Pubmedia Jurnal Pendidikan Olahraga Vol: 3, No 1, 2025, Page: 1-11

The Effect of a Proposed Training Program Using a Short Ball On Developing Motor Response Speed in Young Table Tennis Players

Hamdullah Abed Hammadi

Directorate of Education, Anbar

DOI:
https://doi.org/10.47134/jpo.v3i1.2152
*Correspondence: Hamdullah Abed Hammadi
Email: aldlymyhmdallh@gmail.com

Received: 30-07-2025
Accepted: 30-08-2025
Published: 30-09-2025

Abstract: Motor response speed is one of the basic abilities that determine a player's proficiency in table tennis, as the nature of the game requires quick decision-making and reaction in rapidly changing situations. This research aims to design a training program using a short ball and analyze its impact on developing motor response speed among youth table tennis players (17–19 years old). The researcher adopted an experimental approach using a single-group approach with pre- and post-tests. The sample included 12 players from a youth league club. The training program was implemented over eight weeks, with three sessions per week. Field-approved response speed tests were used, in addition to video recording and analysis of performance. The training sessions included exercises based on the use of a short ball in various positions and rapidly changing scenarios, with the aim of stimulating the motor nervous system to respond immediately. The results showed a significant improvement in the post-test results compared to the pre-test results, demonstrating the effectiveness of the proposed training program. The research highlights the importance of customizing training programs according to the specificity of the targeted skill and the nature of the competitive situation, and recommends implementing the program in youth training centers to develop response speed skills. The researcher also recommends conducting future studies on different age groups and incorporating new training methods such as virtual reality to enhance training effectiveness.

Keywords: Short Ball, Reaction Speed, Table Tennis, Youth Training, Motor Stimulation.

Introduction

Table tennis is one of the games that requires the highest degree of coordination between sensory and motor perception, due to its rapid ball exchange and short reaction time. This makes motor response speed a crucial factor in skill superiority. This factor becomes even more important when dealing with the short ball, which is one of the most commonly used balls to create surprise or reduce the opposing player's response time.

The short ball requires the player to be constantly prepared to make decisions and move within fractions of a second, which requires a special development in training programs that cannot be achieved through general exercises. Herein lies the importance of this research, which seeks to present a training program based on the use of the short ball with the aim of developing motor response speed in youth table tennis players.

The importance of this research lies in the following:

- Responding to the requirements of modern training based on realistic playing situations.
- Providing coaches with a specialized application program that can be used to develop players' reaction speed.
- The research contributes to bridging the gap between theory and practice in the field of junior table tennis training.
- The research results can be generalized to different age groups of players and incorporated into annual training plans.

Research Problem

Field observations and technical reports indicate a relative weakness among some young table tennis players in their immediate response to short balls, especially in situations requiring a sudden reaction during actual play. This weakness manifests itself in the form of delayed foot or body movement, hesitation in decision-making, or errors in execution of the shot.

This is often attributed to a lack of specialized training programs that specifically target these situations, as most training modules focus on developing basic skills without linking them to actual playing situations with limited time.

Hence, the research problem was formulated in the following main question:
Does the proposed training program using short balls achieve a significant improvement in motor response speed in young table tennis players?

Research Objectives

The research seeks to achieve a set of scientific and practical objectives, the most prominent of which are:

- Design a training program that uses short balls to stimulate rapid motor response.
- Measure the change in motor response speed before and after implementing the training program.
- Analyzing the relationship between regular application of short ball and improvement in reaction time.
- Providing recommendations applicable to youth table tennis training.

Research Hypotheses

Based on the theoretical and field background, the following hypotheses were formulated:

- There are statistically significant differences between the pre- and post-test results of motor response speed, with the post-test in favor of the proposed training program.
- The proposed training program using short ball has a positive impact on developing players' motor response speed.
- The number of repetitions of short ball exercises is directly related to the improvement in response time in the post-test.

Research Areas

Human Area

This area consists of young table tennis players belonging to a first-division youth league club in Iraq, aged between 17 and 19 years, with at least 3 years of experience playing the game and regularly participating in official competitions.

Temporal Area

The research was conducted during the period from February 1, 2025, to March 31, 2025. This included data collection, implementation of the training program, and pre- and post-test measurements.

Spatial Area

The research was conducted in the official training hall of a sports club in Babil Governorate. This hall met standard specifications and was equipped with all the tools and equipment necessary for conducting the program and tests.

