Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH
Vol. XXVI, ISSUE 1, 2026, Romania
The journal is indexed in: ERIH PLUS, Ebsco, SPORTDiscus, INDEX COPERNICUS JOURNAL MASTER LIST, DOAJ DIRECTORY OF OPEN ACCES JOURNALS, Caby, Gale Cengage Learning, Cabell's Directories

Science, Movement and Health, Vol. XXVI, ISSUE 1, 2026
January 2026, 26 (1): 85-90
Original article: https://www.doi.org/10.61801/OUA.2026.1.14

DEVELOPMENT OF ACCELERATION SPEED IN U15 FEMALE VOLLEYBALL PLAYERS THROUGH A SPECIFIC TRAINING PROGRAM

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Abstract

Aim. The aim of this study was to evaluate the effects of a volleyball-specific physical training program on acceleration speed and visual-motor coordination in U15 volleyball players.

Methods. Twenty-two athletes from CTF Mihai I Bucharest were evaluated at two experimental moments (initial and final) using the Witty RED electronic system, which allows the measurement of acceleration speed and motor response accuracy to visual stimuli. In the interval between tests, a specific physical training program was implemented, focused on developing these qualities.

Results. Statistically significant differences were recorded between the two tests for both total time ($t(21) = 5.99$, $p < .001$, $d = 1.28$) and response variability (Gap) ($t(21) = 29.83$, $p < .001$, $d = 6.36$), highlighting improvements in acceleration speed and visual-motor coordination.

Conclusions. A well-structured specific physical training program can contribute to optimizing movement speed and increasing the consistency of motor response in youth volleyball.

Keywords: movement speed, visual-motor coordination, volleyball, Witty RED.

Introduction

Volleyball is a sport that often involves rapid actions, changes of direction, visual-motor reactions, and explosive movements, factors that make speed and visual-motor coordination essential qualities for high performance (Zwierko et al., 2023). The importance of these qualities is even greater among young athletes, where the development of coordination and stable reaction capacity can determine their future career development. (Paška et al., 2023)

The accuracy of decisions in competitive sports is closely linked to the speed with which athletes can process visual information and the effectiveness of the visual strategies used in analyzing game situations, elements that differentiate expert athletes from beginners (Sarmento et al., 2018). Training visual components has become a big deal in optimizing athletic performance, since over 80% of the info athletes use in competitions is visual (Wilkins & Gray, 2018). Thus, the visual system becomes fundamental in the rapid interpretation of tactical contexts, in decision-making, and in the efficient technical execution of actions in the game (Vișan, Riteș, & Dumitrache, 2022).

Advances in motor performance assessment allow the use of modern systems such as Witty SEM (Microgate), which provide objective measurements of reactive speed and agility, including reaction to visual stimuli and rapid motor execution (Horička et al., 2024). Recent research shows that volleyball-specific training programs focused on improving speed and agility can lead to significant increases in performance in speed, planned agility, and reactive agility tests (Lima et al., 2021; Puni, Ungurean & Cojocariu, 2021).

In this context, this study aims to analyze the changes that occurred between the initial and final testing of U15 players after applying a volleyball-specific physical training program, with the main objective of developing speed and visual-motor coordination. The assessment was carried out using the Witty RED system, a validated tool for measuring motor performance relevant to volleyball.

Objectives

The general objective of this study was to evaluate the effects of a specific physical training program on acceleration speed and visual-motor coordination in Under15 female volleyball players.

To achieve this aim, the following specific objectives were established:

- To analyze the initial level of motor performance measured through the Witty RED test.
- To implement a physical training program based on volleyball-specific exercises, adapted to the particular characteristics of the U15 category and grounded in periodization principles.
- To compare the results obtained in the initial and final testing, in order to highlight the athletes' progress regarding movement speed and the stability of visual-motor coordination.

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Methods

The research was based on the development, application, and validation of a physical training program based on the principles of modern periodization, with the aim of improving the specific motor performance of promising volleyball players.

The program focused in particular on optimizing acceleration speed, strengthening visual-motor coordination, and reducing the variability of motor execution in dynamic contexts specific to the game.

The study was conducted on a group of 22 U15 volleyball players registered at CTF Mihai I Bucharest club, clinically healthy and participating in official competitions, with initial testing in February 2025 and final testing in September 2025.

