Peculiarities of the competitive activity of taekwondo players aged 12-13 years before and after the changes in the rules

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Abstract
Purpose: improving the technical and tactical readiness of qualified taekwondo wrestlers at the stage of specialized basic training to improve the effectiveness of competitive activity.

Material and methods. The study involved 30 athletes aged 12-13 years. Athletes are engaged in WTF taekwondo in the Dnepropetrovsk region. The research was carried out on the basis of the Communal out-of-school educational institution "City Specialized Children's and Youth Sports School of the Olympic Reserve" of the Dnipro City Council (Taekwondo Department of the WTF) and the sports club “Bars” (Dnipro). Created control and experimental groups in the amount of 15 young men in each group. Anthropometric methods, the index method were used; pedagogical methods for studying the physical and technical-tactical readiness of taekwondo fighters aged 12-13, analysis of video recordings of competitive fights of qualified taekwondo fighters in weight categories up to 33 kg, up to 37 kg, up to 41 kg, up to 45 kg, up to 49 kg, up to 53 kg, up to 57 kg; methods of mathematical statistics.

Results. After conducting a pedagogical experiment based on the results of general physical training among athletes in the experimental group, the increase in performance indicators was from 8.97% to 54.91%; in athletes of the control group - from 1.90% to 31.03%. Also, the taekwondo players of the experimental group significantly outweighed the athletes from the control group for all indicators of special physical fitness, the increase in indicators was from 10.79% to 32.30%; in the control group - from 1.25% to 17.62%. The analysis of performance indicators showed that the athletes of the experimental group significantly reduced all indicators (p < 0.01), in addition to the number of effective performance programs. Indicators of technical and tactical readiness among athletes in the control group grew from 2.38% to 19.85%; in taekwondo players of the experimental group, the increase in indicators of claves was from 13.22% to 56.53%.

Conclusion. Analysis of the scientific and methodological literature on the problem of training taekwondoists at the stage of specialized basic training revealed a number of problematic issues. This concerns the features of improving the process of technical and tactical training of taekwondo cadets. The structure of the annual training of taekwondoists at the stage of specialized basic training has been developed and experimentally substantiated, which is built taking into account the individual style of conducting a competitive taekwondo duel, the manifestation of physical qualities and the calendar of competitions. An improvement in the level of physical fitness of taekwondo wrestlers, a better performance of complex technical and tactical actions and a higher efficiency of indicators of the competitive activity of athletes have been established. It has been determined that the most dominant and effective fighting styles are game and tempo, which is associated with the specifics of the WTF taekwondo and the rules of the competition.

Key words: technical and tactical preparedness, taekwondo cadets, combat style, competitive activity, stage of specialized basic training
Анотація
Сергій Стрельчук, Олена Лукина, Віктор Савченко, Войцех Й. Цинарський, Маріо Баїч, Іоанніс Барбас, Георгій Коробейников. Особливості змагальної діяльності тхеквондистів 12-13 років до та після змін правил.

Мета: удосконалення техніко-тактичної підготовленості кваліфікованих тхеквондистів на етапі специалізованої базової підготовки для покращання змагальної діяльності.

Матеріал і методи. У дослідженні брали участь 30 спортсменів віком 12-13 років. Спортсмени займаються тхеквондо ВТФ у Дніпропетровській області. Дослідження проводились на базі Комунального позашкільного навчального закладу «Міська спеціалізоване дитячо-юнацьке спортивна школа олімпійського резерву» Дніпропетровської міської ради (відділення Тхеквондо ВТФ) та спортивного клубу «Барс» (м. Дніпро). Створено контрольну і експериментальну групи у кількості по 15 юнаків у кожній групі. Застосовувались антропометричні методи, метод індексів; педагогічні методи дослідження фізичної та техніко-тактичної підготовленості тхеквондистів 12-13 років, аналіз відеозаписів змагальних поєдинків кваліфікованих тхеквондистів кадетів вагових категорій до 33 кг, до 37 кг, до 41 кг, до 45 кг, до 49 кг, до 53 кг, до 57 кг; методи математичної статистики.

Результати. Після проведення педагогічного експерименту за результатами загальної фізичної підготовленості у спортсменів експериментальної групи приріст показників склав від 8,97 % до 54,91 %; у спортсменів контрольної групи – від 1,90 % до 31,03 %. Також тхеквондисти експериментальної групи достовірно перевищували спортсменів з контрольної групи за всіма показниками спеціальної фізичної підготовленості, приріст показників коливався від 10,79 % до 32,30 %; в контрольній групі – від 1,25 % до 17,62 %. Аналіз показників змагальної діяльності виявив, що спортсмени експериментальної групи достовірно покращали всі показники (р < 0,01), крім кількості результативних дій та більш висока ефективність показників змагальної діяльності спортсменів.

