

THE CONTRIBUTION OF VOLLEYBALL-SPECIFIC METHODS TO THE DEVELOPMENT OF EXPLOSIVE STRENGTH IN HIGH SCHOOL STUDENTS

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Abstract. The study aims to highlight the contribution of volleyball-specific methods to the development of explosive strength in high school students aged 14 to 16. Volleyball, integrated into physical education lessons, represents an attractive and effective means of stimulating fundamental motor skills. The purpose of the research is to demonstrate that exercises such as attacking and blocking jumps, quick movements, and ball reactions can develop students' ability to generate force in a short period of time. The objectives include: analyzing the biopsychomotor characteristics of the students, selecting exercises that impact explosive strength, applying them in lessons, evaluating progress through motor tests, and formulating recommendations for teachers. The research hypothesis is that the consistent use of volleyball-specific methods leads to a significant improvement in explosive strength compared to traditional methods. The results confirm the major role of volleyball in developing explosive strength, as well as in increasing students' motivation for physical activity. Specific exercises contribute to visible motor progress and to the creation of an engaging educational environment.

Introduction. The analysis of the specialized literature highlights that adolescence, between the ages of 14 and 16, represents an optimal period for the development of explosive strength due to rapid growth, maturation of the neuromuscular system, and the capacity to learn complex movements [2, 4, 13]. Explosive strength is important in volleyball, manifesting through vertical and horizontal jumps, quick movements, and arm strikes [5, 10, 20]. It depends on

physiological, neuromuscular, and psychological factors, which must be stimulated through progressive exercises adapted to the level of training [24, 27]. Plyometric, ballistic, and combined methods, applied regularly, promote the harmonious development of explosive strength and reaction speed [5, 7, 23]. Integrating volleyball-specific exercises into physical education lessons increases students' motivation, stimulating active participation and cooperation [18, 22]. Recent studies have shown that plyometric and volleyball training significantly improve overall motor performance and the ability to perform quick and efficient actions [1, 25]. Plyometric exercises combined with ball throws simultaneously develop upper and lower limb strength, enhancing coordination and stability [1]. Adapting the volume and intensity of exercises to each student's level is important to prevent overtraining and injuries [13, 25]. The application of ballistic and rapid reaction methods allows the development of reaction speed and agility, which are essential in attacking and blocking actions [21, 24]. Integrating volleyball games and competitions into lessons increases the attractiveness of the activity and students' engagement, leveraging their natural motivation for competition and cooperation [18, 22]. Research results show that a well-structured program of volleyball-specific exercises contributes to the harmonious development of explosive strength, coordination, and overall performance of high school students [5, 25]. The development of explosive strength in high school students is important for motor performance and success in team sports. It can be effectively stimulated through progressive exercises, adapted to individual levels and integrated into playful and interactive activities [3,6,8,9,14,15,16,17,19,23,26].

Material-method: The research was conducted at the Sports Program High School, within non-specialized classes, Module V, on students who do not practice competitive sports, aged between 14 and 16, under the guidance of Professor Orășanu Tudor. Activities took place in the school's gymnasium, which was properly equipped for conducting specific exercises and tests. The study was carried out over a period of 7 weeks, within Module V, according to the physical education and sports schedule. During this period, an experimental program for the development of explosive strength through volleyball-specific methods was applied, along with periodic evaluations to monitor progress. The research involved two groups of students, each consisting of 8 boys and 8 girls, in order to analyze the effects of applying volleyball-specific methods on explosive strength. Students were supervised by Professor Orășanu Tudor, who oversaw the exercise sessions, corrected techniques, and ensured compliance with safety principles. Experimental Group: Performed volleyball-specific exercises for the development of explosive strength according to the methodological program.

Control Group: Continued the usual physical education activities without the application of the experimental program. Organizing the students by group and gender allowed for comparison of results and evaluation of the method's

effectiveness, taking into account the physiological and motor differences specific to adolescents. Research Methods: Analysis of specialized literature, Observation method, Testing method, Experimental method, Mathematical-statistical method [12]. Inclusion Criteria: Age 14–16 years, students without medical exemptions, and approval of informed consent regarding the experimental plan by the students. Development and Implementation: Volleyball-specific methods were elaborated and applied for the development of explosive strength in students.