Definition of Terminology

• Short ball:

A ball that is lightly shot and touches the half of the table closest to the opponent without bouncing much, making it difficult for the player to handle in a short time. This requires quick reactions and precise motor decisions (Al-Anbari, 2022).

• Motor response speed:

The ability to execute a specific movement within the shortest possible time after exposure to an external stimulus, measured in standard time units (Ahmed, 2020).

• Suggested training program:

A set of exercises designed by the researcher that focuses on the use of short balls within regular training sessions aimed at developing players' response speed in various playing situations (Hamid, 2023).

2. Theoretical Studies

First: The Concept of Motor Response Speed

Motor response speed is one of the specific motor abilities associated with athletic performance. It refers to a player's ability to make a motor decision and execute it as quickly as possible after being exposed to a specific stimulus. The importance of this ability is evident in games characterized by rapid situations and instantaneous changes in ball direction, such as table tennis (Hamid, 2020).

Reaction speed is affected by several factors, including: (Ahmed, 2020)

• Type of stimulus (visual, auditory, tactile)
• Level of attention and concentration
• Level of training
• Type of exercise used
• Age and motor experience

In table tennis, the primary reliance is on responding to visual stimuli (ball movement, opponent's position, trajectory speed). Therefore, a player requires a response time of often less than half a second to execute an appropriate reaction (Al-Shammari, 2021: p. 18).

Second: Technical Characteristics of the Short Ball

The short ball is used in offensive and defensive tactics and is considered a technical tool for imposing control over ball exchanges. This ball requires the player to quickly change their body position, relying on rapid advancement towards the table using their feet and then accurately executing the shot.

Training the player on the short ball aims not only to develop their blocking skills, but also includes developing immediate response by replicating realistic playing scenarios (Sadiq, 2022).

Third: Training Programs Specific to Reaction Speed

Studies show that using training situations that simulate real-life playing helps develop motor response speed more than general training. It is preferable to use methods such as:

- Guided ball exercises
- Visual or audio stimuli
- Paired (1 vs. 1) situations
- Using tools such as a training robot or random balls

Recent literature focuses on the importance of gradual adjustment of stimulus duration and intensity of performance, so that the player is trained to gradually reduce response time to achieve maximum efficiency (Al-Rubaie, 2023: p. 33).

Methodology

The researcher relied on the experimental approach in his study (Mohammed et al, 2025) (Khalaf et al, 2025), as it is the most appropriate approach to addressing problems aimed at identifying the relationship between two or more variables in a controlled environment. A single-group design with pre- and post-measurements was used. The research group underwent a motor response speed measurement before implementing the training program (pre-measurement), then underwent the same measurement after implementing the program (post-measurement). The differences were statistically analyzed (Suisdareni & Tomoliyus, 2021)

This design allows for identifying the change caused by the independent variable (the training program using the short ball) in the dependent variable (motor response speed). External variables were controlled as much as possible, such as the number of training hours, environmental conditions, and the use of the same tools and tests for all players. See Appendix (1):

Research Sample

The research sample was intentionally selected from one of the active sports clubs in the Babil Governorate Youth League, as its players possessed similar characteristics to the research requirements. The sample consisted of (12) players representing the age group (17–19 years), training at a rate of four sessions per week (Al-Shamkhi, 2011).

The conditions for selecting the sample were as follows:

- The player must be within the target age group.
- He must have at least three years of experience playing table tennis.
- He must be free of motor injuries.
- He must be committed to attending throughout the program.

Table (1) shows the physical characteristics and athletic background of the sample:

Table 1. Physical and Athletic Characteristics of the Research Sample

Variable	Mean	Standard Deviation
Age (years)	18.1	0.63
Height (cm)	172.3	4.15
Weight (kg)	65.7	3.82
Years of playing experience	3.8	0.52

The players were informed of the objectives and nature of the research, and approval was obtained from the management and coaches to facilitate the testing and training program.

Devices and Tools Used in the Research

The researcher used a set of modern and supportive devices and tools to implement the training program and measure response time, as follows:

1. A legal ping-pong table conforming to the specifications of the International Federation.
2. Butterfly 40+ training balls, with standardized weights and charges to ensure consistent performance.
3. An accurate digital chronometer to measure response time.
4. A high-speed video camera (120 frames/second) to record and analyze movement.
5. Dartfish video analysis software to analyze footage and determine response time.
6. Performance evaluation observation cards to monitor player responses.
7. Scorecards for pre- and post-tests.

