ТЕОРІЯ І МЕТОДИКА ПІДГОТОВКИ СПОРТСМЕНІВ

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TRAINING PROCESS MANAGEMENT AT THE STAGE OF WINNING TRAINING IN TAEKWONDO (KYORUGI)

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Annotation

The article analyzes the management of the training process of taekwondo athletes at the stage of pre-competition training using rational planning of training and competition loads. It was found that the training load at the stage of pre-competition training of taekwondo athletes is characterized by an emphasis on the development of special endurance. At the same time, about 40% of all training and training means (these are mainly special technical and tactical exercises) used in pre-competition training are performed in the glycolytic anaerobic energy supply mode, when the heart rate reaches 200 beats/min. It is noted that when building pre-competition training of taekwondo athletes, it is necessary to take into account the trends in the development of modern taekwondo, the structure and content of competitive activity. This fact is confirmed by the presence of a significant and diverse arsenal of means for training taekwondo athletes, planning training work and monitoring the quality of athletes' preparedness at the stage of pre-competition training. **The purpose of the study** is to develop and scientifically substantiate the methodology for managing the training process in highly qualified taekwondo athletes at the stage of their sports improvement. **Research methods:** theoretical analysis and generalization of data from scientific and methodological literature and the Internet (sources were studied in accordance with the research problem); analysis of documentary materials (analysis of competitive activity protocols was conducted); system analysis method (used for a logical and consistent approach to organizing and obtaining research results); chronological method (allowed us to study sources that reveal the essence of the research and obtaining results from the beginning to the end of the competition); a set of methods for diagnosing physical development, state and level of preparedness (various generally accepted methods for assessing the physical development and preparedness of athletes were used); pedagogical observations

(used analysis of the content of the training process taking into account the qualifications of athletes, the competition calendar and sports periodization); pedagogical experiment (different approaches to rational planning of training loads were introduced into the practice of athletes); methods of mathematical statistics (aimed at calculating the total and average values of indicators and their effectiveness). **Research results.** In the process of research, it was found that the most optimal duration of the pre-competitive mesocycle of taekwondo training is 4 weeks or 28 days and includes the following structure: basic microcycle (7 days) – the volume of the load is 40% of the total volume at this stage; special-preparatory microcycle (7 days) – the volume of the load is 30%; model microcycle (7 days) – the total volume of the load is 20%; introductory microcycle (7 days) – the total volume of the load is 10%. **Conclusions.** It was established that the planning of the training load at the stage of pre-competitive training of taekwondo players, tested during the pedagogical experiment, allowed to significantly increase the efficiency of the training process. After a four-week stage of pre-competition training, athletes improved their special endurance indicators by an average of 9-10% – heart rate in the fourth minute of recovery after performing a six-minute test; time to perform spurts during a three-minute test; pulse sum of a 3-minute recovery period after performing a three-minute test; adaptation coefficient, which is determined by the results of a one-minute test.

Keywords: taekwondo athletes, training and competition loads, control of the training process, assessment of effectiveness.

УПРАВЛІННЯ ТРЕНУВАЛЬНИМ ПРОЦЕСОМ НА ПЕРЕДЗМАГАЛЬНОМУ ЕТАПІ ПІДГОТОВКИ В ТХЕКВОНДО (КЕРУГІ)

