THE EFFECT OF BIOLOGICAL MATURATION ON PHYSICAL FITNESS AND FUNCTIONAL CAPABILITIES IN 13–14-YEAR-OLD VOLLEYBALL PLAYERS

Toyirova Zulfina Gaybulla kizi
First-year Master's candidate at Bukhara State Pedagogical Institute

Abstract. *This article scientifically analyzes the impact of biological development level on the physical fitness indicators of 13–14-year-old volleyball players. During adolescence, rapid changes in the morpho-functional characteristics of the organism lead to significant differences in sports performance and the development of physical qualities. The study reveals the relationship between biological age, physical fitness, and functional capabilities. The results highlight the necessity of an individual approach when working with young athletes.*

Keywords: *biological development, biological age, physical fitness, volleyball, adolescents, functional capabilities, sports training, ontogenesis*

Introduction

Currently, one of the pressing issues in sports pedagogy and the system of physical education is the scientific organization of the training process for young athletes. Modern sports practice shows that achieving high athletic performance depends not only on the volume and intensity of training but also directly on taking into account the individual biological characteristics of athletes. Therefore, the application of differential and individualized approaches in working with young athletes is of great importance. Particularly during adolescence, differences in the rate of biological development significantly influence sports performance. At this stage, some adolescents mature biologically earlier, while others develop more slowly. As a result, among athletes of the same chronological (passport) age, there are considerable differences in physical qualities, functional capabilities, and work capacity. This situation reduces the effectiveness of training processes organized based on a standardized approach. The age of 13–14 represents a period of intensive growth and development in the human body and is characterized by the active progression of puberty. During this stage, the musculoskeletal system develops intensively, muscle mass increases, bone length grows rapidly, and the locomotor system strengthens. At the same time, the cardiovascular system improves functionally, increasing stroke volume and the efficiency of blood circulation. The development of the respiratory system leads to an increase in lung vital capacity and improves the oxygen supply to the body.

Main part

Physiological changes create an essential foundation for the development of physical qualities such as strength, speed, endurance, and coordination abilities. In volleyball, in

particular, jumping ability, speed of movement, reaction time, and coordination play a decisive role, and their development directly depends on the level of biological maturation.

Therefore, differences between biological and chronological age lead to significant variations in physical fitness levels. Athletes who mature earlier biologically usually demonstrate higher physical performance and adapt more easily to training loads. In contrast, athletes with slower biological development may lag behind in the development of physical qualities, which can lead to potential errors in evaluating their athletic performance.

Scientific studies indicate that relying solely on chronological age in the selection and training of young athletes is insufficient. It is necessary to conduct a comprehensive analysis of biological development indicators, including anthropometric measurements, functional tests, and physiological parameters. This approach allows for identifying individual development trajectories and designing appropriate training programs.

The purpose of this study is to determine the effect of biological development level on the physical fitness indicators of 13–14-year-old volleyball players, to analyze their interrelationships, and to develop scientific and practical recommendations for improving the training process.

The level of biological development reflects the functional and morphological condition of the human body. In adolescent athletes, these indicators are assessed through body height, body mass, muscle strength, and cardiovascular system capabilities. Research shows that biologically advanced athletes typically have the following advantages:

- ✓ higher strength and speed indicators;
- ✓ better endurance levels;
- ✓ faster development of coordination abilities.

Conversely, in athletes with relatively slower biological development, the formation of physical qualities may be delayed. However, this does not indicate lower future potential but is rather a time-dependent process.

In volleyball, the following physical qualities are particularly important:

- ✓ speed and jumping ability;
- ✓ strength and endurance;
- ✓ movement coordination.

It has been observed that 13–14-year-old volleyball players with a higher level of biological development demonstrate greater jumping height, faster movements, and higher game efficiency. At the same time, it is important for coaches to consider biological age when planning training sessions. Training programs based on an individual approach ensure effective development of athletes without excessive physical strain.

Conclusion

The results of the study indicate that the level of biological development in 13–14-year-old volleyball players directly affects their physical fitness indicators and functional capabilities. Athletes who mature biologically earlier tend to demonstrate higher levels of

strength, speed, and coordination, which positively influence their overall sports performance. However, such advantages are often temporary and do not necessarily guarantee long-term superiority in athletic development. At the same time, athletes with a slower rate of biological maturation may initially show lower physical performance, but with properly organized training and sufficient time for development, they are capable of achieving equally high or even superior results in the future. Therefore, it is essential to avoid premature conclusions when evaluating young athletes solely based on their current performance indicators. In this regard, coaches should carefully consider the individual biological characteristics of each athlete when organizing the training process. Special attention should be paid to factors such as growth rate, functional readiness, and adaptation to physical нагрузка (loads). The implementation of an individualized approach allows for the optimal distribution of training loads, prevention of overtraining, and reduction of injury risks.

Furthermore, taking into account biological maturity contributes to more effective talent identification and long-term athlete development. Training programs designed on the basis of individual characteristics not only enhance performance outcomes but also support the harmonious physical and functional development of young athletes.

Thus, an individualized and scientifically grounded approach to training ensures the healthy development of adolescent volleyball players and promotes a stable and sustainable improvement in their sports performance over time.

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