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## The Effect of Cognitive Coordination Response Speed Exercises on Timed Counterattack Performance in Female Fencers

Fatimah Abed Malih

*College of Physical Education and Sports Sciences for Women, University of Baghdad, Baghdad, Iraq,*  
fatimaa@copew.uobaghdad.edu.iq

Rimah Mohammed Zuwair

*College of Physical Education and Sports Sciences for Women, University of Baghdad, Baghdad, Iraq,*  
rammah.zuair2204m@copew.uobaghdad.edu.iq

Ardo Okilanda

*Universitas Negeri Padang, ardo.oku@fik.unp.ac.id*

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## ORIGINAL STUDY

# The Effect of Cognitive Coordination Response Speed Exercises on Timed Counterattack Performance in Female Fencers

Fatimah Abed Malih<sup>a</sup>, Rimah Mohammed Zuwair<sup>a,\*</sup>, Ardo Okilanda<sup>b</sup>

<sup>a</sup> College of Physical Education and Sports Sciences for Women, University of Baghdad, Baghdad, Iraq

<sup>b</sup> Universitas Negeri Padang

## Abstract

Fencing is characterized by rapid and sudden changes that require speed in decision-making and motor responses. In addition, it requires high sensorimotor awareness and strong coordination between leg, arm, and eye movements. In the current study, the researchers used cognitive coordination response speed exercises and physical and skill exercises in order to develop performance in the time counterattack. The aim of the study is to identify the effect of cognitive coordination response speed exercises on the performance of the time counterattack of female foil fencers. An experimental method was used on the female fencing team players at the College of Physical Education and Sports Sciences for Women/University of Baghdad in the sports season (2025-2026). The sample consisted of (12) players. They were divided equally into an experimental group (practiced cognitive coordination response speed exercises) and a control group (practiced traditional exercises). The post-test results showed that the experimental group, which practiced cognitive coordination response speed exercises, outperformed the control group with a mean score of (9.5) compared to a lower mean score of (7) for the control group. The calculated t-value was (7.31) at a significance level of less than (0.05) regarding the experimental group. The results proved that the cognitive coordination response speed exercises were effective in developing time counterattack performance. Therefore, the study recommended conducting studies based on cognitive coordination response speed exercises due to their importance in developing time counterattack performance. The current study fulfills the third Sustainable Development Goal (good health and well-being).

**Keywords:** Speed of response, Cognitive coordination, Timed counterattack, Fencing

## 1. Introduction

Effective performance in fencing requires a high capacity for quick motor responses and appropriate decision-making in short timeframes. In order to develop these motor responses, defence skills, and time counterattack movements in fencing, and to create a dynamic sequence of performance during competition, the female fencer must have the ability to quickly respond to the coordinated perceptual response of the leg and the armed arm; which indicates the integration between the senses and performance indicating the integration between sensory input and performance to achieve accurate and rapid (Mustafa,

2005). This ability is important in skill performance during attack and counterattacks. It provides quick responses for the fencer in making decisions and executing the counterattack accurately.

Jaafar and Hassan (2024) confirmed that technical performance in fencing requires interconnected abilities that achieve different performance goals, including the ability to respond quickly and the cognitive coordination of the leg and the armed arm. The speed of response of the leg's cognitive coordination and the armed arm is one of the most important factors that help in developing the tactical and technical abilities of the female fencer because it links the neuromuscular response and the speed

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\* Corresponding author.

E-mail addresses: fatimaa@copew.uobaghdad.edu.iq (F. A. Malih), rammah.zuair2204m@copew.uobaghdad.edu.iq (R. Mohammed Zuwair), ardo.oku@fik.unp.ac.id (A. Okilanda).

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of decision-making in the competition. Moreover, understanding this relationship helps coaches and sports training specialists develop more efficient and effective training programs based on improving the speed of response to sensory-motor coordination as a key aspect of enhancing and improving counterattacks.