Table 1. Overview of volleyball-specific exercises applied to the experimental group

Week	Exercise / Volleyball-Specific Method	Objective	Dosage (Repetitions/Sets/Duration)
1	Vertical jumps at the net (block)	Development of lower limb explosive strength, coordination	3 sets x 8 jumps, rest 1 min
1	Serve focusing on jump height	Development of explosive strength in arms and trunk	3 sets x 10 serves, rest 1 min
2	Vertical jumps at the net (attack)	Explosive leg strength and rapid arm extension	3 sets x 10 jumps, rest 1–2 min
2	Quick ball reception with lateral movement	Reaction speed and explosive leg strength	3 sets x 8 reps each direction
3	Short 5 m sprints with direction change	Development of leg explosiveness and agility	4 sets x 5 sprints, rest 1 min
3	Plyometric jumps with the ball	Explosive strength of lower limbs and coordination	3 sets x 8 jumps, rest 1–2 min
4	Combined serve with sprint to reception	Development of explosive strength and reaction speed	3 sets x 8 reps, rest 1 min
4	Mini volleyball games focusing on attack and block	Application of explosive strength in tactical situations	15 min continuous play, rest 2 min, 2 rounds
5	Net jumps with ball thrown by partner	Explosive strength and ball movement anticipation	3 sets x 8 jumps, rest 1 min
5	Quick passes and throws with the ball	Development of explosive arm strength and coordination	3 sets x 10 passes/throws, rest 1 min
6	Short sprints with direction change + vertical jumps	Explosive strength, coordination, and reaction speed	3 sets x 5 sprints + 5 jumps, rest 1–2 min
6	Mini volleyball matches focusing on quick actions	Application of explosive strength in real game situations	20 min continuous play, 2 rounds, rest 2 min
7	Combined circuit: jumps, sprints, ball strikes	Global development of explosive strength and coordination	3 sets x 5 exercises, rest 1–2 min
7	Final evaluation: vertical jumps, sprints, attack/block	Progress assessment in explosive strength	Standardized tests: 3 repetitions, average calculated

Rest periods between exercises are necessary for complete neuromuscular recovery and to maximize explosive strength. Progressive exercises follow the principle of task progression, increasing difficulty and complexity on a weekly basis. Mini-games and tactical situations allow the application of explosive strength in real contexts, enhancing students' motivation.

Table 2. Description of the methods applied to the control group

No.	Test	Objective	Application Method	Traditional Activity / Mode of Work	Evaluation Indicators
1	Standing vertical jump	Assessment of explosive strength of lower limbs	Vertical jumps from a standing position	General jumping exercises and gymnastics	Jump height in cm, average of 3 attempts
2	5 m sprint	Assessment of reaction speed and leg explosiveness	Sprint from the starting line to the indicated distance	Continuous running or classic sprints without specific game context	Time in seconds, average of 3 attempts
3	Net jump (block/attack)	Assessment of volleyball-specific explosiveness	Vertical jumps toward a fixed object	Simple jumps without a volleyball, on-the-spot gymnastics	Jump height, average of 3 attempts
4	Medicine ball throw (3 kg)	Assessment of explosive strength of arms and trunk	Throw the ball as far as possible	Free throws with the medicine ball, without emphasis on speed	Distance thrown in meters, average of 3 attempts
5	Quick ball reception with lateral movement	Assessment of reaction speed and coordination	Lateral movement to catch the ball	Generic catching and passing games without time pressure	Number of balls caught out of 5 attempts

The control group follows the traditional physical education program, focused on general exercises, running, gymnastics, and standard games, without the integration of volleyball-specific methods. Assessment is conducted in the same manner as for the experimental group, allowing for an objective comparison of results. The purpose is to highlight the impact of the experimental method using volleyball-specific exercises on explosive strength, compared to the traditional approach.