Анотація

Вступ. У статті за темою «Управління тренувальним процесом на передзмагальному етапі підготовки» проведено аналіз управління л тренувальним процесом тхеквондистів за допомогою раціонального планування тренувальних та змагальних навантажень. Встановлено, що тренувальне навантаження на етапі передзмагальної підготовки тхеквондистів характеризується акцентованою спрямованістю на розвиток спеціальної витривалості. При цьому близько 40% всіх тренувальних навчально-тренувальних засобів (це в основному спеціальні техніко-тактичні вправи), що застосовуються у передзмагальній підготовці, виконується в гліколітичному анаеробному режимі енергозабезпечення, коли ЧСС досягає величини 200 уд/хв. Відзначено, що при побудові передзмагальної підготовки тхеквондистів необхідно враховувати тенденції розвитку сучасного тхеквондо, структури та змісту змагальної діяльності. Цей факт підтверджується наявністю значного та різноманітного арсеналу засобів підготовки тхеквондистів, планування тренувальної роботи та контролю за якістю підготовленості спортсменів на етапі передзмагальної підготовки. **Мета дослідження –** розробити та науково обґрунтувати методику управління тренувальним процесом у висококваліфікованих тхеквондистів на етапі передзмагальної підготовки. **Матеріали і методи дослідження:** теоретичний аналіз і узагальнення даних наукової та методичної літератури і мережі «Інтернет»; метод системного аналізу; хронологічний метод; комплекс методів для діагностики фізичного розвитку, стану та рівня підготовленості; педагогічний експеримент; методи математичної статистики. **Результати дослідження**. У процесі досліджень було з'ясовано, що найбільш оптимальна тривалість передзмагального мезоциклу підготовки тхеквондистів становить 4 тижні або 28 днів і включає наступну структуру: базовий мікроцикл (7 днів) – обсяг навантаження становить 40% від загального обсягу на цьому етапі; спеціально-підготовчий мікроцикл (7 днів) – обсяг навантаження 30%; модельний мікроцикл (7 днів) – загальний обсяг навантаження 20%; підводячий мікроцикл (7 днів) – загальний обсяг навантаження 10%. У ході досліджень з'ясували, що зниження ваги кваліфікованих тхеквондистів, на 2,5 – 3 кг або 3,5 – 4,1 % ваги тіла не істотно впливає на зміну показників сили, але значно покращує швидкісно-силові показники (коефіцієнт динамічності). Зниження ваги у спортсменів на 4 – 5 кг і більше призводить до суттєвого зниження всіх досліджуваних показників. При зниженні ваги тіла на 2,5 – 3 кг спеціальна працездатність залишається практично на одному рівні, але при подальшому падінні ваги на 4 – 5 кг статистично вірогідно погіршується, проте на техніку виконання ударів негативно не впливає. **Висновки.** Встановлено, що планування тренувального навантаження на етапі передзмагальної підготовки тхеквондистів, перевірений у ході педагогічного експерименту, дозволив суттєво підвищити ефективність тренувального процесу. Після чотиритижневого етапу передзмагальної підготовки у спортсменів у середньому на 9 – 10% покращилися показники спеціальної витривалості – ЧСС на четвертій хвилині відновлення після виконання шестихвилинного тесту; час виконання ударів у спуртах під час виконання трихвилинного тесту; пульсова сума 3-хвилинного періоду відновлення після виконання трихвилинного тесту; коефіцієнт адаптації, який визначається за результатами однохвилинної проби.

Ключові слова: тхеквондисти, тренувальні та змагальні навантаження, контроль за тренувальним процесом, оцінка ефективності.

Introduction. One of the most promising ways to increase the efficiency of the training process of highly qualified athletes not only in taekwondo, but also in other sports is to improve its management technology [1, 2]. In order for management to be effective in the management system, it is necessary to have models of object management in its current state [3, 4]. In the presence of the most modern management model, it is necessary to search for the most effective training tools and methods that ensure the achievement of this model [5, 6]. That is why the current issue of managing the training process at all levels remains rational planning of physical activity. Planning taking into account goals makes it possible to more accurately combine strategic and tactical tasks, to more effectively control the athlete's training process. At the same time, a mandatory condition for optimal planning of training loads is constant pedagogical control, which provides feedback in the athlete training system: 1) the coach receives information about the state of the controlled system (from the athlete); 2) processing this information, the coach makes a decision on the possibilities of correction, determining the range of necessary means and methods of influence [7, 8].

The creation of adequate systems for monitoring the physical fitness of athletes is unthinkable without taking into account the features associated with the specialization, qualification, gender and age of the studied contingent, as well as the stages of athletes' training [9, 10]. Ignoring at least some of them leads to a significant decrease in the effectiveness of control, or even to its complete loss of the role of an effective lever in managing the training process [11, 12]. The training process at the stage of pre-competition training is always of particular importance, since this stage is sometimes the final in the annual training cycle. It is at this time that there is the last chance to correct the mistakes made at the stages of general and special training [13, 14].