Висновки. Встановлено покращання рівня фізичної підготовленості тхеквондистів, більш яскраве виконання складних техніко-тактичних дій та більш висока ефективність змагальної діяльності спортсменів. Установлено, що найбільш домінуючими та ефективними стилями ведення поєдинка тхеквондистів є ігровий та темпової, що пов’язано зі специфікою тхэквондо ВТФ та правилами змагань.

Ключові слова: техніко-тактична підготовленість, тхеквондисти кадети, стиль ведення поєдинку, змагальна діяльність, етап спеціалізованої базової підготовки.
Introduction

Modern sport is characterized by the development of sports achievements, which, according to scientists [1-5], leads to an increase in competition at competitions of various levels. Sports competition stimulates the growth of world and national records and puts higher demands on the system of training athletes.

One of the most important aspects of increasing the efficiency of the competitive activity of taekwondo players is the improvement of technical and tactical preparedness, taking into account the individual style of conducting a match [6-10]. The peculiarities of modern competitive activity determine the orientation of the formation of an individual style with the choice of the most rational technical and tactical actions and their options when conducting a match [2-15].

The stage of specialized basic training plays an important role in the long-term training of taekwondo players. At this stage, comprehensive prerequisites for specialized training are created, which ensures a sufficient level of sportsmanship in competitive matches [5, 11, 16-18].

The analysis of scientific data made it possible to establish the presence of a significant number of scientific studies on the problem of technical and tactical training of athletes in various sports [1, 19 – 21] and in martial arts in particular [2, 22 – 24]. There is a limited number of studies in this direction in the scientific and methodological literature on WTF Taekwondo. It mainly concerns the training of highly qualified taekwondo players at the stages of preparation for higher achievements and the maximum realization of individual capabilities. At the current stage of taekwondo development, there is practically no information about the specifics of technical and tactical training of cadet taekwondo athletes at the stage of specialized basic training.

Modern studies of specialists [1, 3, 20, 25, 26] cannot be imagined without the use of an individual approach in the training process. In WTF taekwondo, the problem of individualization is of particular importance. A high sports result can be achieved by using different methods of fighting [2, 11, 8, 21, 27]. The use of an individual approach in improving the technical and tactical preparedness of qualified taekwondo players can become one of the ways to solve this problem.

The purpose of the study: improvement of the technical and tactical preparation of qualified taekwondo players at the stage of specialized basic training to improve the efficiency of competitive activities.

Material and methods

Participants

Testing of indicators of physical development, general, special physical and technical-tactical preparedness of qualified taekwondo players at the stage of specialized basic training was conducted. Athletes' qualifications are II-I sports class and Candidate for master of sports. The number is 30 taekwondo players aged 12-13, who were divided into experimental (15 athletes) and control (15 athletes) groups.

Research organization

The pedagogical experiment was conducted on the basis of the Municipal after-school educational institution "City Specialized Children's and Youth Sports School of the Olympic Reserve" of the Dnipro City Council (taekwondo department of the WTF) and the sports club "Bars" (Dnipro). The planning of educational and training classes in the group of athletes was carried out according to the Taekwondo Training Program of the VTF. The educational and training process lasted from October 2019 to March 2020.

The main direction of the microcycles was solving the main tasks of physical and technical-tactical training. Special attention was paid to improving the technical and tactical preparation of cadet taekwondo players, taking into account the individual style of fighting. Three sets of exercises for technical and tactical training were developed for taekwondo players with different fighting styles (game, tempo, power). Exercises from the complexes were used in the main part of each training session and comprised 20 minutes of training work. At each of the classes, all sets of exercises were used simultaneously, and each athlete individually performed tasks from the complex that corresponded to his fighting style.

Also, three sets of special physical training exercises were developed, which were used in the preparatory and at the end of the main part of the training session. The complexes contained means and methods of development and improvement of coordination, speed-strength abilities and special endurance. Performing work on these complexes consisted of 10 to 15 minutes of training work four times a week. The total volume of work for all types
of training was characterized as significant, the workload was 50-70% of the maximum possible.

Procedure

To determine the level of physical development, general physical, special physical and technical-tactical preparedness of taekwondo players, pedagogical testing was applied at the beginning and at the end of the pedagogical experiment. The study of physical development was carried out according to indicators of body length, body weight, chest circumference, vital capacity of the lungs. The index method was used to determine the functional state of taekwondo players.

Pedagogical testing was carried out to determine the level of development of general and special physical qualities according to the educational programs for children and youth sports schools, specialized children's and youth sports schools of the Olympic reserve, school of higher sportsmanship and SNZSP in Taekwondo VTF and other martial arts programs [27, 28].