Table 3. Control tests used for evaluation

No.	Test	Objective	Application Method	Evaluation Indicators
1	Standing vertical jump	Assessment of explosive strength of lower limbs	The student jumps as high as possible from a standing position, with rapid arm movement	Jump height in cm, average of 3 attempts

No.	Test	Objective	Application Method	Evaluation Indicators
2	5 m sprint	Assessment of reaction speed and leg explosiveness	Sprint from the starting line to the indicated distance	Time in seconds, measured with electronic or manual stopwatch
3	Net jump (block/attack)	Assessment of volleyball-specific explosiveness	The student jumps for a block or attack at the net, touching a mark	Height reached or difference from net level
4	Medicine ball throw (3 kg) with both hands	Assessment of explosive strength of arms and trunk	The student throws the ball as far as possible from a standing position	Distance thrown in meters, average of 3 attempts
5	Quick ball reception with lateral movement	Assessment of reaction speed, coordination, and explosive strength	The student moves laterally to catch the ball thrown by the teacher	Time required to catch the ball and number of balls caught out of 5 attempts

Each test is conducted both before (initial test) and after the 7-week experimental program (final test) to assess progress. Three repetitions per test are recommended, with the average calculated for an objective evaluation. The teacher monitors the technique and safety of each test execution. The results are compiled for comparative analysis between the experimental and control groups.

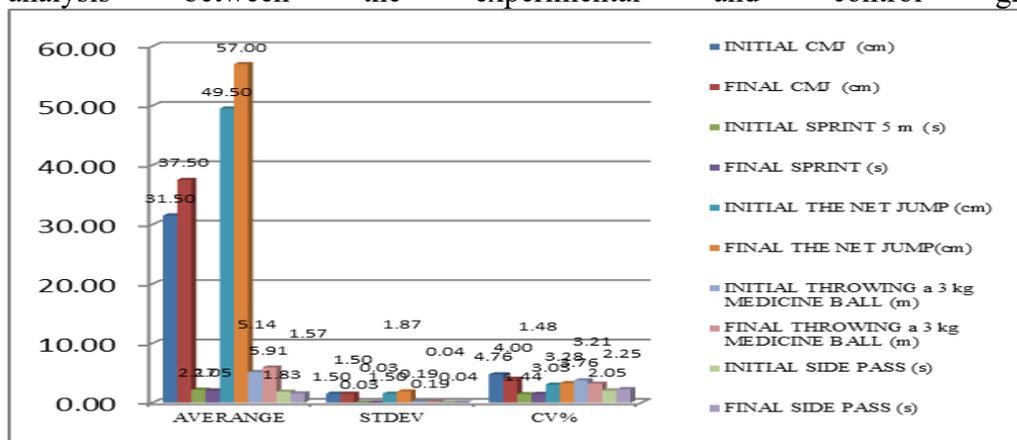


Fig. 1. Experimental group: initial and final results for the boys' group
 CMJ and net jump: The average jump height increased by approximately 6–8 cm. The 5 m sprint time decreased by 0.08–0.12 s, the distance in the medicine ball throw increased by 0.6–0.8 m, and the reaction time in lateral ball reception decreased by 0.25–0.30 s, demonstrating improvements in speed, explosiveness,

and coordination.

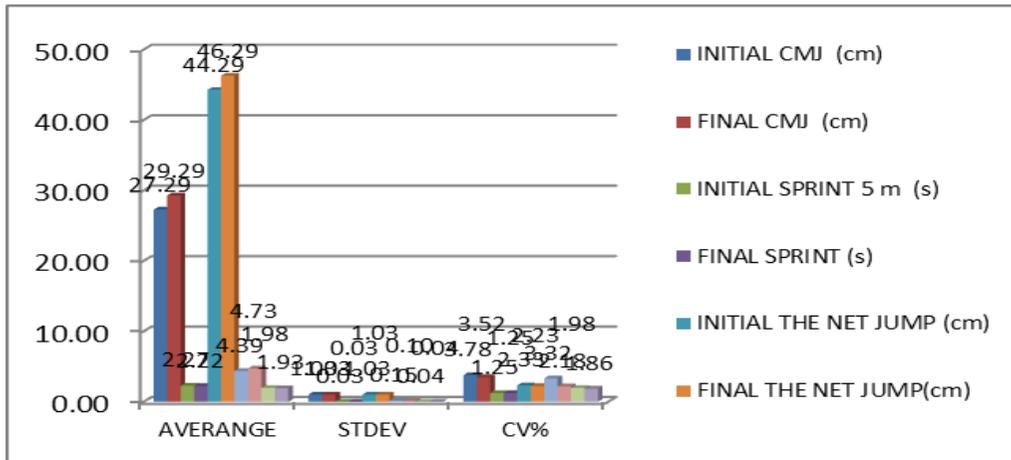


Fig. 2. Control group: initial and final results for the boys' group

The final progress is modest (+2 cm in jumps, -0.04–0.05 s in the sprint, +0.3–0.4 m in the medicine ball throw, -0.05–0.06 s in lateral ball reception), characteristic of traditional exercises.