Tests Applied in Research

Short Ball Reaction Test (Hamid, 2023: p. 27)

- Purpose of the Test

To measure the player's motor response speed when exposed to a sudden situation, such as an unexpected short ball being sent.

- Test Conditions
- The player must be in a fully prepared position and 30 cm from the table.
- The test is conducted in a standard training environment without external influences.
- The same type of ball, racket, and camera is used for all players.
- The test is repeated three times, and the arithmetic mean is taken.
- Performance Method

- The player stands in a prepared position in front of the table.
- The coach sends a sudden short ball to a random direction (right or left).
- The response time is measured from the moment the ball leaves the coach's hand until the first movement of the foot.
- The recording is done using a high-speed camera, and the performance is analyzed using Dartfish software.

Figure (1) illustrates the design of the short ball motor response test, where the player and coach's position, the ball's trajectory, and the recording device (camera) are precisely determined to monitor the moment of the first response.

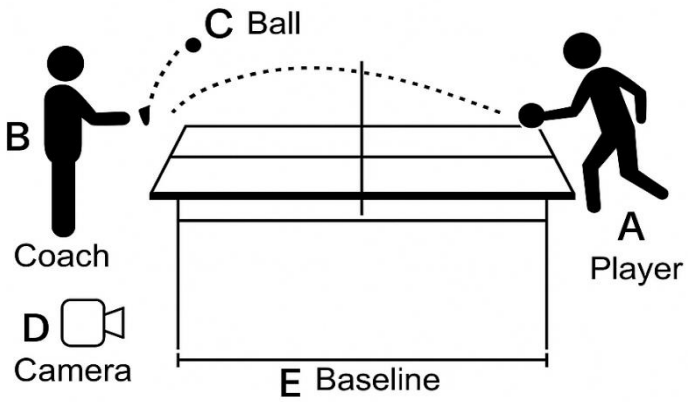

Figure 1. Design of the motor response test using the short ball.

Result scoring criteria:
- Accuracy of movement toward the ball
- Response initiation time
- Speed of approach and shot execution

The pilot experiment

The researcher conducted a pilot experiment on (3) players from outside the primary research sample. The experiment aimed to:
- Test the effectiveness of the equipment and tools used
- Calculate the time required to implement the daily exercises
- Ensure the clarity of the test instructions and program
- Identify any organizational issues that might affect the progress of the experiment

Results of the pilot experiment:
- Each training session lasted 45 minutes
- Players demonstrated good interaction with the exercises
- No technical or organizational issues were recorded

The experiment helped control variables and ensure efficient implementation at the start of the primary experiment. 3-6 Statistical Methods Used

After collecting data from the pre- and post-tests, the researcher used appropriate statistical methods using SPSS v25(Ali & Hamid, 2021) (Fayyad et al, 2025) (Ali et al, 2024), as follows:

- Arithmetic mean: To determine the overall value of response time
- Standard deviation: To measure the dispersion of values around the mean
- Two-sample t-test: To determine the significance of the difference between the pre- and post-tests (Muharib & Ali, 2025).
- Significance level (0.05): To assess the significance of the results

The results will be presented in detail in Chapter Four, along with their analysis and discussion based on the statistical data.

Result and Discussion

Presentation and Analysis of Results

After implementing the 8-week training program on the research sample (12 players), the motor response speed test was re-administered using a short ball. The data were analyzed using a t-test for two related samples to determine the significance of the differences between the pre- and post-measurements. The results are as shown in Table (2):

Table 2. Differences between the pre- and post-measurements of the motor response speed test

Measurement	Mean	Standard Deviation	Calculated t-value	Tabulated t-value	Significance Level (P)	Result
Pre-test	0.87 sec	0.12	6.84	2.20	0.001	Statistically significant
Post-test	0.68 sec	0.09				

Results Analysis:

- Motor response time decreased from 0.87 seconds in the pre-test to 0.68 seconds in the post-test.
- The calculated t-value (6.84) is greater than the tabular value (2.20) at 11 degrees of freedom, indicating a statistically significant difference.
- The significance level (0.001) indicates that the difference did not occur by chance.