### 1.1. Justification and importance of the study

In fencing, the counterattack, specifically the timed counterattack, is an attacking skill that plays a significant role in determining the technical performance level of female players. It is a vital skill that directly affects the team's performance and results, representing a link between attack and defense. It demonstrates the player's ability to control timing, distance, and rhythm by developing rapid response to sensorimotor coordination such as the sense of distance, time, and force, which includes neuromuscular coordination. [Ashour et al. \(2023\)](#) confirmed that "The offensive and defensive skills of the foil weapon require great ability and coordination to reach the goal easily and comfortably." The player who masters the counterattack does not settle for one attempt, but works to continue responding intelligently until she achieves an opportunity, penetrates her opponent's defenses, and scores a touch. The importance of their study is particularly evident in the performance of the time counterattack, which requires instantaneous awareness of the timing of the opponent's movement and a rapid motor coordination to execute the appropriate response accurately.

### 1.2. Problem of the study

Fencing is characterized by rapid and sudden changes that require quick decision-making and motor responses. Based on the results of the tests, the researchers found a weakness in the correct timing of the counterattack due to the difference in the level of cognitive response speed of the leg and the arm. They also noted that there is a lack of training programs aimed at developing these abilities in addition to the limited studies that have addressed this issue among female foil fencers. This lack raises questions about the extent to which cognitive coordination response speed exercises for the leg and the arm affect the performance of the counterattack, especially the time counterattack.

### 1.3. Purpose of the study

Identifying the effect of cognitive coordination speed of response exercises on the performance of the

time counterattack of female foil fencers throughout the following:

- 1- Developing cognitive coordination response speed exercises for female fencers.
- 2- Identifying the differences between pre- and post-tests in the experimental and control groups regarding the performance of the time counterattack of female foil fencers.
- 3- Identifying the differences in post-tests between the experimental and control groups regarding the performance of the time counterattack of female foil fencers.

### 1.4. Hypotheses of the study

1. There are significant differences between the pre-test and post-test scores of the experimental and control groups in the time counterattack performance of female foil fencers in favor of the post-test scores.
2. There are significant differences between the experimental and control groups in the post-test performance of the time counterattack in favor of the experimental group.

### 1.5. Study scope

- **Human Domain:** A total of (12) Female players of the College of Physical Education and Sports Sciences team for the year (2025–2026).
- **Time Domain:** from November 17, 2025 to January 21, 2026.
- **Spacial Domain:** The fencing arena at the College of Physical Education and Sports Sciences for Women (University of Baghdad) located in the Al-Waziriya in Baghdad.

## 2. Methodology and procedures

### 2.1. Methodology

One of the most important factors of successful scientific research is determining the appropriate methodology for solving the research problem. This is an essential step that determines the success of the research approach. Therefore, the experimental method with a controlled approach (experimental group and control group with pre-test and post-test) was used to solve the research problem.

### 2.2. Sample and research population

The sample is defined as the part that represents the original population or the model on which the

Table 1. Illustrates the normal distribution of the study sample.

| Variables    | Unit of Measurement | Mean (Average) | Median | Standard Deviation | Skewness Coefficient |
|--------------|---------------------|----------------|--------|--------------------|----------------------|
| Height       | centimeter          | 168,4          | 168    | 0.87               | −0.74                |
| Weight       | kilograms           | 65.7           | 64     | 0.63               | 0.42                 |
| Age          | years               | 21,02          | 20,8   | 0.71               | 0,4                  |
| Training age | month               | 16,2           | 16     | 0.94               | −0.36                |

researcher conducts the entire focus of his work (Obaidat et al., 2020). The research sample consisted of the (12) female players from the College of Physical Education and Sports Sciences who represent the original population at a rate of (100%). Table 1 shows the distribution of the sample.

Table 1 shows the normal distribution of the sample under the Gaussian curve, because one of the properties of the typical normal distribution curve is that the skewness coefficient is confined between the values (+1) if the sample size is less than (30) individuals (Allam, 2011).

