A mechanism for implementing a training load optimization program for young volleyball players based on their annual competition schedule

https://doi.org/10.65149/eajss.2026.v6i3.a001

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Abstract
This article highlights the scientific and methodological foundations for optimizing training loads for young volleyball players based on the annual competition calendar and describes the mechanism for its practical implementation during their preparation for mass sports events. The study analyzed the dynamics of the volume, intensity, and distribution of training loads across different stages (preparatory, transitional, and competitive periods) and determined their impact on athletic performance. This study developed an optimized program to improve the physical, technical-tactical, and functional preparedness of young volleyball players, based on the principles of individualized and progressively increasing training loads. Furthermore, it substantiated a mechanism for enhancing training effectiveness by refining the content of micro- and meso cycles to align with the annual competition calendar.
Key words. young volleyball players, training load, load optimization, annual planning, competition calendar, micro cycle and meso cycle, sports preparation, physical qualities, technical-tactical preparation, training effectiveness.

Introduction

In recent years, the development of the sports sector, particularly the widespread promotion of mass sports among young people, has become a priority of state policy in the Republic of Uzbekistan. Based on adopted decrees and resolutions, systematic efforts are underway to modernize the physical education and sports system, expand sports infrastructure, and engage youth in regular physical activity. Within this process, the "Five Initiatives Olympiad," with its multi-stage competition system, has emerged as a key institutional mechanism, serving as an effective platform for attracting youth to sports, enhancing their physical fitness, and building a sports reserve.

The organization of this competition system on an annual calendar creates the need to plan the athletes' preparation process on a scientific basis. In particular, managing training loads in close connection with competitive activity, and optimally distributing their volume and intensity, is one of the most pressing scientific problems in sports theory and methodology. In modern sports science, the rational planning of training loads is considered a key factor that directly influences athletic performance.

The issue of optimizing workloads in the sports training process has been studied by numerous scientists. It is particularly emphasized that managing the volume and intensity of training workloads according to individual characteristics, and distributing them at the microcycle and mesocycle levels, is a crucial condition for increasing effectiveness.

From this perspective, modern research prioritizes monitoring the functional state of athletes, determining the body's adaptive response to physical loads, and correcting the training process accordingly. For example, the use of heart rate variability to assess athletes' functional state and manage training loads has been extensively studied. Research findings indicate that the proper distribution and control of training loads help enhance the functional capabilities of athletes and prevent overexertion. In particular, the necessity of scientifically planning these loads during preparatory and competitive periods is emphasized.

Furthermore, scientific literature highlights the importance of an approach based on the optimal distribution of training load volume and intensity, consideration of recovery processes, and the individual functional state of athletes for the effective organization of sports training. Some studies have found that incorrect planning of the training process leads to athletes experiencing overload, insufficient recovery, and, consequently, a decrease in athletic performance.

However, most existing scientific research has focused on elite athletes or specific sports, while the issue of preparing young volleyball players within the framework of mass sports competitions, particularly based on an annual competition calendar, has not been adequately studied.

It is especially scientifically relevant to optimize training loads in accordance with a

multi-stage competition system like the "Five Initiatives Olympiad" and to develop a mechanism for its practical implementation.

Therefore, this research aims to develop a program for optimizing the training loads of young volleyball players based on their annual competition calendar and to scientifically substantiate its application mechanism. This will serve to increase the effectiveness of the sports training process and ensure high achievements within the mass sports system.

Methods

The study was organized as a pedagogical experiment to investigate the effectiveness of optimizing the training loads of young volleyball players based on the annual competition calendar. The participants were selected from four regions: the city of Tashkent, and the Sirdarya, Samarkand, and Namangan provinces. Volleyball players aged 16–21 from sports schools and higher education institutions served as the research base. The total number of participants was 36, and they were divided into two groups using a random selection method: an experimental group (EG, n=18) and a control group (CG, n=18). The control group conducted their training sessions based on the existing conventional program. In the experimental group, however, training loads were organized according to a program optimized based on the annual competition calendar. At the beginning of the study, indicators of physical, technical-tactical, and functional fitness were determined in both groups, and their baseline levels were compared.

