



DEVELOPMENT OF SPEED-STRENGTH ABILITIES OF UNIVERSITY STUDENTS THROUGH VOLLEYBALL TRAINING

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Abstract. *This study examines the effectiveness of volleyball training in developing speed-strength abilities among university students. The research analyzes contemporary scientific approaches to the application of volleyball within higher education physical education programs. Special attention is given to the influence of volleyball-specific exercises on explosive power, movement speed, jumping performance, and overall physical preparedness. The findings demonstrate that systematic volleyball training contributes to significant improvements in speed-strength indicators, motor performance, and students' engagement in physical activity. The results confirm the pedagogical effectiveness of volleyball as a means of optimizing physical education in higher education institutions.*

Keywords: *volleyball, university students, speed-strength abilities, explosive strength, physical fitness, volleyball training, higher education, physical education.*

Introduction. In recent years, the problem of improving the physical preparedness of university students has become one of the priority areas in the theory and methodology of physical education. The modernization of higher education, rapid technological development,

increased academic demands, and the predominance of sedentary lifestyles among young people have significantly reduced students' habitual motor activity [1, 3]. These factors contribute to deterioration in physical fitness, decreased functional capabilities of the body, and reduced motivation toward regular participation in physical education and sports activities [4].

Contemporary scientific research indicates that one of the most important components of students' physical preparedness is the development of speed-strength abilities. Speed-strength qualities are understood as the capacity to perform motor actions requiring the manifestation of considerable muscular effort within minimal time intervals [1, 2, 5]. These abilities are directly associated with explosive power, acceleration capacity, reaction speed, jumping performance, and movement efficiency.

In the context of higher education physical training, the development of speed-strength abilities is considered an essential prerequisite for enhancing students' functional preparedness, physical performance, and adaptive potential. Researchers emphasize that insufficient development of explosive strength and movement speed negatively affects not only sports performance but also the overall physical condition and motor competence of university students [7, 8, 10].

Among various means used in physical education, volleyball occupies a special place due to its dynamic nature, accessibility, and multidimensional training effects. Volleyball training requires repeated execution of explosive movements, including vertical jumps, rapid accelerations, sudden decelerations, multidirectional movements, and technically coordinated actions performed under time pressure. Such

characteristics make volleyball a highly effective tool for developing speed-strength abilities [6, 9].

A review of scientific literature demonstrates that volleyball-specific training positively influences explosive lower-limb strength, movement speed, reaction time, agility, and neuromuscular coordination. Regular volleyball practice promotes adaptations in muscular power output, coordination efficiency, and movement control. Furthermore, volleyball contributes to students' motivation, teamwork skills, and sustained participation in physical activity.

Despite the increasing number of studies devoted to volleyball training and student physical education, the issue of developing speed-strength abilities of university students through volleyball remains insufficiently explored. Existing investigations often focus on elite athletes or isolated aspects of performance enhancement, while the pedagogical effectiveness of volleyball training in the university educational environment requires further scientific substantiation.

The purpose of this study was to determine the effectiveness of volleyball training in the development of speed-strength abilities among university students.

Materials and Methods. To accomplish the objective of the study, a combination of complementary research methods was applied to ensure an objective evaluation of the effectiveness of volleyball training in developing speed-strength abilities among university students.

The study involved 60 first- and second-year university students aged 18-21 years who regularly attended physical education classes and had no medical contraindications for participation in sports activities. The participants were divided into two groups: a control group (n=30) and

an experimental group (n=30). The distribution of students was carried out taking into account age, health condition, and initial indicators of physical preparedness.

The pedagogical experiment lasted for one academic semester (16 weeks). Students in the control group participated in traditional physical education classes based on the standard university curriculum, including general physical conditioning exercises, athletics elements, flexibility training, and general endurance development.

In contrast, the experimental group followed a volleyball-based training program designed specifically to enhance speed-strength abilities. The program incorporated volleyball-specific exercises aimed at improving explosive power, movement speed, jumping ability, agility, and neuromuscular coordination.

The experimental program emphasized specialized volleyball exercises involving repeated jumping actions, rapid multidirectional movements, acceleration-deceleration drills, medicine ball exercises, plyometric training, reaction-based activities, and competitive game situations. Particular attention was given to technical elements closely associated with explosive muscular performance, including attacking jumps, blocking movements, jump serves, defensive displacement techniques, and rapid positional transitions.

The following research methods were used during the study:

1. Analysis of scientific and methodological literature. Theoretical analysis was conducted to examine contemporary scientific approaches related to speed-strength development, volleyball training methodology, and physical education in higher education institutions.

2. Pedagogical observation. Systematic observation was employed to assess students' participation levels, movement quality, exercise execution, and behavioral responses during training sessions.