The analysis of the competitive activity of cadet taekwondo players of various qualifications was carried out in order to determine the main indicators of technical and tactical preparedness: 1. The quality coefficient, which reflects the effectiveness of technical and tactical skill - the ratio of points won to the sum of points won and lost [11,26]. 2. The coefficient of technical readiness is the ratio of won actions to the sum of won and lost actions [11, 26]. 3. Performance – the average number of points won per match [11, 26]. 4. The number of productive actions performed during the match [10, 11, 26]. 5. Average number of points for effective action [10, 11, 26].

Statistical analysis

Material systematization and primary mathematical processing were performed using MS Excel (Microsoft. USA) and Statistica 8.0 (StatSoft, USA) software packages. In the process of data analysis, the following were calculated: arithmetic mean, error of the arithmetic mean, Student’s t-test. When determining the statistical significance of the difference between the athletes' indicators using the non-parametric Mann-Whitney test, a reliability level of 95% was assumed (significance level p=0.05).

Results

Table 1 presents indicators of physical development of athletes of the control and experimental groups. Testing was conducted before and after the pedagogical experiment (yearly training cycle).

The analysis of the obtained results showed that the characteristics of physical development in the experimental and control groups increased during the pedagogical experiment. Thus, the average values of the body weight of the taekwondo players of the control and experimental groups at the end of the pedagogical experiment were 47.52 ± 1.43 kg and 47.44 ± 1.56 kg, that is, they increased by 9.31% and 7.23%, respectively. The average body length of the taekwondo athletes of the control group increased by 1.69% and amounted to 161.79 ± 1.55 m, the body length of the athletes of the experimental group increased by 2.23% and amounted to 160.13 ± 1.81 m. The data analysis showed, that indicators of physical development do not have statistically significant differences between athletes of both groups (p > 0.05).

Table 1

| Tests                   | Stage of the experiment | Control group (n=15) | Experimental group (n=15) | t      | p       |
|-------------------------|-------------------------|----------------------|--------------------------|--------|---------|
|                         |                         | X ± m                | X ± m                    |        |         |
| Body length, cm         | To                      | 159.09 ± 1.66        | 156.63 ± 1.85            | 0.222  | >0.05   |
|                         | After                   | 161.79 ± 1.55        | 160.13 ± 1.81            | -0.695 | >0.05   |
| Body weight, kg         | To                      | 43.47 ± 1.56         | 44.24 ± 1.81             | 0.381  | >0.05   |
|                         | After                   | 47.52 ± 1.43         | 47.44 ± 1.56             | -0.038 | >0.05   |
| chest volume, sm        | To                      | 78.45 ± 1.06         | 77.75 ± 1.18             | 0.350  | >0.05   |
|                         | After                   | 80.41 ± 1.05         | 80.01 ± 1.17             | -0.254 | >0.05   |
| lung capacity, l        | To                      | 2.51 ± 0.07          | 2.50 ± 0.07              | 0.464  | >0.05   |
|                         | After                   | 3.05 ± 0.07          | 3.02 ± 0.07              | -0.293 | >0.05   |
| Quetelet index, g•cm-1  | To                      | 272.41 ± 7.40        | 281.37 ± 8.73            | 0.210  | >0.05   |
|                         | After                   | 293.09 ± 6.59        | 295.39 ± 6.64            | 0.246  | >0.05   |
| Vital index, ml•kg-1    | To                      | 58.14 ± 1.38         | 57.00 ± 1.46             | 0.275  | >0.05   |


The analysis of indicators of the general physical fitness of qualified taekwondo players of the experimental and control groups before and after the pedagogical experiment is presented in Table 2.

The analysis of data on general physical fitness showed that all indicators of athletes of both groups have positive changes. However, indicators of coordination abilities (shuttle run test 4x9 m) have a slight increase in taekwondo players of both groups (1.90% - control, 8.97% - experimental). Also, the indicators of flexibility development in the athletes of the experimental group have a minimal increase: straight splits - 1.86%, splits to the right - 0.66%, splits to the left - 0.46%. In athletes of the control group, the increase in flexibility indicators is significantly higher (p < 0.01) compared to the experimental group.

