Scientific and methodological foundations and effectiveness of applying the training macrocycle in the preparation process of para table tennis players

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Abstract

This study focuses on scientifically organizing the training process for young para table tennis athletes, planning and individualizing their physical and technical-tactical preparation within the framework of a macrocycle. The work substantiates the need to standardize training loads, taking into account the specific characteristics of para table tennis, sports classification, age, gender, and differences in functional capabilities.

During the research, a scientific and methodological approach was proposed aimed at monitoring athletes' physical development level and functional state, developing a mechanism for constructing a training macrocycle, and determining the ratios of general, special physical, and technical preparation. The annual macrocycle structure was divided into preparatory, special preparatory, pre-competition, competition, and transition periods, with their content and tasks systematized according to the preparation level of para table tennis athletes. It has been scientifically justified that during the preparatory period, 60% of training loads should be directed towards general physical preparation, 20% towards special physical preparation, and 20% towards technical preparation.

The results of the pedagogical experiment demonstrated that utilizing a specially developed set of exercises significantly improves athletes' indicators of speed, agility, movement coordination, strength, and overall endurance. It was determined that planned workloads based on an individualized approach serve to stabilize functional state, reduce the risk of excessive fatigue and injuries, and increase motivation for training.

The research findings indicate the necessity of ensuring the integration of physical and technical-tactical preparation in the long-term training system for para table tennis athletes. The proposed methodology has scientific and practical significance for application in sports schools, specialized parasports centers, and coaches' practices.

Keywords: Adaptive physical education and sport, para table tennis, stretching, exercise complex, sports classification, nosology, program, plan, physical preparation, means and methods, technical techniques, pre-competition training cycle, training process.

Introduction

On a global scale, extensive scientific research is being conducted on the formation of technical and tactical training of young para table tennis players at the initial stage of preparation, the development of physical qualities specific to para table tennis, and the improvement of their technical training based on the use of special means, taking into account the age characteristics of young players. Scientific and methodological work is being carried out to improve the functional state and level of physical fitness in training sessions with para table tennis players. However, technologies aimed at normalizing the load on para-athletes during training using a special set of exercises, taking into account their sports classifications and different individual status, age, gender, and physical fitness indicators, have not been sufficiently studied. This necessitates the improvement of scientific and practical research on planning training sessions to enhance the physical fitness of table tennis players.

The aim of the research: To develop proposals and recommendations for the macrocycle of the training process of para table tennis players.

Research objectives:

1. Monitoring and analysis of table tennis players' preparation;
2. Mechanism for constructing a training macrocycle for table tennis players.

Research tasks: To achieve the set goal, the following tasks were carried out:

Analyze the specific characteristics of para table tennis and the requirements for physical fitness based on scientific literature;

Determine the level of physical development and functional state of para table tennis athletes;

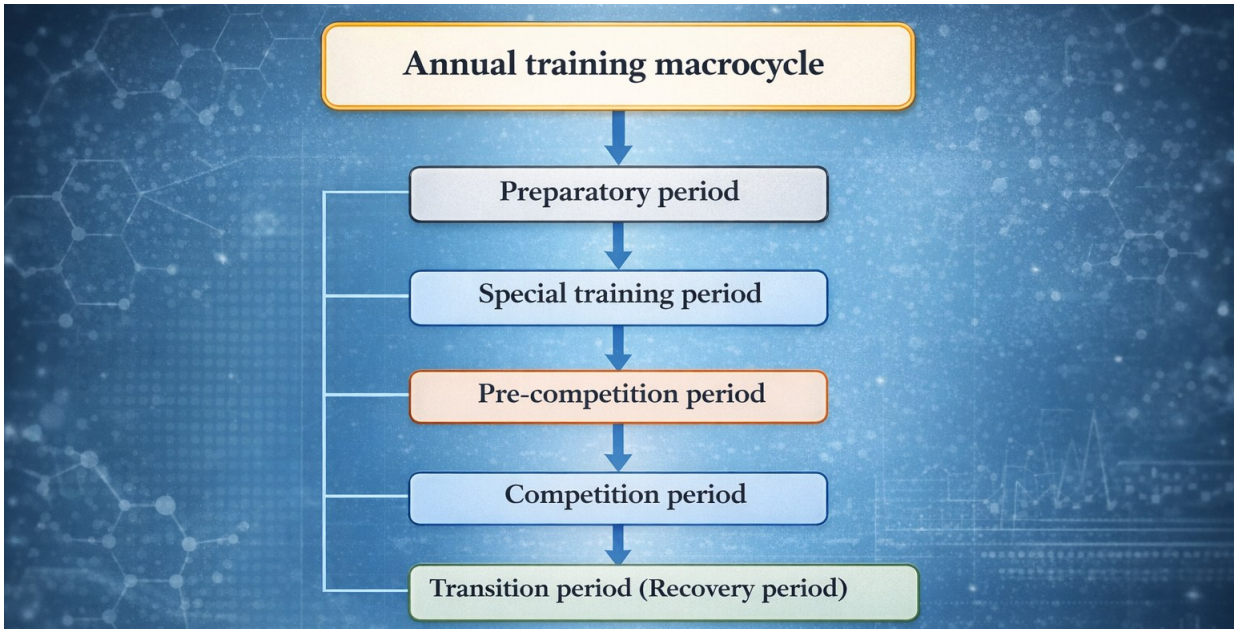
Plan training loads, taking into account the sports classification, age, gender, and individual capabilities of athletes;

