, which have the character of imitation shock and defensive actions in the training process of taekwondo athletes aged 13-14 years. Their use in the training process leads to a noticeable improvement in the balance of athletes.

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