Table 2

Indicators of general physical training of taekwondo players of the experimental and control groups before and after the pedagogical experiment

| Tests                              | Experiment stage | Stage experiment (n=15) | Experimental group (n=15) | t    | p    |
|------------------------------------|-----------------|-------------------------|---------------------------|------|------|
|                                    |                 | \( \bar{x} \pm m \)    | \( \bar{x} \pm m \)       |      |      |
| Running 60 m, s                    | To              | 10.85 ± 0.23            | 10.79 ± 0.26              | 0.432| >0.05|
|                                    | After           | 10.39 ± 0.21            | 9.44 ± 0.15               | -3.710| <0.01|
| Long jump from a standing position, sm | To              | 173.97 ± 2.63           | 174.12 ± 2.48             | 0.486| >0.05|
|                                    | After           | 179.35 ± 2.60           | 194.23 ± 2.45             | 4.173| <0.01|
| Jump up from a place, sm           | To              | 36.67 ± 1.77            | 36.18 ± 1.75              | 0.427| >0.05|
|                                    | After           | 40.56 ± 1.59            | 46.91 ± 1.13              | 3.258| <0.01|
| Flexion and extension of the arms in the supine position, number of times | To              | 23.33 ± 1.29            | 23.80 ± 1.36              | 0.379| >0.05|
|                                    | After           | 28.67 ± 1.11            | 36.87 ± 1.31              | 4.776| <0.01|
| Standing on bent arms, s           | To              | 22.62 ± 1.48            | 22.76 ± 1.96              | 0.472| >0.05|
|                                    | After           | 29.64 ± 1.21            | 44.43 ± 1.88              | 6.609| <0.01|
| Sitting up from a lying position, number of times | To              | 32.27 ± 1.81            | 33.07 ± 1.73              | 0.346| >0.05|
|                                    | After           | 46.73 ± 2.53            | 47.13 ± 1.80              | 0.129| >0.05|
| Shuttle run 4x9 m, s               | To              | 11.79 ± 0.15            | 11.78 ± 0.15              | 0.489| >0.05|
|                                    | After           | 11.57 ± 0.15            | 10.81 ± 0.10              | -4.151| <0.01|
| 10 flips forward, s               | To              | 17.41 ± 0.55            | 17.60 ± 0.63              | 0.409| >0.05|
|                                    | After           | 16.74 ± 0.46            | 13.70 ± 0.21              | -6.050| <0.01|
| Straight twine, degrees            | To              | 157.88 ± 3.78           | 155.16 ± 4.48             | 0.318| >0.05|
|                                    | After           | 173.07 ± 1.85           | 158.06 ± 3.84             | -3.520| <0.01|
| Twine on the right, degrees        | To              | 163.68 ± 2.79           | 156.33 ± 3.16             | 0.380| >0.05|
|                                    | After           | 174.97 ± 1.27           | 157.37 ± 2.68             | -5.923| <0.01|
| Twine to the left, degrees         | To              | 165.54 ± 2.28           | 162.32 ± 11.38            | 0.211| >0.05|
|                                    | After           | 175.15 ± 1.25           | 163.07 ± 2.99             | -3.730| <0.01|
| Jumps with rotations to the right, degrees | To              | 334.61 ± 8.98           | 325.53 ± 11.45            | 0.266| >0.05|
|                                    | After           | 387.72 ± 10.04          | 451.49 ± 15.07            | 3.522| <0.01|
| Jumps with rotations to the left, degrees | To              | 322.40 ± 9.74           | 317.49 ± 10.08            | 0.366| >0.05|
|                                    | After           | 372.94 ± 8.43           | 443.35 ± 12.13            | 4.767| <0.01|
| Running 1500 m, s                 | To              | 468.18 ± 7.54           | 472.22 ± 11.92            | 0.356| >0.05|
|                                    | After           | 448.63 ± 6.84           | 412.00 ± 5.46             | -4.183| <0.01|
| Dynamometry of the stronger hand, kg | To              | 26.56 ± 1.14            | 26.37 ± 0.99              | 0.456| >0.05|
|                                    | After           | 32.47 ± 1.27            | 32.23 ± 1.01              | -0.144| >0.05|

Note: * - denotes statistically significant differences p < 0.01 between indicators before and after the pedagogical experiment; ** – p < 0.05.
The same increase in indicators is observed in strength qualities. Thus, the increase in the results of the sit-up test from the lying position for the taekwondo athletes of the control and experimental groups was 44.80% and 42.51%, respectively (p > 0.05); in the dynamometry test of the stronger hand, the increase in the control group is 22.25%, in the experimental group - 22.22% (p > 0.05).

The greatest increase in indicators after the pedagogical experiment is observed in the athletes of the experimental group in the tests: running 60 m - by 31.03%; 1500 m run - by 14.30%; jumping up from a standing position - by 29.65%; 10 rollovers forward - by 28.46%; jumps with turns to the right and left - by 38.69% and 39.64%, respectively; flexion and extension of the arms in a lying position - by 54.91%; hanging on bent arms - by 95.21%.