### 2.3. Tools and devices used in the study

- Databases on the World Wide Web (Internet)
- Arabic and foreign sources and references
- Casio electronic stopwatch
- Lenovo laptop (1)
- Video camera (1)
- Height and weight measuring device
- Legal fencing arena
- 12 foils
- 6 painted targets on a wall
- 6 movable wooden training targets
- 1 roll of transparent tape
- 1 colored marker
- 6 blindfolds

### 2.4. Performance test: Time counter-attack

The tester stands in the ready position (en garde) holding the foil in front of her partner, and upon hearing the word “start,” her partner (the attacking player) performs a repeat attack. The testee begins by timing the attack and then performs a counterattack against the opponent’s attack by stepping back one step and then forward and performing the time counterattack to take a touch, then step back and advance another step and perform the attack again. The technical performance of the counterattack is evaluated through a standardized form used in previous studies AlHaddad and Al-Yasiri (2022) based on evaluating the performance according to the parts of the movement and its manifestations by filming the skill and then presenting it to three experts who give a score from (1–10). Then, the mean scores of the evaluators was calculated.

### 2.5. Pilot study

Abdul Hadi (2001) indicates that “the pilot study is a small-scale experiment carried out to identify the advantages and disadvantages that may accompany the tests or procedures of the main research experiment.” Therefore, the pilot study was conducted on Monday, November 17, 2025, at 9:00 AM in the fencing arena on a sample of (6) female players from the research population. The pilot study aimed at the following:

- Understanding how to perform the time counter-attack.
- Understanding the test requirements, including equipment and support team members.
- Understanding the camera placement for recording and all the details of the test.
- Knowing the total time required to complete the main experiment.
- Understanding how to perform cognitive coordination speed of response exercises, the required equipment, the execution location, and their level of difficulty. Also, understanding how to structure the training load.

### 2.6. Main experience

#### 2.6.1. Pre-tests

The pre-test to evaluate the technical performance of the time counterattack was conducted on the experimental and control groups on Monday, November 24, 2025, at 9:00 AM in the fencing arena after the warm-up for the members of the research samples. All variables were decided for the standardization in post-tests. The two groups were randomly distributed (6 players in each group), the equivalence between them was carried out in the pre-test to evaluate the technical performance of the time counterattack, as shown in Table 2, which indicates the equivalence and homogeneity of the two groups.

#### 2.6.2. Applying cognitive coordination speed response speed exercises

The trainer’s curriculum was used for both groups, except that the experimental group performed cognitive coordination response speed exercises at the beginning of the main section of the training unit

Table 2. Shows the equivalence and homogeneity of the two groups.

| Group Statistics   | Independent Samples Test |                |               |       |        |       |                 |
|--------------------|--------------------------|----------------|---------------|-------|--------|-------|-----------------|
|                    | Mean                     | Std. Deviation | Levene's Test | Sig   | T-Test | Sig   | Significance    |
| Time counterattack |                          |                |               |       |        |       |                 |
| Experimental       | 5.5                      | 1.04           | 1             | 0.341 | 0.63   | 0.541 | Non-significant |
| Control            | 5.16                     | 1.72           |               |       |        |       |                 |

Statistically significant at the 0.05 level.

and in the skills preparation section for 15 minutes of the main section. Exercises for response speed cognitive coordination require a healthy nervous system. Therefore, they should be implemented at the beginning of the training unit because if they are implemented at the end of the training unit, the training objective will shift to endurance rather than speed of response, coordination, and cognition (Sheppard & Young, 2022). Furthermore, Abu Al-Ala et al. (2019) point out that “the body, when fatigued, uses compensatory physical mechanisms that lack the required skill precision in fencing.” This is physiologically attributed to the fact that “the speed of cognitive coordination response depends on the efficiency of the central nervous system in receiving and processing stimuli to make an accurate motor decision. If the training session continues and fatigue occurs, the level of neural excitability increases and there is a slowdown in the transmission of signals across neural connections, which leads to a decrease in the accuracy of motor response” (Czajkowski, 2021). Cognitive coordination response speed exercises do not rely heavily on physical exertion, but rather on the complexity of the exercises as follows:

- The intensity of the load: determined by the speed of performance (10–15 seconds), the multiplicity of stimuli, and that the performance of the exercises with an intensity close to competition (90%–100%), because slowness deprives the training of its value in the speed of cognitive coordination response.
- Load Volume: The volume should be moderate to low (6–8 frequency), because excessive repetition weakens the ability to respond quickly in coordination, perception, and concentration.