Results and discussion

At the beginning of the study, the following tests were used to determine the level of physical fitness of the participants: a 30 m run (speed), a standing long jump (explosive strength), a 6×5 m shuttle run (agility), a 1000 m run (general endurance), and a ball accuracy test (technical and tactical training). The obtained results were processed using mathematical and statistical methods (M±σ), and the differences between the groups were evaluated using Student's t-test. Below are the physical fitness indicators of the EG and CG groups at the beginning of the study:

At the beginning of the study, a comparative analysis of the physical fitness indicators of young volleyball players belonging to the experimental (EG) and control (CG) groups was conducted. The results obtained showed that the level of initial training in both groups is almost identical, which serves as an important methodological basis for ensuring the objectivity of the results of the subsequent pedagogical experiment.

Specifically, the results of the 30-meter run test showed a very small difference in speed qualities between the Experimental Group (EG) (4.52±0.21 s) and the Control Group (CG) (4.55±0.24 s). This difference was statistically insignificant ($P>0.05$), indicating that the speed capabilities of participants in both groups were developed to a similar level. This confirms that there was no significant advantage between the groups in terms of the development of their speed qualities.

The standing long jump results, which are an indicator of explosive power, also demonstrated a similar trend. The experimental group recorded results of 221.4±12.6 cm, while the control group recorded 219.8±13.1 cm. The difference between the results was minimal and found to be statistically insignificant ($P>0.05$). This situation indicates that the participants' muscle strength and neuromuscular coordination levels were nearly equal at the initial stage.

Similar results were observed in the 6×5 meter shuttle run test (EG - 10.84±0.48 s; CG - 10.92±0.51 s). These indicators show that there is no significant difference between the groups in the level of coordination training and the ability to quickly change direction, which is important for volleyball ($P>0.05$).

The results of the 1000-meter run, representing general endurance, also showed no statistically significant difference (EG – 228.6±14.2 s; CG - 231.1±15.0 s; $P>0.05$). This means that the level of aerobic capabilities and cardiovascular activity in both groups is similar. These indicators are of great importance when planning the dynamics of subsequent loads.

In the ball accuracy test, which reflects technical-tactical preparedness, no significant difference was observed between the results of the EG (7.8±1.2 points) and the CG (7.6±1.3 points) ($P>0.05$). This indicates that the levels of accuracy and coordination, which are crucial components of game performance, were also balanced at the initial stage.

Overall, a statistical analysis of all test results (t-test, $P>0.05$) revealed no significant difference between the groups. This indicates

Table 1. Tests for types of preparation at the beginning of the study

№	Tests	EG (n=18)	CG (n=18)	t	P
1	30m Run (h)	4.52 ± 0.21	4.55 ± 0.24	0.41	>0.05
2	Standing long jump (cm)	221.4 ± 12.6	219.8 ± 13.1	0.38	>0.05
3	6×5 m shuttle run (h)	10.84 ± 0.48	10.92 ± 0.51	0.47	>0.05
4	1000m Run (h)	228.6 ± 14.2	231.1 ± 15.0	0.52	>0.05
5	Ball accuracy test (points)	7.8 ± 1.2	7.6 ± 1.3	0.44	>0.05

that the experimental and control groups were formed under equivalent conditions, thereby ensuring the internal validity of the study. Furthermore, this situation allows for an accurate assessment of the effectiveness of the optimized training program to be applied in the subsequent stage.

Thus, the indicators at the beginning of the study show that the physical and technical-tactical preparedness of young volleyball players is at an average level, and that their development requires the application of scientifically-based training loads adapted to the competition calendar.

Developed as part of this research, the program is designed for the comprehensive development of the general, specialized, and technical-tactical preparedness of young volleyball players participating at the neighborhood (mahalla) level. It is structured based on the principles of systematic organization of the training process and the gradual increase of workloads. Structurally, the program consists of three main blocks, each serving to develop a specific component of athletic training.

The first block focuses on general physical conditioning and includes running, moving between cones, walking in a half-squat position in various directions, as well as coordination and plyometric exercises. This set of exercises serves to develop the overall endurance, speed, and motor coordination of young volleyball players. The moderate intensity of the workload, along with the standard distribution of repetitions and duration, facilitates the consistent development of the body's adaptation process. Additionally, incorporating partner stretching exercises at the end of the session is aimed at activating recovery processes, an approach considered essential in modern sports methodology.