In taekwondo players of the control group, compared to the athletes of the experimental group, a slight increase is observed: running 60 m - by 4.42%; 1500 m run - by 4.35%; standing long jump - by 3.09%; jump up from a standing position - by 10.60%; 10 rollovers forward - by 4.00%; jumps with spins to the right and left - by 15.87% and 15.67%, respectively; flexion and extension of the arms in the supine position - by 22.88%; hanging on bent arms - by 31.03%.

The analysis of data on the special physical fitness of taekwondo players before and after the pedagogical experiment is presented in Table 3. This analysis showed that in both the control and experimental groups there was an increase in results in almost all indicators. However, in athletes of the experimental group, this increase is reliable (p < 0.05 - 0.01).

The obtained data show that the athletes of the control group did not have statistically significant differences in indicators of special physical fitness before and after the pedagogical experiment. There is a trend of increasing indicators in the following tests: change of combat stance in 1 min. – by 17.62% (t = 1.246; p > 0.05); the number of performed exercises in 1 round – by 7.1% (t = 2.061; p > 0.05); the number of performed exercises in the 2nd round – by 8.22% (t = 0.964; p > 0.05); the number of performed exercises in the 3rd round – by 17.38% (t = 1.966; p > 0.05); the sum for all rounds – by 10.29% (t = 1.717; p > 0.05); endurance index - by 5.40% (t = 0.777; p > 0.05). When performing the figure-of-eight test, athletes of the control group did not increase their results (p > 0.05).

Among taekwondo players of the experimental group, the increase according to these indicators is significantly higher: the change in combat stance in 1 minute. – by 28.01% (t = 3.330; p < 0.01); the number of performed exercises in 1 round – by 10.79% (t = 2.898; p < 0.05); the number of performed exercises in the 2nd round – by 20.51% (t = 2.309; p < 0.05); the number of performed exercises for the 3rd round – by 32.30% (t = 3.439; p < 0.01); the sum for all rounds – by 19.84% (t = 3.053; p < 0.01); endurance index - by 13.51% (t = 2.288; p < 0.05). There was also an increase in the performance of the figure eight running test (by 23.51%), but it was not reliable. It should be noted that there is also no significant difference between the groups in the figure of eight running test and, as a consequence, in the coefficient of special endurance (2) (p > 0.05).

Table 3

| Tests | Experiment stage | Stage experiment (n=15) | Experimental group (n=15) | t | p |
|-------|------------------|-------------------------|--------------------------|---|---|
|       |                  | $\bar{X} \pm m$        | $\bar{X} \pm m$          |   |   |
| Change of combat stance in 1 min., number of exercises | To | $92.73 \pm 2.42$ | $94.73 \pm 2.03$ | 0.245 | >0.05 |
|       | After            | $109.07 \pm 2.37$       | $121.27 \pm 1.35$        | 4.468 | <0.01 |
| Coefficient of special endurance. Conditional units (1) | To | $0.81 \pm 0.02$ | $0.83 \pm 0.02$ | 0.236 | >0.05 |
|       | After            | $0.83 \pm 0.02$         | $0.92 \pm 0.01$          | 4.448 | <0.01 |
| Running figure eight, s | To | $16.92 \pm 0.30$ | $16.91 \pm 0.31$ | 0.483 | >0.05 |
|       | After            | $16.71 \pm 0.29$        | $16.12 \pm 0.24$         | -1.587 | >0.05 |
| Coefficient of special endurance. Conditional units (2) | To | $0.92 \pm 0.02$ | $0.92 \pm 0.02$ | 0.476 | >0.05 |
|       | After            | $0.92 \pm 0.02$         | $0.88 \pm 0.01$          | -1.579 | >0.05 |
The number of performed exercises in 1 round

|          | To      | After   | t   | p     |
|----------|---------|---------|-----|-------|
|          | 76.93 ± 0.64 | 82.40 ± 0.24 | 0.476 | >0.05 |
|          | 75.93 ± 0.71 | 84.13** ± 0.61 | 2.658 | <0.05 |

The number of performed exercises for 2 rounds

|          | To      | After   | t   | p     |
|----------|---------|---------|-----|-------|
|          | 62.40 ± 1.07 | 67.53 ± 0.86 | 0.169 | >0.05 |
|          | 61.13 ± 1.38 | 73.67** ± 1.03 | 4.565 | <0.01 |

Number of performed exercises for 3 rounds

|          | To      | After   | t   | p     |
|----------|---------|---------|-----|-------|
|          | 52.93 ± 0.78 | 192.27 ± 2.30 | 0.228 | >0.05 |
|          | 52.00 ± 1.18 | 189.07 ± 3.07 | 2.658 | <0.05 |

Total for all rounds

|          | To      | After   | t   | p     |
|----------|---------|---------|-----|-------|
|          | 62.93 ± 1.07 | 212.07 ± 1.89 | 0.169 | >0.05 |
|          | 61.13 ± 1.38 | 226.60* ± 3.10 | 4.565 | <0.01 |

Endurance index (3)

|          | To      | After   | t   | p     |
|----------|---------|---------|-----|-------|
|          | 0.74 ± 0.01 | 0.78 ± 0.01 | 0.204 | >0.05 |

Note: * - denotes statistically significant differences p < 0.01 between indicators before and after the pedagogical experiment; ** - p < 0.05.