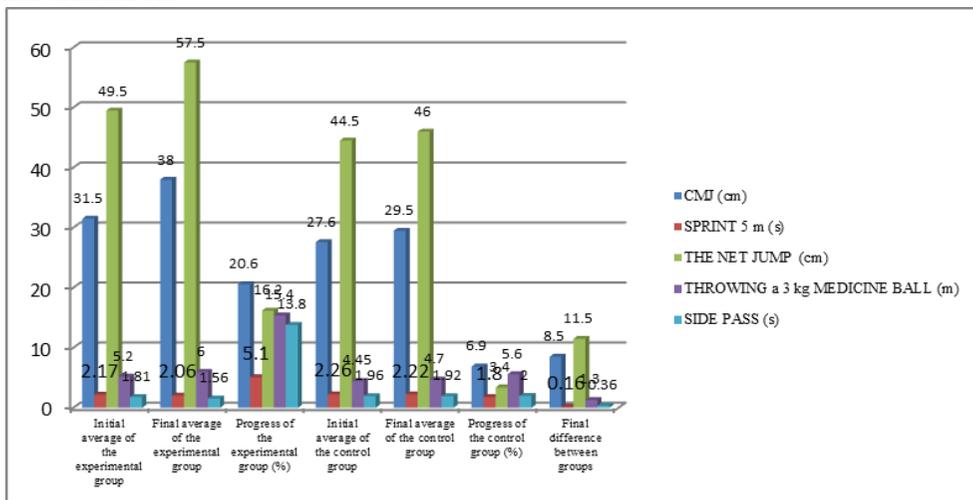


Fig. 3. Difference between groups – boys

The experimental group showed significantly greater progress compared to the control group. Vertical and net jumps increased by 20.6% and 16.2%, respectively, in the experimental group, whereas the control group showed increases of only 6.9% and 3.4%. Additionally, sprint and lateral ball reception improved more in the experimental group, highlighting the development of explosiveness and reaction speed. Regarding explosive strength of the arms, the medicine ball throw progressed by 15.4% in the experimental group, compared to 5.6% in the control group, confirming the effectiveness of volleyball-specific exercises. Overall, in all tests, the final values were clearly higher in the experimental group, demonstrating that

volleyball-specific training methods are more effective than the traditional approach in developing explosive strength in high school students.

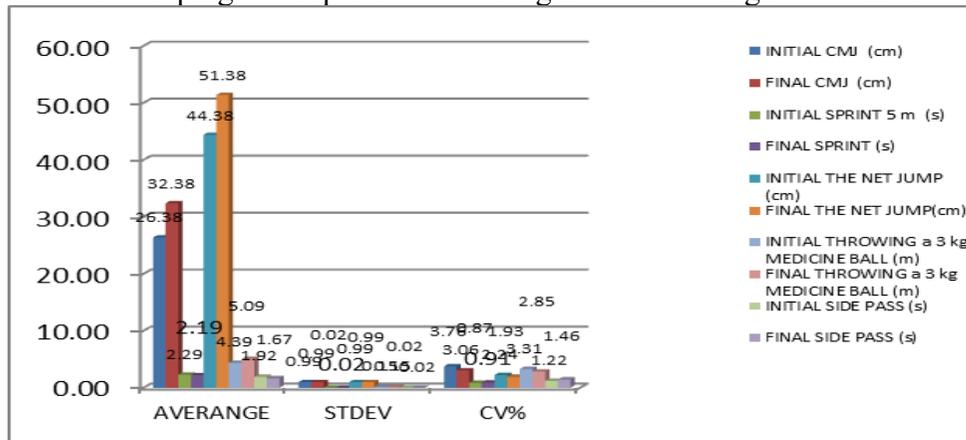


Fig. 4. Experimental group: initial and final results for the girls' group

In the CMJ and net jump tests, an average increase of 6 cm was recorded, similar to that of the boys, but adapted to the adolescents' level. The 5 m sprint showed a decrease in time by 0.10–0.12 s, indicating an improvement in leg speed and explosiveness. In the medicine ball throw, progress was 0.6–0.7 m, confirming the development of explosive strength in the arms and trunk. Additionally, in the lateral ball reception test, reaction time decreased by 0.22–0.25 s.