Hypothesis – it is assumed that the analysis, management and control of the methodology for planning the pre-competitive stage of training will contribute to improving the results of athletes' preparedness and competitive activity in taekwondo.

The purpose of the study: to develop and scientifically substantiate the methodology for managing the training process in highly qualified taekwondo athletes at the stage of pre-competitive training.

Research objectives:

1. To determine the most rational structure of the pre-competitive mesocycle and its microcycle components at the stage of sports improvement of taekwondo players.
2. To substantiate the main parameters of training load management (direction, magnitude and intensity) and their distribution during the period of pre-competitive training of athletes, taking into account the features of future taekwondo competitions.
3. To develop and substantiate a methodology for comprehensive pedagogical control at the stage of pre-competitive training of highly qualified taekwondo players.
4. In the course of a pedagogical experiment, to test the management of the training process of highly qualified taekwondo players at the stage of pre-competitive training.

Research material and methods

Participants: two training camps with the participation of 16 leading athletes (8 men and 8 women) of the national team were analyzed. It should be noted that informed consent to participate in this experiment was obtained from all participants. Testing was conducted in accordance with the ethical standards of the responsible committee for the rights of experiments (institutional or regional) or the 2008 Helsinki Declaration. The research was conducted according to the research plan at the Educational and Scientific Institute «Prideneprovsk State Academy of Physical Culture and Sports» of the Ukrainian State University of Science and Technology under No. 0121U108253, topic – «Theoretical and methodological foundations of training of athletes in Olympic and professional sports». Procedure: an analysis of various indicators of the aspects of athletes' preparedness that most affect the sports result was carried out. To assess technical and tactical training, a visual assessment of the quantity and quality of technical and tactical actions, expressed in points, was used. To assess the physical preparedness of athletes, the following were used: the PWC170 test with a specific load, a six-minute test, a three-minute test with impacts, the stress index. Baevsky (In), tapping test, tremorometry, attention switching test, well-being, activity, mood test, dynamic coefficient and speed-strength index were calculated [15, 16].

Statistical analysis: Research methods: analysis and generalization of materials from scientific and methodological literature; a set of methods for diagnosing physical development, state and level of preparedness; pedagogical observations; pedagogical experiment; methods of mathematical statistics.

For the mathematical analysis of the research results, standard statistical methods and calculations of quantitative using the Excel 2020 application package.

Research results

Currently, in the general theory of sports training of athletes, there are two fundamentally different approaches to the rational construction of pre-competition training.

The first approach is based on the assumption that the planning of the physical training process of athletes of different qualifications should be based on simulation models that take into account long-term adaptation processes occurring in isolated muscle, heart, endocrine, immune and central nervous systems [17, 18]. With this approach, the type of sports specialization is leveled, taking into account the specifics of the sport, the stage of sports training and the features of the individual techni-

cal-tactical and physical fitness of the athlete.

The second of them assumes that in the conditions of training activities, athletes must fully use specific training tools and methods that simulate the most difficult conditions encountered during competitions. At the same time, the most important criterion for the quality of the construction of the macrocycle of pre-competition training is the dynamics of the level of special endurance of athletes [19, 20].

Based on the approaches considered, the authors also propose different construction of microcycles at the stage of pre-competition training. Given that the main experimental studies of Mykhalyuk E. [13] were performed in boxing, this approach was chosen as the main one for planning training loads in taekwondo [2].

Discussion

The main tasks of training taekwondo athletes at the stage of pre-competition training were: achieving the maximum level of special performance or endurance (physical fitness); high reliability of technical and tactical actions (technical and tactical fitness); optimal psychological stability (psychological fitness) [21]. In this variant of constructing pre-competition training of athletes, attention is focused on the development of special endurance, which involves the athletes performing large volumes of glycolytic anaerobic training.