The study of the level of special physical fitness of taekwondo players after the pedagogical experiment shows reliable differences between the average group indicators of the experimental and control groups. The highest reliable differences are observed when performing the tests: changing the combat stance in 1 minute. (t = 4.468; p < 0.01); the number of performed exercises in the 2nd round (t = 4.565; p < 0.01); sum for all rounds (t = 4,000; p < 0.01).

At the beginning and after the pedagogical experiment, taekwondo players of both groups took part in city and regional competitions and in the Taekwondo Championship of Ukraine among cadets. Analysis of the data of competitive activity revealed that positive changes occurred in both the control and experimental groups during the experiment (Table 4).

In the athletes of the control group, no statistically significant differences were found in the average indicators of technical and tactical preparedness before and after the pedagogical experiment (p > 0.05). There is a slight tendency to improve indicators: the number of points won - by 9.79%; the number of lost points - by 3.91%; quality factor – by 4.16%; the number of effective actions won - by 11.92%; the number of lost effective actions - by 2.38%; coefficient of technical readiness - by 6.00%; productivity - by 9.76%; the number of effective actions on average per fight – by 11.57%; the average number of points for effective action – by 1.68%.

Table 4

| Tests                      | Experiment stage | Stage experiment (n=15) | Experimental group (n=15) | t   | p     |
|----------------------------|------------------|-------------------------|--------------------------|-----|-------|
|                            |                  | X ± m                   | X ± m                    |     |       |
| Average number of matches  | To               | 5                       | 5                        |     |       |
|                            | After            | 5                       | 5                        |     |       |
| Average number of wins     | To               | 2.67 ± 0.27             | 2.60 ± 0.24              | 0.393 | >0.05 |
|                            | After            | 3.20 ± 0.22             | 4.07 ± 0.21              | 4.565 | <0.01 |
| Number of points won       | To               | 64.00 ± 4.18            | 69.73 ± 4.41             | 0.290 | >0.05 |
|                            | After            | 70.27 ± 3.69            | 97.80 ± 4.23             | 3.459 | <0.01 |
| Number of points lost      | To               | 66.47 ± 2.57            | 76.67 ± 3.72             | 0.158 | >0.05 |
|                            | After            | 69.07 ± 3.39            | 60.67 ± 2.86             | 4.000 | <0.01 |
| Quality factor             | To               | 0.48 ± 0.02             | 0.47 ± 0.02              | 0.218 | >0.05 |
|                            | After            | 0.50 ± 0.02             | 0.61** ± 0.01            | 3.931 | <0.01 |
| The number of effective actions won | To | 26.33 ± 1.40 | 28.67 ± 1.53 | 0.161 | >0.05 |
|                            | After            | 29.47 ± 1.11            | 35.67 ± 1.40             | 3.479 | <0.01 |
| The number of effective actions of losers | To | 25.20 ± 0.88 | 27.93 ± 1.29 | 0.078 | >0.05 |
|                            | After            | 25.80 ± 0.99            | 28.80 ± 1.08             | -2.048 | >0.05 |
| Coefficient of technical readiness | To | 0.50 ± 0.02 | 0.50 ± 0.01 | 0.418 | >0.05 |
|                            | After            | 0.53 ± 0.01             | 0.60 ± 0.01              | 4.521 | <0.01 |
Performance (points per fight)  |  To  | 12.80 ± 0.84 | 13.95 ± 0.88 | 0.200 | >0.05  
| After  | 14.05 ± 0.74 | 19.56 ± 0.85 | 4.907 | <0.01  

The number of effective actions on average per battle  |  To  | 5.27 ± 0.28 | 5.73 ± 0.31 | 0.161 | >0.05  
| After  | 5.88 ± 0.22 | 7.13 ± 0.28 | 3.516 | <0.01  

The average number of points for a productive action  |  To  | 2.41 ± 0.06 | 2.42 ± 0.06 | 0.475 | >0.05  
| After  | 2.37 ± 0.05 | 2.74 ± 0.06 | 4.587 | <0.01  

Note: * - denotes statistically significant differences p < 0.01 between indicators before and after the pedagogical experiment; ** – p < 0.05.