- Rest breaks: There should be a complete rest between exercises and sets (1–2 minutes) to restore the nervous system's activity, so that the player can process information in the next repetition with high accuracy.

The experiment started on Wednesday, November 26, 2025 and continued until Monday, January 19, 2026 with two sessions per week on Mondays and Wednesdays of each week (A total of 16 training sessions). The training session lasted 75 minutes, including warm-up and cool-down. Both the experimental and control groups performed the warm-up and cool-down sessions together.

#### 2.6.3. Post-tests

After the cognitive coordination response speed exercises, the post-tests were conducted on the experimental and control groups on Wednesday, January 21, 2026, at 9:00 AM after warming up and standardizing all variables with the pre-tests.

#### 2.6.4. Statistical methods

The results were statistically processed using SPSS and the following formulas: Mean - Std. Deviation - Levene's Test - Skewness Coefficient -Independent Samples Test -Test Paired Samples.

### 3. Presentation and analysis of the results

#### 3.1. Presentation of the results

Tables 3 to 5 and Fig. 1 show that the experimental and control groups improved in their performance of the time counterattack, but the experimental group was better at performing the time counterattack than

Table 3. Results of the difference between pre- and post-performance of the time counterattack for the experimental group.

| Group Statistics   | Paired Samples Test |                |                    |        |        |       |              |
|--------------------|---------------------|----------------|--------------------|--------|--------|-------|--------------|
|                    | Mean                | Std. Deviation | Paired Differences |        | t-test | Sig   | Significance |
|                    |                     |                | Mean               | Std. D |        |       |              |
| Time counterattack |                     |                |                    |        |        |       |              |
| pre-test           | 5.5                 | 1.04           | 4                  | 1.09   | 8.94   | 0.000 | significant  |
| post-test          | 9.5                 | 0.54           |                    |        |        |       |              |

Statistically significant at the 0.05 level.

Table 4. Results of the difference between pre- and post-performance of the time counterattack for the control group.

| Group Statistics   | Paired Samples Test |                |      |        |        |       | Significance |
|--------------------|---------------------|----------------|------|--------|--------|-------|--------------|
|                    | Mean                | Std. Deviation | Mean | Std. D | t-test | Sig   |              |
| Time counterattack |                     |                |      |        |        |       |              |
| pre-test           | 5.16                | 0.75           | 1.83 | 0.98   | 4.56   | 0.000 | significant  |
| post-test          | 7                   | 0.63           |      |        |        |       |              |

Statistically significant at the 0.05 level.

Table 5. Results of the difference between the experimental and control groups in post-test performance of the time counterattack.

| Group Statistics   | Independent Samples Test |                |         |       |              |
|--------------------|--------------------------|----------------|---------|-------|--------------|
|                    | Mean                     | Std. Deviation | T- Test | Sig   | Significance |
| Time counterattack |                          |                |         |       |              |
| Experimental       | 9.5                      | 0.54           | 7.31    | 0.000 | significant  |
| Control            | 7                        | 0.63           |         |       |              |

Statistically significant at the 0.05 level.