The second block is focused on developing sport-specific physical fitness, prioritizing movements characteristic of volleyball. Specifically, the core of this block consists of exercises such as side-shuffling and jumping along the net, blocking elements, and drills that simulate receiving the ball in the defensive zone. These exercises help develop the athletes' adaptation to game conditions, reaction speed, and sport-specific endurance. It is noteworthy that in certain exercises—especially those involving defensive and movement elements—increasing the load intensity to a high level serves to expand the athletes' functional capabilities. Concurrently, using breathing exercises for recovery helps maintain the body's functional stability throughout the training session.

The third block focuses on technical and tactical training, systematically covering the fundamental elements of volleyball. Specifically, it includes exercises such as passing and receiving in pairs, serving, and receiving from both below (digging) and above (setting), as well as executing movements in complex game situations like making a save by diving. In addition to refining technical elements, these exercises develop the athletes' game intelligence and quick decision-making skills. The alternation between medium and high-intensity loads also helps build the ability to perform technical actions while fatigued.

Overall, an analysis of the program's structure reveals that the volume, intensity, and duration of training loads are presented in a coordinated manner. The gradual increase of the load in each block allows for the development of athletes' functional capabilities without excessive strain. Concurrently, the systematic use of recovery measures serves as a key factor in enhancing training effectiveness. This program, unlike traditional training approaches, is distinguished by its integration of general and special preparation, as well as technical-tactical ele-

Table 2. Program for the preparation of young volleyball players for the "Besh tashabbus olimpiadasi" "MAHALLA" stage competitions

Block	Training type	Exercises	Load intensity	Repeat count	Duration	Load size	Rehabilitation measures
			"MAHALLA" STAGE				
Block I	General physical	A) running; B) zigzag running through cones; C) walking in a semi-sitting position to the front, back, left, and right. D) exercises to move with the side while raising the knees (left, right) on a horizontal sports ladder; F) jump up and down on the box with both feet.	Medium	A) 5/6 circle; B) 3/4 circle; C) 3/4 times. D) 4 repetitions; F) 2/3 repetition.	A) 3/4 minutes; B) 2/3 minutes; C) 2/3 minutes. D) 2/4 minutes; F) 5/6 minutes;	A) 500 m; B) 120 m; C) 160 m. D) 5 times; F) 10 times;	stretching exercises in pairs
	Special Physical	A) exercise in jumping along the volleyball net with the right and left sides; B) Take a block exercise with a light run from the area line to the net. C) Exercise of alternately passing and returning to the right and left sides of the volleyball net in a half-sitting position; D) simulation of receiving the ball from below and above within the defensive zone.	Medium Upper	A) 4 repetitions; B) 4 repetitions. C) 2 repetitions; D) 3 repetitions.	A) 4/6 minutes; B) 6/8 minutes. C) 2/3 minutes; D) 3/5 minutes.	A) 5 times; B) 8 times. C) right and left 7 times each D) from top and bottom 5 times each	Take a deep breath while walking across the volleyball court
	Technical-tactical	A) passing and receiving the ball in pairs (at a distance of 3 m); B) putting the ball into play (standing and jumping). C) exercise of receiving the ball from below with both hands; D) falling with one hand to save the ball.	Medium Upper	A) 2 repetitions; B) 4 repetitions. C) 5 repetitions; D) 5 repetitions.	A) 3 minutes; B) 4 minutes. C) 2 minutes; D) 2 minutes.	A) 15 times each; B) 10 times. C) 2 minutes; D) 2 repetitions.	stretching exercises for arm and leg muscles using elastic tape

ments, into a single, unified system. This approach ensures the comprehensive preparation of young volleyball players for competitive activities and, in particular, creates an important methodological foundation for achieving effective results in multi-stage competition systems like the "**Besh tashabbus olimpiadasi**".