Taking into account the recommendations of most specialists [2, 7, 8], the following sequence of the pre-competition mesocycle was determined: basic microcycle (7 days) – the volume of the load is 40% of the total volume at this stage, the predominant focus of training work in the mixed aerobic-anaerobic zone (HR up to 180 – 185 beats / min); special preparatory microcycle (7 days) – the volume of the load is 30%, the predominant focus of work in the glycolytic anaerobic zone (heart rate up to 200 beats/ min); model microcycle (7 days) – the total volume of the load is 20%, training simulates competitive conditions (sparring) and involves performing training loads also in the glycolytic anaerobic zone (heart rate up to 200 beats/min); lead-up microcycle (7 days) – the total volume of the load is 10%, one session is sparring, the predominant focus of the training load is aerobic in nature (heart rate up to 170 beats/min).

The schematic diagram of the dynamics of the training load and the expected change in the condition of taekwondo athletes in terms of special endurance indicators at the stage of pre-competition training are presented in Fig. 1. Planning of the training load in different microcycles of this stage is shown in Fig. 2-5.

As a result of the analysis of the scientific and methodological literature, the following were selected as means of pedagogical control:

– to assess the condition of athletes: PWC170 test with specific load, six-minute test, three-minute test with racket strikes, Baevsky's tension index (In); tapping test, tremorometry, attention switching test, well-being, activity, mood test;

- to assess technical and tactical training: visual assessment of the quantity and quality of technical and tactical actions, expressed in points.

Based on these data, a detailed training program for taekwondo athletes at the pre-competition stage was developed.

To obtain information on the feasibility of using artificial weight loss in taekwondo, a questionnaire survey was conducted among 16 highly qualified athletes aged 17–21. The subjective assessment of the impact of weight loss on physical fitness and performance was compared with experimental studies involving 16 athletes aged 17–21. Their weight ranged from 54–87 kg. The experiment was conducted under training camp conditions. One of the main tasks in the athletes' training was to rapidly lose weight (14 days) by 4–5 kg or 5.8–6.8% of body weight.

As a result, it was found that reducing the weight of taekwondo athletes by 2.5-3 kg or 3.5-4.1% of body weight did not have a significant impact on the change in strength indicators, but significantly improved speed-strength indicators (dynamic coefficient). Reducing the weight of athletes by 4-5 kg and more led to a significant decrease in all the studied characteristics: static and dynamic strength, speed-strength qualities. When reducing body weight by 2.5-

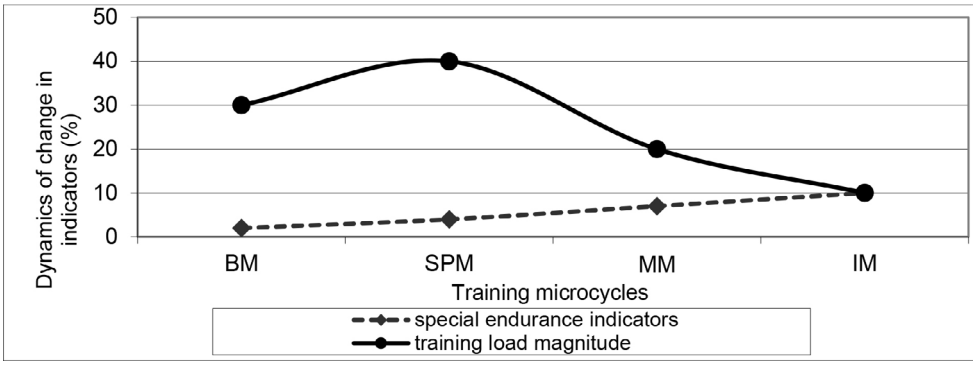

Fig. 1. Dynamics of training load and planned change in the state of taekwondo athletes according to special endurance indicators at the stage of pre-competition preparation: BM – basic microcycle; SPM – special preparatory microcycle; MM – modeling microcycle; IM – introductory microcycle

3 kg, special working capacity remains practically at the same level, but with a further decrease in weight by 4-5 kg, it statistically significantly worsens. However, this does not have a negative impact on the technique of performing technical and tactical actions. Reducing the weight of athletes by 2.8-3.3 kg leads to a decrease in the value of the PWC170 indicator by 7%. At the same time, against the background of a decrease in power, the pulse reaches the level of 170 beats/min faster. The time of work at a heart rate below 170 beats/min is on average 2 minutes. The duration of work at a frequency of 170 – 180 beats/min is reduced to 48 seconds. Particularly significant changes in the studied parameters occur after a weight loss of 6 – 8%.