3. Pedagogical testing of speed-strength abilities.

To evaluate the effectiveness of the intervention, standardized physical performance tests were administered before and after the experimental period:

- standing long jump - assessment of explosive lower-limb power;
- vertical jump test - evaluation of jumping ability and explosive strength;
- 30-meter sprint - measurement of movement speed;
- shuttle run 4×9 m - assessment of agility and coordination speed;
- medicine ball throw (3 kg) - evaluation of upper-body explosive strength.

4. Statistical analysis.

The obtained data were processed using methods of mathematical statistics. Mean values (M), standard deviations (SD), and percentage changes were calculated. The statistical significance of differences between the control and experimental groups was determined using Student's t-test. Differences were considered statistically significant at $p < 0.05$.

Results and Discussion. The analysis of the results obtained during the pedagogical experiment demonstrated the positive influence of volleyball training on the development of speed-strength abilities among university students in the experimental group.

Following the completion of the experimental program, students participating in volleyball-based training showed statistically significant

improvements in most of the investigated speed-strength indicators compared both with their baseline data and with the results of the control group. The most substantial changes were observed in explosive lower-limb power, movement speed, jumping performance, and agility.

The results of physical testing revealed that standing long jump performance in the experimental group increased by an average of 12.4%, whereas the corresponding improvement in the control group reached only 4.8%. Similarly, vertical jump performance demonstrated a notable increase of 14.1% in the experimental group compared to 5.2% in the control group. These findings indicate the effectiveness of volleyball-specific exercises in stimulating explosive muscular contractions and enhancing lower-limb power output.

Positive changes were also identified in movement speed indicators. In the 30-meter sprint test, students of the experimental group reduced their running time by 6.7%, while the control group showed an improvement of 2.5%. The shuttle run (4×9 m) results demonstrated improved agility and coordination speed: completion time decreased by 8.3% in the experimental group compared with 3.1% in the control group.

The medicine ball throw test also revealed significant improvements in upper-body explosive strength. Students in the experimental group increased throwing distance by 10.9%, whereas participants in the control group improved by only 3.9%. This outcome may be explained by the regular implementation of volleyball-specific movements involving explosive arm actions, serving techniques, attacking motions, and specialized strength exercises incorporated into the training program.

The observed positive dynamics can be attributed to the physiological and biomechanical characteristics of volleyball activity. Volleyball requires repeated execution of high-intensity explosive actions performed under conditions of limited time and rapidly changing movement situations. Frequent jumping, acceleration, blocking, attacking, and quick defensive reactions create favorable conditions for stimulating neuromuscular adaptation and developing speed-strength capabilities.

From a pedagogical perspective, the results suggest that volleyball training represents an effective educational technology for optimizing the physical preparation of university students. Beyond its direct influence on speed-strength abilities, volleyball promotes active participation, emotional engagement, teamwork, and sustained motivation toward physical education.

At the same time, it should be acknowledged that the effectiveness of volleyball-based speed-strength training depends on several pedagogical and methodological factors, including training load regulation, exercise selection, instructional quality, students' individual characteristics, and duration of intervention. Therefore, scientifically grounded programming and systematic pedagogical supervision remain essential conditions for achieving optimal training outcomes.

Future research may focus on investigating the long-term effects of volleyball-specific speed-strength programs on functional readiness, neuromuscular adaptation, injury prevention, and academic performance among higher education students.

Conclusions. The present study demonstrated that volleyball training is an effective means of developing speed-strength abilities

among university students within the system of higher education physical training.

The results of the pedagogical experiment confirmed that systematic volleyball practice contributes to significant improvements in explosive strength, jumping performance, movement speed, agility, and coordination abilities. Students participating in the volleyball-based training program showed greater positive changes in speed-strength indicators compared with those following the traditional physical education curriculum. It was established that volleyball-specific exercises involving repeated jumping actions, rapid multidirectional movements, acceleration-deceleration patterns, and explosive technical elements create favorable conditions for stimulating neuromuscular adaptation and improving muscular power output. These findings highlight the important role of volleyball in enhancing students' overall physical preparedness.

The study also confirmed the pedagogical value of volleyball as an educational technology capable of increasing students' engagement in physical activity and strengthening motivation toward participation in physical education classes. The dynamic, emotionally attractive, and competitive character of volleyball promotes sustained involvement in training activities and supports the development of teamwork, discipline, and active lifestyle habits.

The obtained findings allow us to conclude that the broader implementation of volleyball-based training programs in higher education institutions is scientifically justified and pedagogically effective for improving students' speed-strength preparedness. Future investigations may focus on examining the long-term influence of

volleyball training on functional fitness, neuromuscular performance, injury prevention, stress resistance, and professional-personal development among university students.

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