The intervention program was designed in January 2025 and implemented over a period of seven months (February–August 2025). It was progressively integrated into the training structure, with reduced volume during the competitive phase (February–March), and progressively increased intensity during the preparatory period (May–August), in accordance with the principles of periodization and specificity. The exercises focused on developing movement speed and visual-motor coordination.

The main objective of the program was to enhance short-distance acceleration speed through rapid-start drills and directional changes, integrated into volleyball-specific situations such as movement to the block, coverage on short balls, defensive recovery, and offensive-defensive transitions.

Motor performance was assessed using the Witty RED test (Microgate, Italy), which consists of 19 shuttle runs toward 10 light sources positioned at heights and distances relevant to defensive volleyball actions. The test measures total execution time and variability (Gap), the latter being an indicator of the consistency of the visual-motor response.

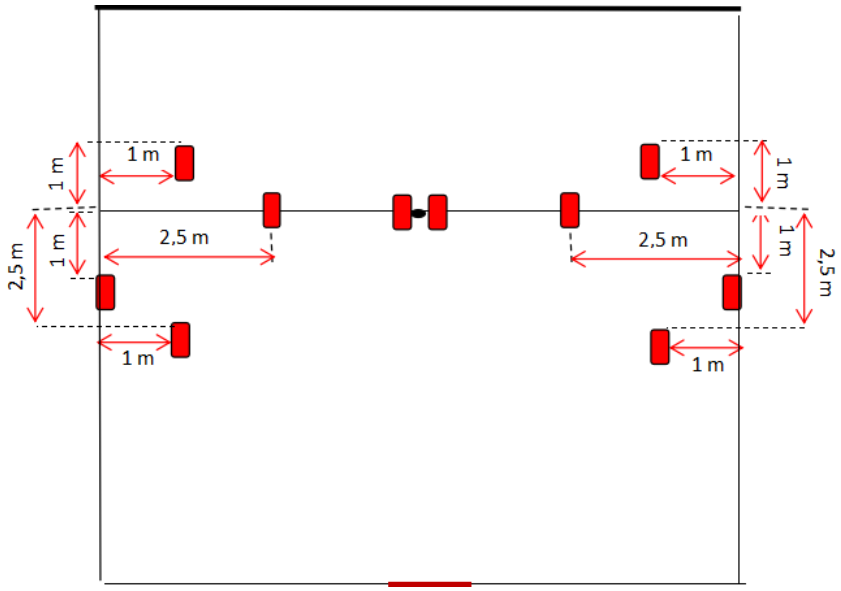

Figure 1. Witty RED Test

According to Figure 1, the Witty RED test involves positioning the 10 light sources in directions and areas representative of defensive actions, and at heights where ball contact typically occurs during defensive play. In addition to assessing reaction speed to light stimuli and acceleration over varied distances, the calibration of the test also places demands on other key physical components essential to volleyball performance.

Thus, the 19 shuttle runs that athletes must complete to deactivate the light sources—each followed by a return to the placement point, marked by a 1-meter line located at the midpoint of the baseline—strongly challenge attention stability, attentional volume, and speed endurance with sport-specific demands.

The test consists of a sequence of 19 forward–backward displacements across different directions and distances, imposing an intensity that shifts the effort toward a functional zone characterized by working under oxygen debt.