Develop a set of special exercises aimed at improving physical qualities;

Assess the effectiveness of the developed training methodology through practical experiments.

Methods

Fig 1. Structural view of the annual macrocycle in preparing para table tennis players for sports qualification



This study employed a comprehensive scientific and methodological approach aimed at determining the effectiveness of organizing the training process based on a macrocycle and improving the physical and technical-tactical preparation of young athletes engaged in para table tennis. The research utilized theoretical, pedagogical, physiological, and mathematical-statistical methods. In the theoretical stage of the study, scientific and methodological literature on para table tennis, recommendations from international parasports organizations, and existing concepts for planning the training process were analyzed. Based on this analysis, the requirements for physical fitness of para table tennis players, characteristics of sports classification, and criteria for individualizing training loads were determined. In the empirical stage, methods of pedagogical observation, pedagogical experimentation, testing, and functional diagnostics were applied. To assess the level of athletes' physical development, a set of special tests was developed and implemented to evaluate indicators of speed, agility, coordination, strength, and general endurance. Functional status was assessed through cardiovascular system indicators, post-training recovery rate, and fatigue level.

A series of rotational movements have been developed to ensure the effectiveness of technical and tactical techniques used in table tennis training. A sequence of tasks to be observed in para-sport training has been established, aimed at planning sessions to improve physical fitness, optimally selecting initial training methods for technical movements, determining the structure of main deceptive passes, and identifying the fundamental structures of para-table tennis dynamics. These serve to comprehensively increase and develop the level of physical fitness in accordance with a movement strategy for complex strikes.

Result and discussion

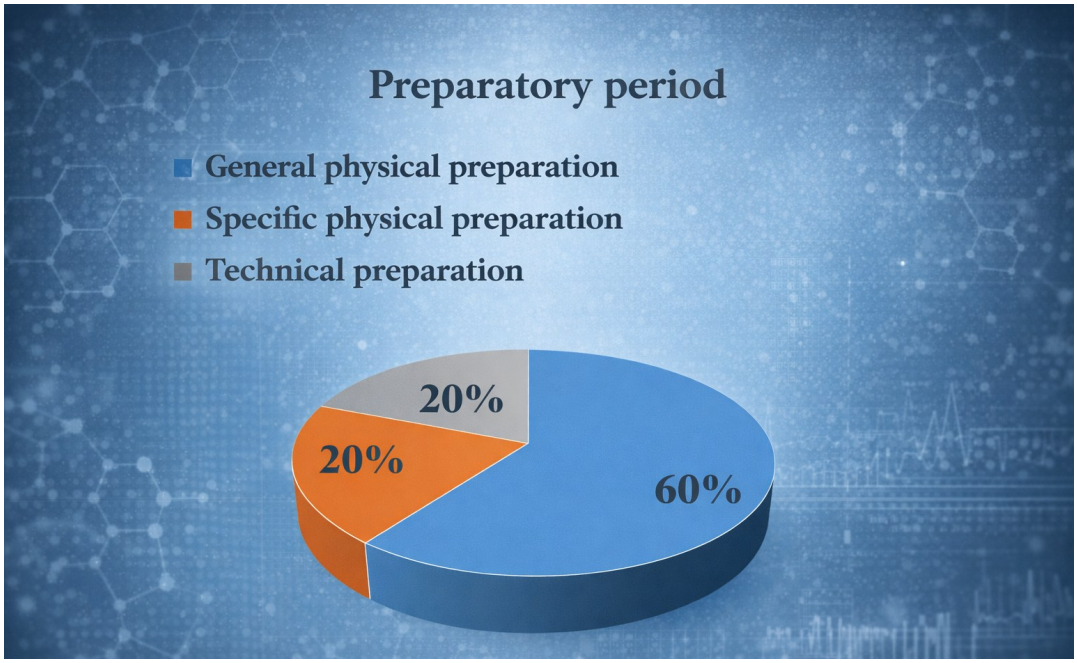
During the study, a basic system for structurally organizing training process periods was created to help table tennis players achieve high sports results in modern conditions of intense competition. This system encompasses all types of sports training and their specific combinations and content.