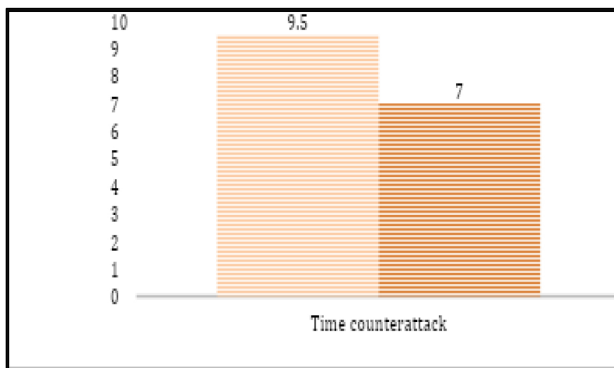


Fig. 1. Illustrates the difference in performance for the time counterattack between the two groups in the post-test.

the control group. This is due to their implementation of cognitive coordination response speed exercises.

#### 4. Discussion

The researchers point out that fencing is a sport that relies on visual stimuli and requires responses within fractions of a second when performing all its skills in general, and the time counterattack in particular, due to its dependence on precise timing in executing against an opponent's attack. This is because performance in fencing is linked to the player's ability to anticipate the timing of the movement, which affects the speed of motor response. The shorter this time, the more the fencer can surprise her opponent before she can complete her attack or close the defensive distance. Furthermore, implementing cognitive coordination response speed exercises leads to transforming the time counterattack

into a carefully planned performance, because cognitive training contributes significantly to developing the motor performance of players by enhancing response speed and information processing (Wu et al., 2024). It is based on scientific and kinetic principles, improves the technical performance of the attack, increases the scoring of clean touches, and reduces the consumption of unnecessary physical effort.

Madi and Asmaa (2023) indicates that "one of the most important pillars on which a fencer relies is speed of response, which requires speed of attack towards the opponent and directing the weapon suddenly towards the opponent's target in order to get a touch."

Roubi (2015) confirms that "respond speed exercises stimulate the nervous system while cognitive coordination exercises improve the connection between sensory-motor perception," and performing them in the same exercise together gives the fencer a high ability to execute a successful time counterattack that cuts off the path of attack on her opponent and wins the touch with the least physical effort and the highest time accuracy. He adds that "cognitive training contributes significantly to activating the sensory system, which accelerates the transfer of information to neural representations and through motor neurons to the responding organs" (Borysiuk et al., 2024).

Moreover, "attention and focus are directly related to the speed of response of a fencing player. Cognitive coordination improves the speed of decision-making in unexpected situations" (Abdul Sahib, 2022).

In fencing, the fencer is required to "link what the senses perceive (the eye) with what the muscles execute, i.e., to combine the movement of the feet with



the extension of the arm with high coordination and fluidity during the correct distance and appropriate timing towards the target of the competition at the moment when her target or her arm is exposed during her rush.” (Barth & Beck, 2007). The timed counterattack is one of the most difficult skills because it requires a head start. If response speed and coordination are not at their peak, the counterattack may turn into a double touch or a loss of touch to the attacker who has the right to attack with the foil and sword. (Czajkowski, 2005). It also requires high thinking and analysis of the attacker’s movements and attacks, and then responding.

## 5. Conclusions

1. Cognitive coordination response speed exercises have a positive effect on the performance of the time counterattack in the experimental group.
2. Continued and consistent training led to improved time counterattack performance in the control group.
3. The cognitive coordination response speed exercises developed the time counterattack in the experimental group better than the usual exercises of the control group.

## 6. Recommendations

1. It is necessary to rely on cognitive coordination response speed exercises for training programs for female fencers because they develop the performance of the timed counterattack.
2. It is necessary to pay attention to preparing complex exercises with motor duties that achieve more than one goal when implemented.
3. Conducting similar research with different samples and other fencing skills, other games, and different activities.
4. Adopting modern technology in sports training and methods that achieve multiple goals with the same performance of fencing skills.

## Conflicts of interest

None.

We confirm that all tables and figures in this article are ours and written by the researchers themselves.

## Ethical clearance

This manuscript approved by the Scientific Committee of the College of Physical Education and Sports Sciences for Women, University of Baghdad, Iraq, on (2025/11/17).