Results

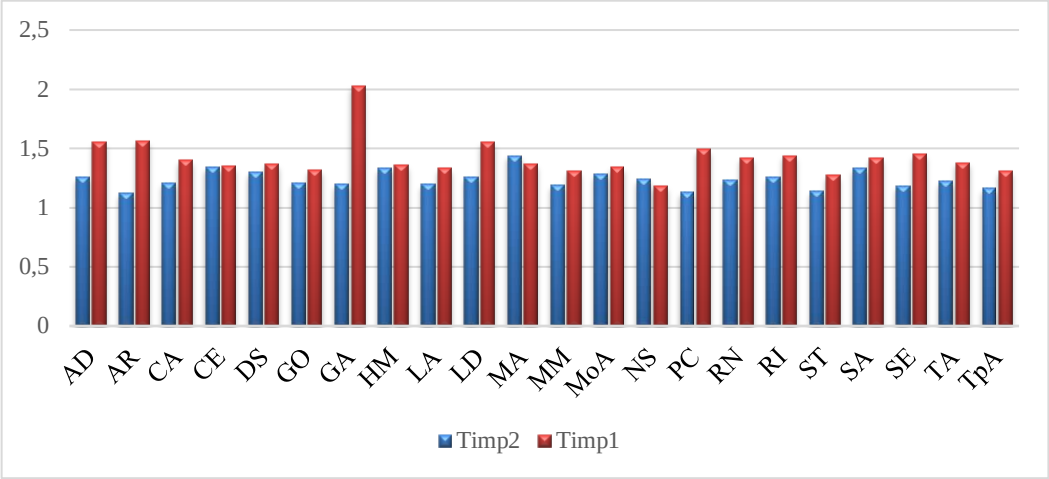

Figure 2. Difference in time taken to complete the Witty Red test between the two tests

According to Figure 2, the analysis of differences between the two testing sessions highlights a clear decrease in execution times for the majority of athletes, indicating a significant improvement in acceleration speed and visual-motor coordination. The overall reduction in times demonstrates not only faster reactions, but also enhanced precision and stability in movement initiation, which directly contributes to the efficiency of game-specific actions. The consistent decrease in times suggests both superior acceleration and improved stability of execution.

An exception is athlete M.A., who shows a regression in performance, which can be explained by a period of hospitalization and medical treatment between the test sessions, a circumstance that affected her effort capacity and motor progress. Therefore, her results require an interpretation adjusted to the medical context.

Table 1. Verification of the statistical difference between the two tests at Witty RED – Student's t-test

		T-test for paired samples					95% Confidence interval		
Student's t		statistic	d. of freedom	p	Average difference	St error of the difference	Min	Max	Cohen's d
TimeI	TimeF	5.991	22	< .001	16.7423	2.795	10.9307	22.5538	1.2773
GapI	GapF	29.827	22	< .001	83.3791	2.795	77.5656	89.1926	6.3591
L_L2I	L_L2F	3.181	22	0.005	0.6895	0.217	0.23868	1.1404	0.6781
L_L3I	L_L3F	3.633	22	0.002	0.9136	0.252	0.39058	1.4367	0.7745
L_L4I	L_L4F	4.913	22	< .001	0.8282	0.169	0.4776	1.1788	1.0474
L_L5I	L_L5F	4.331	22	< .001	0.8659	0.2	0.45011	1.2817	0.9233
L_L6I	L_L6F	1.386	22	0.18	0.3186	0.23	-0.15962	0.7969	0.2954
L_L7I	L_L7F	1.925	22	0.068	0.5973	0.31	-0.04808	1.2426	0.4103
L_L11I	L_L11F	5.527	22	< .001	1.25	0.226	0.77967	1.7203	1.1784
L_L13I	L_L13F	3.96	22	< .001	0.9027	0.228	0.42868	1.3768	0.8443
L_L14I	L_L14F	6.921	22	< .001	1.3959	0.202	0.97648	1.8153	1.4756
L_L15I	L_L15F	3.008	22	0.007	1.4241	0.473	0.43955	2.4086	0.6413
L_L16I	L_L16F	3.602	22	0.002	1.0059	0.279	0.42522	1.5866	0.768
L_L18I	L_L18F	2.956	22	0.008	0.875	0.296	0.25946	1.4905	0.6303

L_L19I	L_L19F	4.305	22	< .001	0.8959	0.208	0.46312	1.3287	0.9178
GL_L2I	GL_L2F	-2.354	22	0.028	-0.5105	0.217	-0.96132	-0.0596	-0.502
GL_L3I	GL_L3F	0.452	22	0.656	0.1136	0.252	-0.40942	0.6367	0.0963
GL_L4I	GL_L4F	2.065	22	0.051	0.3482	0.169	-0.0024	0.6988	0.4403
GL_L5I	GL_L5F	-4.072	22	< .001	-0.8141	0.2	-1.22989	-0.3983	-0.8681
GL_L6I	GL_L6F	1.081	22	0.292	0.2486	0.23	-0.22962	0.7269	0.2305
GL_L7I	GL_L7F	0.378	22	0.709	0.1173	0.31	-0.52808	0.7626	0.0806
GL_L11I	GL_L11F	-1.017	22	0.321	-0.23	0.226	-0.70033	0.2403	-0.2168
GL_L13I	GL_L13F	-0.514	22	0.612	-0.1173	0.228	-0.59132	0.3568	-0.1097
GL_L14I	GL_L14F	-3.838	22	< .001	-0.7741	0.202	-1.19352	-0.3547	-0.8183
GL_L15I	GL_L15F	1.635	22	0.117	0.7741	0.473	-0.21045	1.7586	0.3486
GL_L16I	GL_L16F	1.883	22	0.074	0.5259	0.279	-0.05478	1.1066	0.4015
GL_L18I	GL_L18F	-0.186	22	0.854	-0.055	0.296	-0.67054	0.5605	-0.0396
GL_L19I	GL_L19F	-0.212	22	0.834	-0.0441	0.208	-0.47688	0.3887	-0.0452