To assess the effectiveness of the developed variant of planning the training load at the stage of pre-competitive training of taekwondo athletes, a specially organized pedagogical experiment was conducted, in which a group of highly qualified athletes (16 people) aged 17 – 21 years participated.

Stage control was carried out at the beginning and end of the stage of pre-competitive training of taekwondo athletes. The subject of stage control was the aspects of athletes' preparedness that most affect the sports result. To assess technical and tactical training, a visual assessment of the quantity and quality of technical and tactical actions, expressed in points, was used. To assess the physical fitness of athletes, the fol-

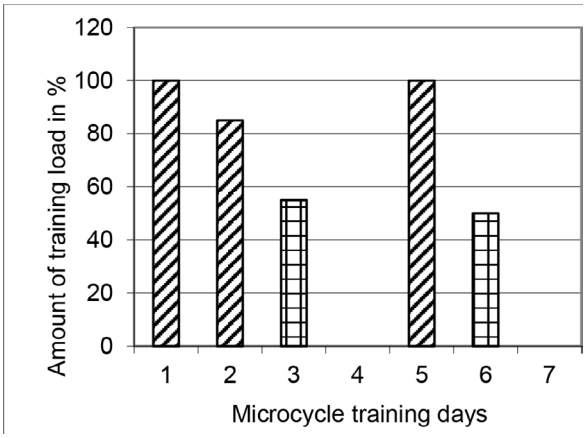

Fig. 2. Scheme of the organization of the training load in the basic microcycle at the stage of pre-competitive training in taekwondo:

▨ - aerobic-anaerobic orientation of the training load (1,2,5);

▩ - aerobic direction of the training load (3,6).

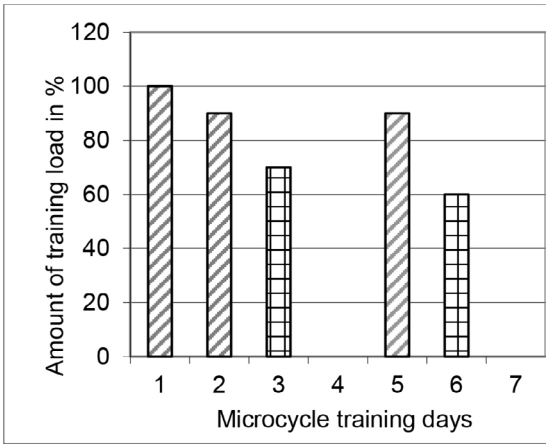

Fig. 3. Planning of training load in a special preparatory microcycle at the stage of pre-competitive training in taekwondo:

▨ - glycolytic anaerobic training load orientation (1,2,5);

▩ - aerobic-anaerobic orientation of training load (3,6).

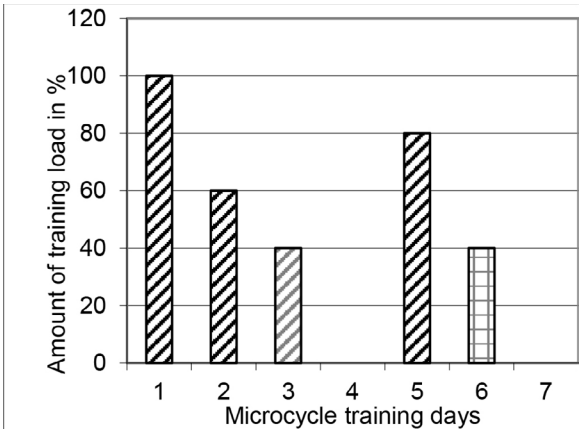

Fig. 4. Planning of training load in the model microcycle at the stage of pre-competition training of taekwondo athletes:

▨ - glycolytic anaerobic training load orientation (1,2,3,5);

▩ - aerobic-anaerobic training load orientation (6).