Compared to the control group, the taekwondo players of the experimental group significantly improved the indicators of technical and tactical preparedness: the number of points won - by 40.25% (t = 3.459; p < 0.01); the number of lost points - by 26.37% (t = 4.000; p < 0.01); quality factor – by 29.78% (t = 3.931; p < 0.01); the number of successful actions won - by 24.41% (t = 3.479; p < 0.01); coefficient of technical readiness - by 20.00% (t = 4.521; p < 0.01); productivity - by 40.21% (t = 4.907; p < 0.01); the number of productive actions on average per fight - by 24.23% (t = 3.516; p < 0.01); the average number of points for effective action – by 13.22% (t = 4.587; p < 0.01). The indicator of the number of lost productive actions among the athletes of the experimental group improved by 22.50%, but in comparison with the indicator of the control group, this increase is not reliable (t = -2.048; p > 0.05).

In general, there is a tendency to improve indicators of technical and tactical preparedness among taekwondo players of both groups, which also reflect the features of competitive activity. But in the experimental group, the growth of indicators is much better, and this is due to the fact that the athletes of this group won more often in competitive matches and performed technical and tactical actions in matches more qualitatively.

The data analysis of the structure of the competitive activity of the taekwondo players of the control and experimental groups is presented in Table 5.

Table 5

| Reception groups       | Control group | Experimental group |  
|------------------------|---------------|--------------------|  
|                        | To            | After              | To            | After              |  
| Intermediate level (safety vest) |  
| Pandal-chaga           | 190           | 261                | 203           | 201                |  
| Yop-chaga              | 71            | 39                 | 73            | 42                 |  
| Miro-chaga             | 16            | 17                 | 18            | 19                 |  
| Tweet-chaga            | 9             | 10                 | 11            | 31                 |  
| Tornado-pandal-chaga   | 3             | 2                  | 5             |                    |  
| Two-pandal-chaga       | 6             | 1                  | 1             | 4                  |  
| Jirugi                 | -             | 3                  | 1             | 8                  |  
| Всього:                | 295           | 333                | 307           | 310                |  
| Top level (head)       |  
| Fate-chaga             | 38            | 19                 | 40            | 58                 |  
| Bakkat-dolo-chaga      | 3             | 15                 | 4             | 19                 |  
| Нерьо-чаги              | 36            | 61                 | 64            | 100                |  
| Твіт-дольо-чаги         | 5             | 7                  | 2             | 19                 |  
| Yop-chaga              | 15            | 2                  | 8             | 6                  |  
| Tweet-chaga            | 1             | 3                  | 1             | 8                  |  
| Tornado-dolo-chaga     | 2             | -                  | 1             | 3                  |  
| Total:                 | 100           | 107                | 120           | 213                |  
| Total in the middle and upper level: | 395 | 440 | 427 | 523 |  
| Gamjom (punishment)    | 79            | 56                 | 77            | 100                |
The analysis of the structure of the competitive activity of the taekwondo players of the control group after the experiment shows that, out of 440 effective strikes, the cadets most often used techniques from the following groups: at the middle level, pandal-chaga (side kick) strikes were used 261 times, yop-chaga (direct strike) - 39 times; miro-
chaga (semi-shock) - 17 times; tweet-chaga (direct blow from a turn) - 10 times; in the upper level - neryo-chagi (direct blow from top to bottom) - 61 times; dolo-chaga (side kick) – 19 times; bakkat-dolyo-chagi (side kick from the outside) – 15 times.

The analysis of the structure of the competitive activity of the athletes of the experimental group shows that out of 523 successful strikes, taekwondo players most often used techniques from the following groups: at the middle level, pandal-chaga strikes were used 201 times; yop-
chaga strikes - 42 times; twit-chaga – 31 times, miro-
chaga – 19 times; to the upper level - neryo-chaga - 100 times; fate-chaga - 58 times; bakkat-dolyo-chagi - 15 times; tweet-share-chaga - 19 times.

It should be noted that the athletes of the experimental group began to use technical and tactical actions most often, which are more difficult to perform in a competitive match and are evaluated by judges with higher scores. It should also be noted that the number of punishments among athletes of the experimental group increased by 23 times. In our opinion, this is explained by the fact that the number of technical and tactical actions in the upper level has increased by almost half. When performing a series or combination of complex coordination strikes, a taekwondo player cannot always maintain a stable posture and may touch the carpet with a part of the body other than the foot. It is these movements that lead to the athlete being punished by the judges.

**Discussion**

Based on the data of the ascertaining experiment, the feasibility of improving the technical and tactical preparedness of cadet taekwondo players (weight categories up to 33 kg, up to 37 kg, up to 41 kg, up to 45 kg, up to 49 kg, up to 53 kg, up to 57 kg) in the annual cycle is substantiated.