Note. $H_a\ \mu_{\text{Measure 1 - Measure 2}} \neq 0$

According to Table 1, the comparison between the initial and final results obtained in the Witty RED test reveals significant improvements in acceleration speed and in the stability of visual-motor coordination, both representing essential components for the efficiency of volleyball-specific actions.

The reduction in total execution time ($t(21) = 5.99$, $p < .001$, $d = 1.28$) indicates faster acceleration, while the decrease in Gap variability ($t(21) = 29.83$, $p < .001$, $d = 6.36$) suggests an enhanced control of motor responses under complex visual stimulation. Moreover, the positive effects identified at most activation points ($0.63 \leq d \leq 1.48$) reflect an efficient adaptation to the rapid succession of stimuli, facilitating improved anticipatory skills and optimal synchronization of movements, particularly in blocking, defensive actions, and transitions.

The reductions observed in the GAP LAP indicators confirm a more stable visual-motor response and a decrease in fluctuations between successive actions, contributing to superior temporal control and increased precision during the dynamic phases of the game.

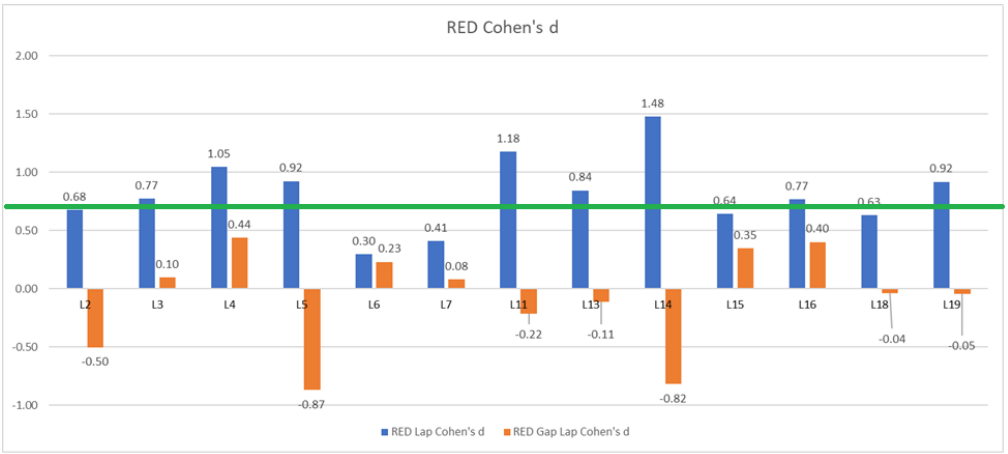

Figure 3. Size of the RED test effect (Cohen's d)

Overall, these results suggest a general improvement in LAP performance, while in the case of GAP LAP the trend is mixed, with some significant decreases and several variables remaining stable between the testing sessions.

Discussions

The specificity of physical training in volleyball represents a key factor in optimizing athletic performance, as it contributes to the development of motor abilities required for the efficient execution of game actions. Exercises tailored to the real demands of volleyball can accelerate the acquisition of technical-tactical skills, influence neuromotor adaptations, and support the harmonious development of athletes during their formative stage. In this context, acceleration speed and visual-motor coordination play a decisive role, as the effectiveness of defensive and transition phases depends on the athletes' ability to react rapidly and accurately to changing game situations.

An important component of the intervention was the periodization of the program, which allowed for the controlled integration of training loads without compromising competitive performance. Through the gradual adjustment of training volume and intensity, tailored to the competition schedule and age-specific characteristics, an optimal framework was created for the emergence of the targeted neuromuscular adaptations. The structured and phased organization of training supports, according to Platonov (2015), both the development of individual performance and the homogenization of the physical level within the team—an aspect reflected in the consistent progress observed among most participating athletes.