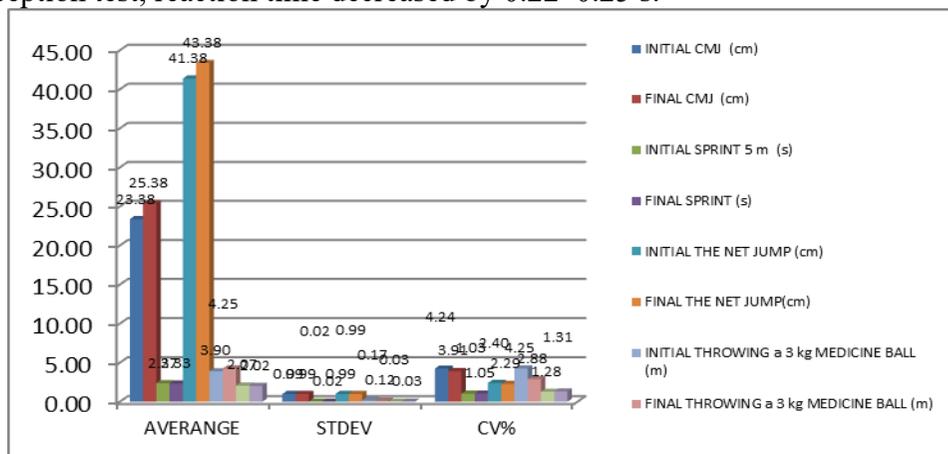


Fig. 5. Control group: initial and final results for the girls' group

In the CMJ and net jump tests, a modest increase of approximately 2 cm on average was observed. The 5 m sprint showed a slight improvement of only 0.04–0.05 s. In the medicine ball throw, progress was 0.3–0.4 m, lower than that achieved by the experimental group. Regarding lateral ball reception, reaction time decreased by only 0.05 s, indicating a slower rate of progress.

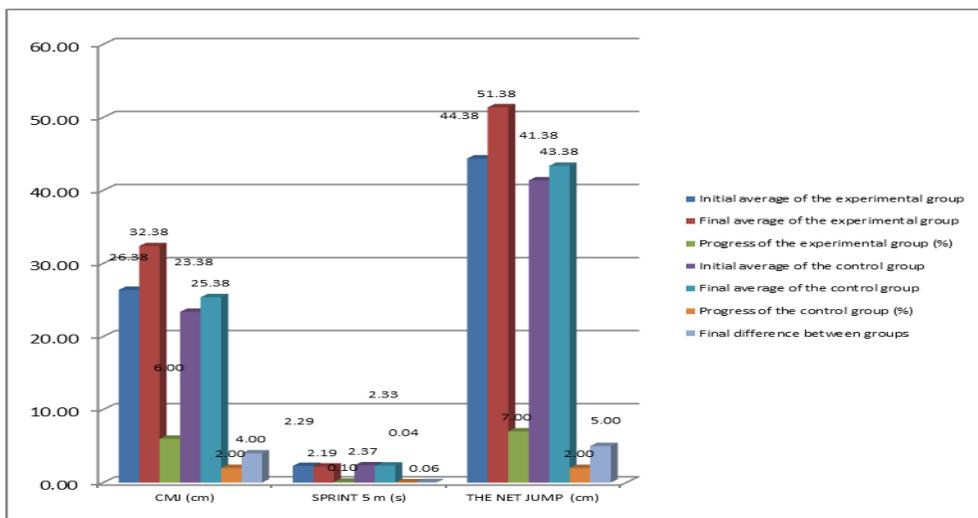


Fig. 6. Difference between groups – girls

CMJ and net jump: The progress percentage of the experimental group (+24.5% and +15.7%) was significantly higher than that of the control group (+9.5% and +5.1%), highlighting the development of volleyball-specific explosive strength. Sprint and lateral ball reception also showed greater improvements in the experimental group, indicating enhanced speed and sport-specific coordination. In the medicine ball throw, progress of +18.3%, compared to +8.2% in the control group, confirms the effectiveness of volleyball-specific exercises. Overall, all tests recorded higher final values in the experimental group, demonstrating that a volleyball-specific training program is more effective than the traditional method in developing explosive strength in high school female students.