## Author’s contributions

All contributions to this study were carried out by the researchers Fatimah Abed Malih conducted the study procedures, collected and organized the data, participated in the implementation of the experimental program, and contributed to drafting the manuscript. Rimah Mohammed Zuwair developed the research idea, designed the study, supervised the research procedures, interpreted the results, and reviewed and finalized the manuscript. Ardo Okilanda contributed to the study design, provided scientific consultation, and reviewed the manuscript.

The study also benefited from the assistance of a number of experts: Prof. Dr. Fatimah Abed Malih (Statistics), Asst. Prof. Dr. Ishraq Ghalib Oudah (Revision), and Asst. Prof. Dr. Fatimah Mohammed Al-Asadi (Translation), Directorate of Scholarships and Cultural Relations, Ministry of Higher Education and Scientific Research.

## Facilitating the task

This study was supported by the College of Physical Education and Sports Sciences for Women/University of Baghdad.

## Roles of each researcher in the research

- **First researcher: Fatimah Abed Malih** was responsible for the conceptualization of the research idea, study design, literature review, supervision of data collection and experimental procedures, interpretation of the results, reviewing the manuscript, and final revision.
- **Second researcher: Rimah Mohammed Zuwair** was responsible for participating in the implementation of the study procedures, collecting and organizing the data, assisting in conducting the experimental program, contributing to the interpretation of the results, and assisting in drafting the manuscript.
- **Third researcher: Ardo Okilanda** contributed to the study design, provided scientific consultation, and reviewed the manuscript

## Funding statement

This research received no external funding.

## Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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### Appendix (1) the technical performance evaluation form for the counterattack.

| Name of Participant                         |                                            |   | Name of Evaluator |                       |   | Signature |                   |   |   |            |   |   |             |   |   |                         |
|---------------------------------------------|--------------------------------------------|---|-------------------|-----------------------|---|-----------|-------------------|---|---|------------|---|---|-------------|---|---|-------------------------|
| Technical performance of the counter attack | Smoothness and coordination of performance |   |                   | Timing of performance |   |           | Preparatory phase |   |   | Main phase |   |   | Final phase |   |   | Total score (out of 10) |
|                                             | Score                                      |   |                   | Score                 |   |           | Score             |   |   | Score      |   |   | Score       |   |   |                         |
|                                             | 0                                          | 1 | 2                 | 0                     | 1 | 2         | 0                 | 1 | 2 | 0          | 1 | 2 | 0           | 1 | 2 |                         |

### Appendix (2) Names of experts evaluating the technical performance of the counter-attack

| No. | Name and Title                     | Specialization              | Workplace                                                                          |
|-----|------------------------------------|-----------------------------|------------------------------------------------------------------------------------|
| 1   | Prof. Dr. Dhafer Namooos Al-Taie   | Teaching Methods - Fencing  | Ministry of Education – Diyala Directorate of Education                            |
| 2   | Asst. Prof. Dr. Ishraq Ghalib Ouda | Exercise Physiology-Fencing | University of Baghdad, College of Physical Education and Sports Sciences for Women |
| 3   | Asst. Lect. Rasha Salem Blasim     | Training - Fencing          | University of Baghdad, College of Physical Education and Sports Sciences for Women |

### Appendix (3) Sample exercises for cognitive coordination response speed

- From a standing (ready) position, the player advances and then retreats (with a teammate). Upon hearing the coach's whistle, she executes the timed counter-attack.
- From a standing (ready) position, the player executes the timed counter-attack in front of target No. (6), then is blindfolded to execute the attack on the same target.
- From a standing (ready) position, the player stands blindfolded and holds the weapon. The instructor taps the weapon on the ground from different directions, and the player must follow the tapping sound and strike back.
- From a standing (ready) position, the player stands unarmed, then performs a forward roll, stands, and executes a timed counterattack with a target.
- From a standing position (ready) in front of a target, the blindfolded player stands. Upon hearing one tap, she executes a timed counterattack on area (6). Upon hearing two taps, she touches area (4).
- From a standing position (ready), the attacking player stands in front of a teammate. Upon hearing the target number from the coach, the player executes a timed counterattack towards the target.