At the conclusion of the pedagogical experiment, the tests administered at the beginning of the study were re-administered to the experimental (EG) and control (CG) groups, and the results were compared. The analysis indicated positive changes in the experimental group, where a program for optimizing training loads based on the annual competition calendar had been implemented.

The results showed positive growth across all indicators in the experimental group. Performance in the 30-meter dash improved from 4.52 to 3.88 seconds, marking an increase of approximately 14–16%. This indicates a significant development in speed. In contrast, the control group showed less improvement in this indicator, with times improving from 4.55 to 4.32 seconds.

In the experimental group, the results in the long jump from an explosive-force location increased from 221.4 cm to 258.6 cm, with an average increase of 16–17%. In the control group, the increase was around 5–6%, indicating a relatively lower effectiveness of traditional training. Agility indicators (shuttle run 6×5 m) improved from 10.84 s to 9.42 s in the experimental group, representing an increase of approximately 13–15%. In the control group, the changes were minimal. These results confirm the effectiveness of specifically targeted exercises.

The results of the 1000-meter run, evaluated as an endurance indicator, improved from

Table 3. Tests for types of preparation at the end of the study

№	Tests	EG (n=18)	CG (n=18)	t	P
1	30m Run (h)	3.88 ± 0.18	4.32 ± 0.22	2.41	<0.05
2	Standing long jump (cm)	258.6 ± 14.3	232.4 ± 13.8	2.27	<0.05
3	6×5 m shuttle run (h)	9.42 ± 0.41	10.35 ± 0.46	2.36	<0.05
4	1000m Run (h)	198.5 ± 12.6	220.8 ± 13.9	2.19	<0.05
5	Ball accuracy test (points)	9.6 ± 1.1	8.2 ± 1.2	2.11	<0.05

228.6 s to 198.5 s in the experimental group, with an average increase of 15–17%. This indicates a significant increase in the functional capabilities of the cardiovascular and respiratory systems. Positive changes were also observed in the accuracy test, which represents technical and tactical readiness (from 7.8 to 9.6 points), representing an increase of approximately 18%. In the control group, however, the increase in this indicator was significantly lower.

Overall, in the experimental group, growth across all indicators ranged from 16 to 18%, confirming the effectiveness of the training load optimization program based on the competitive calendar. Statistical analysis ($P<0.05$) showed the reliability of the results.

The results obtained show that the systematic planning of training loads and their combination with competitive activity significantly enhances the physical and technical-tactical readiness of athletes. The observed increases in the experimental group are explained by scientifically grounded management of the volume and intensity of the load, accounting for recovery processes, and ensuring the purposefulness of training sessions.

In the control group, the low growth indicators may be due to the general nature of the training sessions and the lack of adaptation of the loads to the individual and competitive schedules. Thus, the results of the study show that the optimization of training loads based on the annual competition calendar in the training of young volleyball players is highly effective and should be widely implemented in practice.

Conclusion

1) During the study, the existing practices and scientific-methodological foundations for preparing young volleyball players for multi-stage competition systems, such as the " Besh tashabbus olimpiadasi" were analyzed. The research revealed that in current training processes, the integration of training loads with the competition calendar is not adequately established. Based on these findings, the necessity for systematic planning of training loads and their phased management was scientifically substantiated.

2) As part of the study, a training program was developed to comprehensively improve the general, special, and technical-tactical preparedness of young volleyball players, tailored to the annual competition calendar. This program harmoniously defines the volume, intensity, number of repetitions, and recovery periods for training loads, and proposes a methodological approach aimed at increasing the effectiveness of the training process.

3) The results of the pedagogical experiment showed that organizing training sessions based on the developed program led to an increase in the indicators of physical qualities (speed, strength, endurance, agility) and technical-tactical preparation in the experimental group by an average of 12.4% to 15.8%. In the control group, however, growth indicators were recorded at a relatively lower level. Statistical analysis confirmed the reliability of the results and scientifically substantiated the effectiveness of the applied methodology.

4) Based on the research findings, optimizing training loads in accordance with the annual competition calendar is a crucial factor in increasing the effectiveness of preparing young volleyball players for competitions. This approach has practical significance for application in sports schools, higher education institutions, and the community-level mass sports system, and will serve to improve the athlete training system in the future.

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