Overall, the findings of this research support the idea that the use of volleyball-specific training methods, based on visual stimulation and rapid displacements, represents an effective strategy in youth volleyball. The observed adaptations can significantly contribute to strengthening motor abilities and improving the efficiency of technical-tactical actions, with important implications for the design of training programs targeting athletes in their developmental stage.

Conclusions

The volleyball-specific exercises and physical training methods implemented proved to be effective in enhancing acceleration speed and visual-motor coordination in U15 female athletes. All analyzed indicators demonstrated improvements at the final testing, confirming a clear increase in physical performance following the intervention. These outcomes reflect faster reaction execution and superior movement stability in game-specific scenarios, directly supporting the effectiveness of defensive and transition phases.

The progress observed indicates that this targeted training approach aligns with the current performance demands of volleyball in this age category and contributes to the development of fundamental motor abilities necessary for progression toward higher competitive levels. Moreover, the structured integration of periodization principles facilitated positive neuromuscular adaptations without negatively influencing competitive performance, emphasizing the practical value of customized training programs in youth athlete development.

From an applied perspective, the findings highlight the importance of incorporating rapid displacement drills and visual-based decision-making tasks into training sessions to enhance anticipatory skills and temporal coordination in dynamic phases of play. Coaches working with formative-stage players are therefore encouraged to prioritize complex training stimuli that closely replicate real match conditions.

A limitation of the study concerns the temporary medical condition that affected one participant and the absence of a control group, which may restrict broader generalization of the results. Future research should explore larger cohorts, positional differences, and longitudinal monitoring across multiple competitive seasons for a more comprehensive understanding of performance development in youth volleyball.

Overall, this study supports the integration of sport-specific physical preparation strategies as a key component in modern volleyball training, reinforcing their role in shaping the athletic foundation required for long-term performance advancement.

References

Horička, P., Paška, Ľ., Šimonek, J., Berdis, I. & Poláčková, L. (2024). The Validation of the Defensive Reactive Agility Test in Top-Level Volleyball Male Players: A New Approach to Evaluating Slide Speed Using Witty SEM. *Applied Sciences*, 14(15), 6391. https://doi.org/10.3390/app14156391.

Lima, R. F., Rico-González, M., Pereira, J. F. A., Caleiro, F. & Clemente, F. M. (2021). Reliability of a Reactive Agility Test for Youth Volleyball Players. *Polish Journal of Sport and Tourism*, 28(1), pp.8–12.

Paška, Ľ., Horička, P., Šimonek, J., Záková, N. & Poláčková, L. (2023). Planned and Reactive Agility and Selected Parameters in Female Volleyball Players. *Journal of Physical Education and Sport*, 23(10), pp. 2300–2306.

Platonov, V. N., (2015), *Periodization of sports training: General theory and its practical applications.* București: Discobolul Publishing.

Puni, A-R., Ungurean, B-C. & Cojocariu, A. (2021). Optimising Speed and Agility in a Volleyball Game – Junior Players. *New Trends and Issues Proceedings on Humanities and Social Sciences*, 8(3), pp.09–20. https://doi.org/10.18844/prosoc.v8i3.5403.

Sarmento, H., Anguera, M. T., Campaniço, J. & Leitão, J. (2018). Visual Search Activity and Attentional Skills in International Level Football Players. *International Journal of Sports Science & Coaching*, 13(5), pp. 779–788. https://doi.org/10.1177/1747954118765318.

Wilkins, L. & Gray, R. (2018). Development and Validation of a Novel Sport Vision Training System. *Journal of Motor Behavior*, 50(6), pp.1–10. https://doi.org/10.1080/00222895.2017.1381767.

Vișan, C., Riteș, A. & Dumitrache, G. (2022). Visual-motor reaction ability in volleyball players. *Bulletin of the Transilvania University of Braşov*, *Series IX: Sciences of Human Kinetics*, 15(64), pp. 95–102.

Zwierko, M., Lesiakowski, P., Puchalska-Nierychło, A., Król, P. & Wodarski, P. (2023). Reactive agility performance in youth volleyball players–A preliminary study. *Journal of Human Sport and Exercise*, 18(3), pp. 1–12. https://doi.org/10.14198/jhse.2023.183.04.