**Appendix (4)****Training Unit:** first**Objective:** To develop the performance of the time counter-attack.**Week:** 1**Intensity:** %90**Unit Time:** 75 minutes**Working Time:** 15 minutes

| No. | Perceptual–Motor Reaction Speed Exercises                                                                                                                                                                                  | Exercise Duration | Repetitions | Rest Between Repetitions | Number of Sets | Rest Between Sets |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------|--------------------------|----------------|-------------------|
| 1   | From a standing ready position, the player performs a timed counterattack toward a target marker (No. 6). Then, she is blindfolded and repeats the attack on the same target.                                              | 10 s              | 6           | 21 s                     | 2              | 60 s              |
| 2   | From a standing ready position, the player stands blindfolded while holding the weapon. The coach taps the ground with the weapon from different directions. The player follows the sound and performs a thrust toward it. | 10 s              | 6           | 21 s                     | 2              | 60 s              |

# تأثير تمارين سرعة استجابة التوافق الإدراكي في أداء الهجمة الزمنية المضادة لدى لاعبات المبارزة

فاطمة عبد مالح<sup>1</sup>، رماح محمد زوير<sup>1</sup>، اردو اوكيلاند<sup>2</sup>

1- جامعة بغداد كلية التربية البدنية وعلوم الرياضة للبنات

2- جامعة نيجيري بادانج

## المستخلص

رياضة المبارزة تتميز بالتغيرات السريعة والمباغطة التي تحتاج الى سرعة في اتخاذ القرارات والاستجابات الحركية، وتتطلب إدراكا حسيا حركيا عاليا يتصف بالتوافق العالي بين حركات الارجل والذراع والعين، لذا عمدت الباحثتان الى استعمال تمارين سرعة استجابة التوافق الإدراكي إضافة الى التمارين البدنية والمهارية من اجل تطوير الأداء في الهجمة الزمنية المضادة. وهدفت الدراسة الى التعرف على تأثير تمارين سرعة استجابة التوافق الإدراكي في أداء الهجمة الزمنية المضادة لدى لاعبات سلاح الشيش.استعمل المنهج التجريبي على لاعبات منتخب المبارزة في كلية التربية البدنية وعلوم الرياضة للبنات /جامعة بغداد للموسم الرياضي(2025-2026) والبالغ عددهن (12) لاعبة، قسمت بالتساوي مجموعة تجريبية (مارست تمرينات سرعة استجابة التوافق الإدراكي) ومجموعة ضابطة (مارست التمرينات التقليدية)، اظهرت نتائج المقارنات البعدية في الاوساط الحسابية تفوق المجموعة التجريبية التي خضعت لتطبيق تمرينات سرعة استجابة التوافق الإدراكي على المجموعة الضابطة اذ حققت وسط حسابي (9.5) بينما حققت المجموعة الضابطة وسط حسابي اقل (7) وبلغت قيمة T المحسوبة (7.31) عند مستوى خطأ اقل من مستوى دلالة (0.05) ولمصلحة المجموعة التجريبية، ما يؤكد ان استعمال تمارين سرعة استجابة التوافق الإدراكي التي نفذتها المجموعة التجريبية اثبتت فعاليتها في تطوير أداء الهجمة الزمنية المضادة، لذلك اوصت الدراسة بإجراء دراسات تعتمد على تمارين سرعة استجابة التوافق الإدراكي لأهميتها في تطوير أداء الهجمة الزمنية المضادة. وان هذه الدراسة تحقق الهدف الثالث من اهداف التنمية المستدامة (الصحة الجيدة والرفاه).

**الكلمات المفتاحية:** سرعة استجابة، التوافق الإدراكي، الهجمة الزمنية المضاد، رياضة المبارزة