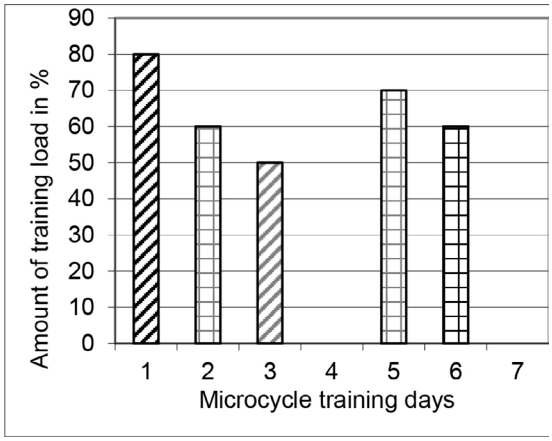

Fig. 5. Planning of training load in the introductory microcycle at the stage of pre-competition training of taekwondo athletes:

▨ – sparring matches (1,3);

▩ – aerobic-anaerobic orientation of the training load orientation (2,5,6)

lowing tests were used: PWC170 test with specific load, six-minute test, three-minute test with impacts, Baevsky's tension index (In), tapping test, tremorometry, attention switching test, well-being, activity, mood test, and the dynamic coefficient and speed-strength index were calculated.

Current control was carried out daily before the training session. The subject of current control was the state of the athlete's motor function. To assess the current state of the athletes, the following were used: a three-minute test with impacts, a one-minute test, a tapping test, tremorometry, an attention switching test, and a speed-strength index was calculated.

A total of 19 tests dedicated to current control were conducted during the period of the pedagogical experiment: 4 during the basic microcycle; 5 each in the special preparatory, modeling, and lead-in microcycles.

Operational control was carried out at the beginning of the training session and immediately after its end. The subject of operational control was the functional state of the athlete's body. To assess such a state, a tapping test, tremorometry, and an attention switching test were used. These tests coincided with some tests of current control, which facilitated and somewhat simplified their procedure. To assess training loads: fixing the volume, intensity, and direction of training sessions.

A total of 20 operational state tests were conducted during the pedagogical experiment: 5 in each microcycle.

At the beginning of the pedagogical experiment, on the first day of the pre-competition training stage, a comprehensive stage test was conducted.

During the training process, the planned indicators of special endurance of athletes were compared with those recorded as a result of pedagogical control. In case of discrepancy, the magnitude of the training load was adjusted.

This method of planning training loads at the stage of pre-competition training of taekwondo athletes, tested during the pedagogical experiment, allowed to significantly increase the effectiveness of the training process, since the main task of management, i.e., transferring athletes from the initial state to the previously planned one, was successfully completed. After a four-week stage of pre-competition training, the athletes' special endurance indicators improved by an average of 9-10% – heart rate in the fourth minute of recovery after performing a six-minute test; time of performing spurts during the three-minute test; pulse sum of the 3-minute recovery period after the three-minute test; adaptation coefficient, which is determined by the results of the one-minute test. Comparative data of these indicators are presented in Table 1.

However, the positive trend was not inherent in all indicators characterizing the preparedness of athletes. Thus, during the period of pre-competitive training, the strength and speed-strength qualities of taekwondo athletes did not statistically significantly improve, that is, they remained practically at the same level as at the beginning of the pedagogical experiment. In addition, the indicators of general working capacity (PWC170) deteriorated by an average of 5.5%. These facts are explained by the fact that at the stage of pre-competitive training, the main attention was paid to the development of the main factor – special endurance, which limits the success of taekwondo athletes. Other indicators of athletes' preparedness should increase during the preparatory and special-preparatory stages. The effectiveness of the developed methodology for planning the training load of taekwondo athletes at the stage of pre-competitive training is also confirmed by the results of athletes' performances at competitions of various levels.