Based on theoretical developments and their verification in preliminary experiments, we developed annual macrocycles for table tennis players. In this case, given the intensive calendar of annual competitions and strict limitations on training time, it was determined that the studied structure for constructing these periods should have a specific combination of training types corresponding to the set tasks.

A structural element of the annual macrocycle has been developed for training para table tennis players. The structural variant of the annual macrocycle for this preparatory process is presented in Figure 1.

As shown in Figure 2, the annual stage (macrocycle) of the para table tennis training

Fig 2. Estimated ratio of training volume in various priority areas during the preparatory period of the annual macrocycle for para table tennis players



process is divided into several relatively independent yet interconnected periods: preparatory, special preparatory, pre-competition, competition, and transition. Their duration corresponds to the parameters of meso - and microcycles of varying lengths. It should be noted that according to the structure shown in Figure 2, all annual macrocycles appear externally identical. However, in parasports training, they naturally differ from each other in structure and objectives. Additionally, their dialectical differences, as well as the level of development in parasports training, have certain quantitative and qualitative continuity. In the subsequent stage, the level of training type surpasses that of the previous stage.

The optimal percentage distribution for various types of training during the preparation periods of para table tennis athletes has been established. According to this distribution, the preparatory period focuses on developing general and special physical training as well as technical training, allocated in specific percentage ratios (see Figure 2).

As shown in the figure above, the preparatory period for para table tennis players is allocated as follows: 60% for general physical training, 20% for special physical training, and 20% for technical training. Thus, the preparatory period of the sports training process consists of general physical, special physical, and technical training. Based on the time allocated to these types of training, they are considered fundamental preparation types for each subsequent macrocycle.

This clearly shows the types of preparation and their distribution in terms of time allocation during the preparatory period of the first training stage. As can be seen from Figure 3.3, the volume distribution of sports preparation types in the preparatory period is not uniform. Thus, during this period, the main volume of para table tennis training - up to 60% of the time - was allocated to general physical preparation. This was based on the need to develop and improve strength, speed-strength abilities, movement speed, and overall coordination during this period. At the same time, a slightly smaller volume of training - up to 20% - is allocated to special physical preparation, which includes developing coordination abilities specific to para table tennis techniques. The same volume - up to 20% - of para table tennis training is dedicated to the technical preparation of para table tennis players. During the preparatory period, the content of general physical preparation, special physical preparation, and technical preparation included technical methods for ball passing, attacking, and defending in future game situations.

In conclusion, the results of the conducted research demonstrated that utilizing a specially developed set of exercises in the training process with para table tennis athletes significantly improves their physical fitness indicators. Specifically, an increase in speed

and movement coordination levels, as well as improvements in muscle strength and overall endurance indicators were observed in the athletes.

Furthermore, training loads tailored to individual capabilities led to the stabilization of the athletes' functional state, resulting in a reduction of excessive fatigue and injuries during the training process. This increased the athletes' interest in training and ensured a steady growth in their sports performance.

The results of the conducted scientific research demonstrated that improving the physical fitness of athletes engaged in para table tennis is a complex and multifaceted process, requiring a scientifically grounded, systematic, and individualized approach to training planning. Para table tennis athletes belong to various sports classifications, and their physical capabilities, functional states, motor activities, and adaptation levels differ significantly from one another. Consequently, the application of traditional training methods does not always yield high effectiveness. Based on the research results, it was determined that a specially developed set of exercises, taking into account the athletes' age, gender, sports experience, level of physical fitness, and functional state, positively impacts the development of their physical qualities, particularly speed, agility, movement coordination, strength, and overall endurance. Additionally, the individualization of training loads helped prevent excessive strain on the athletes' bodies, reduce fatigue levels, and increase motivation for training.

Conclusion

The results of the pedagogical experiment demonstrated that employing a scientifically grounded training methodology stabilizes athletes' functional state, enhances the efficiency of motor activities, and significantly reduces the risk of injury during training sessions.

This factor is crucial for the gradual improvement of athletic prowess in athletes' long-term preparation process. Furthermore, the findings obtained during the study indicated that in the training process for para table tennis players, physical preparation should be organized in close integration with technical and tactical training. An increase in physical fitness levels ensures the precision and consistency of technical movements, enabling the achievement of high athletic performance in competitive activities. Overall, the results of this study hold scientific and practical significance for planning the training process to enhance the physical preparedness of para table tennis athletes. This methodology can be implemented in sports schools, specialized sports centers, and by coaches involved in parasports. Future scientific research in this field will serve to further increase the effectiveness of the training process, provide a deeper understanding of individualized approach mechanisms, and improve the system for training para table tennis athletes.

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