See Figure (2): Graphical representation of the differences between the two measurements

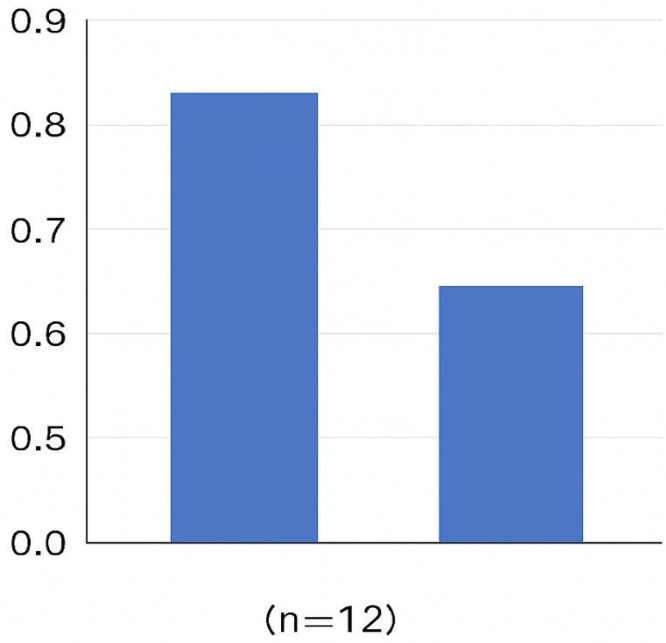

Figure 2. Change in response time between pre- and post-measurements.

A graph showing the decrease in response time after the program is included.

Discussion

The results showed that the proposed training program using short balls contributed effectively to developing motor response speed in young table tennis players. This improvement is due to several factors, most notably:

- A high focus on realistic playing situations: Players were trained in situations similar to those occurring in a match, especially when receiving short balls.
- Repetition and gradual loading: This contributed to developing neuromuscular coordination and reducing response time.
- Stimulating the central nervous system: This was achieved by introducing the element of surprise and changing the direction of the ball, which requires a quick response from the player.
- Accuracy in execution and video monitoring: Video analysis helped correct errors and improve motor performance.
- These results are consistent with similar studies, such as:
- Khalil's study (2023), which demonstrated that short ball training significantly reduced response time.
- Nouri's study (2022), which demonstrated the importance of the element of surprise in developing motor reaction.

The foreign study by Wang et al. (2021) confirmed that realistic simulation training improves decision-making speed. This marked improvement highlights the importance of designing specific training programs, rather than relying on general exercises, especially in young age groups characterized by a high potential for motor development.

Conclusions

Based on the results of the statistical analysis, pre- and post-tests, and field observations during the implementation of the training program using the short ball, the researcher reached the following conclusions:

1. The training program clearly demonstrated its effectiveness in developing motor response speed among young table tennis players, as the average response time decreased statistically significantly.
2. Repetition of exercises focused on realistic playing situations enhanced the players' ability to make quick decisions and execute precise motor responses, especially in cases of sudden short ball deliveries.
3. The motor and visual elements in the training program stimulated the motor nervous system and increased reaction speed, demonstrating the importance of integrating visual stimuli into training.
4. The use of a camera and video analysis contributed to improving the quality of monitoring and immediate evaluation of performance, and increased the accuracy of exercise execution.
5. The youth stage (17–19 years) is an appropriate stage for response speed development programs, given the flexibility of the nervous system and the speed of motor learning.

Recommendations

Based on the findings and conclusions reached by the research, the researcher recommends the following:

1. Include similar training programs in the basic training units for junior and youth teams, with a focus on short balls and sudden situations.
2. Increase the amount of exercises that rely on quick reactions within the training unit, especially using random situations and unexpected balls.
3. Use visual stimulation and video recording to improve performance and motivate players to correct their mistakes.
4. Design standardized tests to measure response speed to short balls in table tennis, and use them periodically to assess progress.
5. Conduct future studies on different age groups (under 15 years – over 20 years) to determine the impact of age on program effectiveness.
6. Conduct comparisons between programs based on short balls versus long balls to determine the impact of ball type on developing aspects of motor performance.
7. Use virtual reality technologies or visual and auditory stimuli in exercises to further support the development of response speed.

References

Ahmed, F. (2020). Motor Abilities in Individual Games. Cairo: University Publishing Center.

Al-Anbari, S. (2022). Foundations of Modern Table Tennis Training. Baghdad: Dar Al-Kutub Al-Riyadhiyah.

Al-Shamkhi, S. Y. M. (2011). The effect of anaerobic exercises on the development of strength endurance and speed in young handball players.