The developed experimental program for improving the technical and tactical training of cadet taekwondo players is based on didactic and specific principles of sports training, the principles of creating winning positions and ways of optimally using the laws of motion for the effective implementation of winning actions. The experimental program includes a number of components: the goal, tasks, forms of organization of classes, plan of training classes, content and volume of training loads, means and methods for the development of special physical qualities, individual means and methods of technical and tactical training taking into account the individual style of conducting a competitive match (game, pace, power), control criteria.

As a result of the application of this program during the annual cycle of training, the values of almost all indicators of general, special physical and technical-tactical preparedness of qualified cadet taekwondo players increased. At the beginning of the pedagogical experiment, the groups were equal in terms of all readiness indicators. After the experiment, there is an uneven increase in indicators among the athletes of the control and experimental groups. The values of indicators of physical development increased to 10%. Taekwondo players' weight changed slightly - in the control group by 9.31%, in the experimental group by 7.23%. This is explained by the fact that athletes try to be in a certain weight category during the annual training cycle. Taekwondo players know their main opponents in these weight categories quite well, their main fighting tactics and main crown techniques. The obtained data are confirmed by studies of martial arts specialists [2, 10, 11, 29, 30].

Indicators of general physical fitness increased unevenly for both groups. In the control group, the increase in individual indicators in athletes was from 1.90% to 31.03%, except for strength qualities (sitting up from a sitting position), where the increase was 44.80%. Among taekwondo players of the experimental group, the increase in indicators was from 8.97% to 54.91% (except for flexibility), strength qualities - 95.21%. A significant increase in indicators of strength qualities can be explained by a rationally planned pedagogical influence.

The indicators of special physical fitness among athletes in the experimental group increased from 10.79% to 32.30%, and in the control group - only from 1.25% to 17.62%. Significant differences (p < 0.05; p < 0.01) between the indicators of taekwondo players in the experimental and control groups were found in almost all tests, except for the figure-eight running test and the coefficient of special endurance (2).

The analysis of indicators of technical and tactical preparedness in competitive activities showed that during the pedagogical experiment, all indicators in the experimental group increased statistically significantly. Significant differences (p < 0.01) were found between the experimental and control groups for all indicators, except for the indicator of the number of effective actions of the losers. Indicators of technical and tactical preparedness among athletes of the control group
increased from 2.38% to 19.85%. Among taekwondo players of the experimental group, the increase in indicators was from 13.22% to 56.53%.

The obtained data testify to the effectiveness of the developed program for improving the technical and tactical training of cadet taekwondo players at the stage of specialized basic training. This program can be recommended for improving the technical and tactical training of cadet taekwondo players.

It is also important to note that taekwondo players of the experimental group successfully performed at the main competitions during the period of the pedagogical experiment. Performing at the Championship of Ukraine among cadets, two athletes won a silver award and three - a bronze award, three more took 5-6th places. Among the athletes of the control group, the best result was one bronze award at the Championship of Ukraine among cadets. In addition, two of the athletes at the main competitions fulfilled (confirmed) the standard of a candidate for master of sports of Ukraine, six athletes confirmed the standards of the 1st sports category. Among the athletes of the control group at the main competitions, one confirmed the standard of a candidate for master of sports of Ukraine and four - the standard of the 1st sports category.

The obtained data are confirmed by the data of leading specialists in martial arts [2, 11, 23, 31, 32].

Conclusions

1. The analysis of scientific and methodical literature on the problem of research and generalization of the practical experience of taekwondo training at the stage of specialized basic training revealed a number of problematic issues. They relate to the peculiarities of the process of improving the technical and tactical training of taekwondo players, the study of indicators of their physical and technical readiness, taking into account the individual characteristics of athletes, namely the individual style of conducting competitive activities.

2. On the basis of the identified trends in the competitive activity of qualified cadet taekwondo players, generally accepted (basic) styles of fighting (game, tempo, power), an experimental program for improving the technical and tactical preparedness of cadet taekwondo players at the stage of specialized basic training was developed. Developed technical and tactical complexes for improving the technical and tactical skills of qualified cadet taekwondo players, which are based on didactic and specific principles of sports training, principles of creating winning positions and ways of optimal application of the laws of motion for effective implementation of winning actions.

3. The improvement of the level of physical and technical-tactical preparation of taekwondo players, better performance of complex technical-tactical actions and higher efficiency of indicators of competitive activity of sportsmen were established. It was established that the most dominant and effective styles of conducting competitive activities are game and tempo, which is related to the specifics of WTF taekwondo and competition rules. Leading physical qualities are speed and strength, coordination abilities and special endurance.

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Conflict of interest

The authors declare no conflict of interest.

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