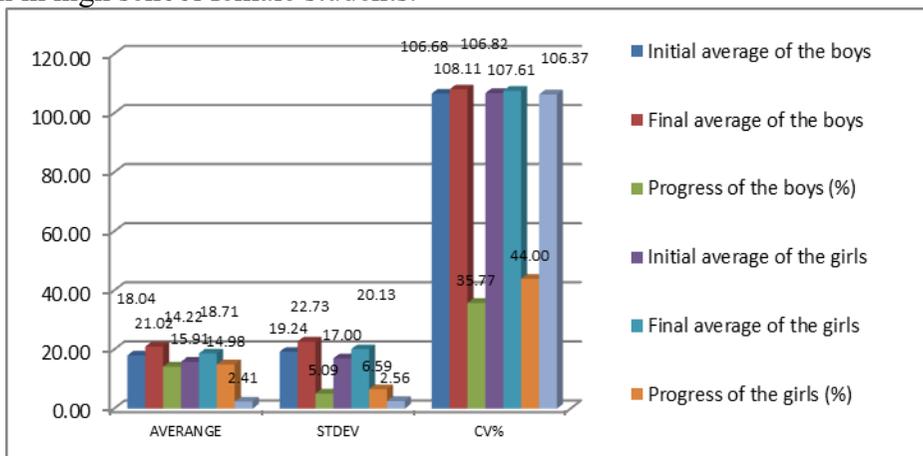


Fig. 7. Difference between groups – boys and girls

CMJ and net jump: Boys recorded higher absolute initial and final values, but girls showed slightly greater percentage progress (+24.5% compared to +20.6% in CMJ). 5 m sprint: Boys remained faster, but both sexes improved speed at a comparable rate.

Medicine ball throw: Girls progressed more in percentage terms (+18.3% compared to +15.4%), although boys had higher absolute values. Lateral ball reception: Both sexes reduced reaction time, with boys showing greater improvement (-13.8% compared to -11.6%). Although physiological differences result in higher absolute values for boys, girls demonstrated comparable or even superior percentage progress in certain tests, confirming the effectiveness of the volleyball-specific method for both sexes.

Discussions: The authors' study examines the effects of regular volleyball training on the physical fitness levels of high school students, highlighting the differences between those who practice the sport regularly and those who do not participate in additional sports activities [25]. Another study also addresses the development of explosive strength through volleyball-specific training, emphasizing the importance of adapting methods to the age-related characteristics of students. Effective strategies for stimulating and developing explosive strength are based on the knowledge and experience of the specialist, aiming to maximize students' motor potential and achieve performance in school competitions [11].

Conclusions The systematic application of volleyball-specific exercises (net jumps, serves, quick receptions, direction changes) during physical education classes led to significant improvements in explosive strength for both boys and girls, compared to the traditional method. Difference between experimental and control groups: The groups that trained with volleyball-specific methods showed greater increases in jumping, sprinting, medicine ball throw, and lateral reception tests, confirming the principle of training specificity and the relevance of applying exercises related to the practiced sport. Sex differences: Boys recorded higher absolute values in most tests due to physiological advantages. Girls showed comparable or even higher percentage improvements in certain tests, indicating that the volleyball-specific method is effective for both sexes. Transfer to practical performance: The gains achieved through the volleyball-specific method directly translate to game actions such as attacking, blocking, and rapid movements, highlighting the usefulness of integrating volleyball exercises into physical education for non-competitive students. The study confirms that volleyball-specific methods are superior to the traditional approach in developing explosive strength in high school students, demonstrating both efficiency in physical progress and practical relevance for motor performance in the game.

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