Ali, O., & Hamid, H. (2021). Building of Psychological Directions Parameter for Anbar Educational Directorate Teachers for non-specialty Towards Practicing Classroom and Extracurricular Activities. Anbar University Journal of Physical Sciences and Sports, 12(23), 23–46. https://doi.org/10.37655/uaspesj.2021.175083

Ali, O., Mushref, A., & Ali, B. (2024). The Role of Supplements in Improving Muscular Strength and Endurance in Professional Soccer Players: A Systematic Review. American Journal of Social and Humanitarian Research, 5(12), 485–497. https://doi.org/https://doi.org/10.31150/ajshr.v5i12.3116

Al-Rubaie, J. (2023). Contemporary Training Systems for Reaction Development. Baghdad: Ministry of Higher Education and Scientific Research.

Al-Shammari, M. (2021). Sensory-Motor Response in Speed Sports. Najaf: University of Kufa - College of Physical Education.

Fayyad, F. H., Hammood, Y. M., Ali, O. A., Mushref, A. J., Awad, A. K., & Shanta, A. (2025). Building and legalizing a test to measure the level of football agility of young players. Retos, 68, 1578–1590. https://doi.org/https://doi.org/10.47197/retos.v68.116368

Hamid, A. (2023). Qualitative Training Programs and the Development of Motor Responses. Amman: Wael Publishing House.

Hassan, N. (2021). The Effect of Playing Situational Exercises on Response Speed in Table Tennis Juniors. Iraqi Journal of Sports Research, 15(2), 115–130.

Khalaf, H. H., Abrahim, A. A., Khaleel, N. M., Hummadi, J. N., Mushref, A. J., & Ali, O. A. (2024). The Impact Of The Dines Model As An Educational Mediator On Cognitive Achievement And Learning Overhead Passing Skill In Volleyball. Proximus Journal of Sports Science and Physical Education, 1(12), 70–71.

Khalil, S. (2023). Comparing the effectiveness of short and long balls in developing motor response speed. Journal of Sports Training and Rehabilitation, 9(3), 145–158.

Mohammed, K. J., Suleiman, K. I., Naser, M. M., Ali, O. A., & Ali, O. (2025). The effect of colorful and varied visual skill exercises on the development of sensory perception and complex skill performance among futsal players. Retos, 69, 1226–1239.

Moreira, P.E.D. (2025). Effects of a dual-task training programme on tactical and working memory performance in young soccer players. *Journal of Sports Sciences*, *43*(18), 2058-2074, ISSN 0264-0414, https://doi.org/10.1080/02640414.2025.2532999

Muharib, B. O. & Ali, O. M. (2025). The effect of a proposed training method using some exercises to develop agility specific to football. Journal of Humanities and Natural Sciences, 6(5), 54–67.

Nouri, M. (2022). Using random balls to develop reaction speed in table tennis players. Journal of Sports Sciences, 18(1), 87–99.

Rocha, D.S. (2025). Relationship between training time and exercise addiction, flexibility, and performance in extreme conditioning program practitioners. *Sport Sciences for Health*, *21*(3), 1693-1697, ISSN 1824-7490, https://doi.org/10.1007/s11332-025-01383-0

Sadiq, K. (2022). Table Tennis Training: Tactics and Response. Basra: Sports Library.

Suisdareni, S., & Tomoliyus, T. (2021). The effect of drill exercise and reaction speed on the drive accuracy of beginner table tennis athletes. Jurnal Keolahragaan, 9(2), 231-237.

Wang, L., Zhang, H., & Liu, Q. (2021). Virtual Simulation Training Improves Reaction Time in Elite Table Tennis Players. Journal of Sports Science & Medicine, 20(1), 55–62.

Appendices:

Appendix (1): Sample Training Unit within the Proposed Program

General Information | Details
Unit Title | Developing Reaction Speed Using the Short Ball
Target Group | Youth Table Tennis Players (Ages 17–19)
Unit Duration | 45 minutes
Frequency | 3 units per week for 8 weeks
Implementation Venue | Official Training Hall – Babylon Governorate Club

Training Unit Components:

Phase	Time (minutes)	Content
Warm-up	10	General exercises: rope jumping, arm rotations, dynamic muscle stretching
Main	30	- Reaction drills using short balls in different positions (stationary and moving)
		- Random short ball serves from the coach with immediate reaction
		- Individual training (1 vs 1) on reacting to surprise balls
		- Paired drills (two players alternating in receiving short balls)
Cool-down	5	Stretching exercises, deep breathing, video review of players' performance

Organizational Notes:

- Use Butterfly 40+ balls.
- Record performance on video to analyze reaction speed.
- Repeat each drill at least 5 times.
- Include an element of surprise in each unit (change serve angle or ball timing).