Conclusions

1. The training load at the stage of pre-competition training of taekwondo players is characterized by an emphasis on the development of special endurance. At the same time, about 40% of all training educational and training means (these are mainly special technical and tac-

Table 1

Comparative characteristics of indicators of special endurance of taekwondo players before and after the pedagogical experiment

Name of the test/ indicators	Before the experiment M ± σ	After the experiment M ± σ	P
Six-minute test: Heart rate (bpm) at the fourth minute after the end of the test	128,0 4,8	122,0 4,0	< 0,05
Three-minute test: - time of execution of blows in spurts (sec)	77,1 3,3	71,5 3,0	< 0,05
Three-minute test: pulse sum 3-minute recovery period after performing the test (bpm)	458 29,2	421 18,4	< 0,05
Three-minute test: Pedagogical assessment of hitting technique (scores)	4,2 0,3	4,5 0,2	< 0,05
One-minute test (heart rate beats/min/number of kicks)	3,5 2,7	3,0 2,4	< 0,05
Voltage index (units)	61,0 8,8	54,0 6,8	< 0,05

tical exercises) used in pre-competition training are performed in the glycolytic anaerobic energy supply mode, when the heart rate reaches 200 beats/min.

2. The most optimal duration of the pre-competition mesocycle of taekwondo players' training is 4 weeks or 28 days and includes the following structure: basic microcycle (7 days) – the volume of the load is 40% of the total volume at this stage, the predominant focus of training work is in the mixed aerobic-anaerobic zone; special preparatory microcycle (7 days) – load volume 30%, the predominant focus of work in the glycolytic anaerobic zone (HR up to 200 beats/min); model microcycle (7 days) – total load volume 20%, classes simulate competitive conditions (sparring) and provide for the performance of training load also in the glycolytic anaerobic zone (HR up to 200 beats/min); lead-in microcycle (7 days) – total load volume 10%, one class – sparring, the predominant focus of training load – aerobic nature (HR up to 170 beats/min).

3. To control the effectiveness of planning training load at the stage of pre-competitive training of taekwondo athletes, it is advisable to use the following battery of tests: to assess general physical performance and functional state – PWC170, Baevsky stress index, six-minute test, well-being, activity, mood test; to assess special performance – three-minute test with impacts, one-minute test. The main tests of current control, carried out at the beginning of each microcycle (the first training day – morning session), should be: three-minute test with impacts, one-minute test. And the tests, carried out daily before the start of the next training, include registration of indicators of the athlete's condition – tapping test and tremorometry, which can be used as means of operational control, which allows assessing the condition of athletes directly during the performance of training tasks and immediately after their completion.

4. In the course of experimental studies, it was found that reducing the weight of qualified athletes involved in taekwondo by 2.5 – 3 kg or 3.5 – 4.1% of body weight does not significantly affect the change in strength indicators, but significantly improves speed-strength indicators (dynamic coefficient). Weight loss in athletes by 4-5 kg or more leads to a significant decrease in all the studied indicators. When body weight decreases by 2.5-3 kg, special performance remains practically at the same level, but with a further decrease in weight by 4-5 kg, it statistically significantly worsens, but does not negatively affect the technique of performing blows.

5. Planning the training load at the stage of pre-competition training of taekwondo athletes, tested during a pedagogical experiment, allowed to significantly increase the effectiveness of the training process. After a four-week stage of pre-competition training, athletes improved their special endurance indicators by an average of 9-10% – heart rate at the fourth minute of recovery after performing a six-minute test; time for performing blows in spurts during a three-minute test; pulse sum of a 3-minute recovery period after performing a three-minute test; adaptation coefficient, which is determined by the results of a one-minute test.

In general, the considered data of the analysis of the planning of the training process at the pre-competition stage of preparation can be integrated into the scientific developments of the training and competition processes for the preparation of highly qualified taekwondo athletes to ensure their success in competitions of various levels.

Conflict of interest. The authors declare that there is no conflict of interest.

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