The speed of motor reaction and its relationship to the starting stage of the 200-meter running event for female students

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ABSTRACT

The 200-meter sprint is one of the short sprint events that rely heavily on special physical abilities, especially in the starting and starting stages, as this stage is considered one of the most important stages affecting the overall performance of the race, due to its direct impact on the final time of the student. A critical factor in the success of initiation is the speed of the motor reaction, which reflects the efficiency of the neuromuscular system in responding quickly to stimuli.

Based on the importance of this variable, the research aimed to study the relationship between motor reaction speed and the start time in the female 200-meter event, in order to determine the extent to which the response speed affects the improvement of the start of the runners, which contributes to the development of competitive performance and results in short races.

The researcher used the descriptive method in the method of relational relations, as it is the most suitable to achieve the objectives of the study. The research sample consisted of (30) female students of the first stage at the College of Physical Education and Sport Sciences – Baghdad University for Girls for the academic year (2024-2025), and they were selected by simple random method.

The research concluded that motor reaction speed is one of the important indicators that affect the quality of performance in the starting stage, and therefore it is one of the determining factors for success in the 200-meter race. Accordingly, the researcher recommends the need to focus on training to improve reaction speed within the training curriculum for female students, especially in short sprint events, in addition to integrating modern technical tests in performance analysis and making the most of individual abilities.

1. Introducing the research

1-1 Introduction

The 200-meter sprint is one of the events that requires runners to possess high speed and technical strength, as the start stage of this race is one of the most important stages that directly affect the overall performance of the student (Al-Mutairi, 2019, p125). A quick and effective start gives the runner an important competitive advantage in the early stages, which reflects positively on the final time.

One of the main factors that affect the quality of the initiation phase is the speed of the motor reaction, which is defined as the time it takes for the neuromuscular system to respond to a specific stimulus (acoustic or visual) by performing an appropriate movement (11:36). Reaction speed is one of the vital indicators that reflects the efficiency of the nervous and muscular systems in responding quickly, which in turn affects the quality of the start during sprint races.

The importance of the research stems from the need for coaches and physical education specialists to understand the relationship between motor reflex speed and the start stage of the 200-meter race, especially in females who face training challenges that are sometimes different from their male counterparts (9: 104). Knowing this relationship helps in designing effective training programs aimed at improving response speed and improving starting performance.

The research also contributes to the development of performance measurement methods using modern technical devices, which enhances the accuracy of technical evaluation and helps in making scientifically based training decisions.

1-2   Research Problem

The start stage is a crucial stage in the 200m race, directly affecting the final performance time. One of the factors affecting the quality of the trigger is the speed of the motor reaction, which expresses the response time of the motor nervous system to a specific stimulus. While this ability is important, many female runners in college environments don't pay enough attention to developing reflex speed. Therefore, the research problem is to determine the extent to which there is a relationship between motor reflex speed and the stage of initiation of the 200-meter race among first-stage female students at Baghdad University for Women.

1-3   Research Objectives

This research aims to:

1- Measuring the speed of motor reaction in a sample of first-stage female students at Baghdad University for Girls.

2- Analysis of the start phase of the 200-meter event in the sample.

3- Study of the relationship between motor reaction speed and start time in a 200-meter race.

4- Providing scientific and training recommendations to improve the speed of reaction and thus improve the performance of the start in the race.

1-4 Hypothesis Research

1- There is a significant correlation between motor reaction speed and the time of the start stage of the 200-meter running event among first-stage female students at the College of Physical Education and Sport Sciences for Girls – University of Baghdad.

1.5 Research Areas

1-5-1 Human Field: Female students of the first stage at the College of Physical Education and Sport Sciences / for Girls - University of Baghdad.

1-5-2 Temporal Domain: Period from 1/11/2023 to 1/4/2024**.**

1-5-3 Spatial Field : Scouting Stadium for Girls, University of Baghdad .

1.6 Definition of Terms

1.6.1 Kinetic Reaction Speed:

It is the time it takes for the central nervous system and muscles to respond to an external stimulus (audio or visual) by performing a specific movement, and it is an indicator of the efficiency of the neuromuscular response, usually measured in seconds or milliseconds, and it directly affects the quality of motor performance, especially in sports that require a quick start such as sprinting. (13: 92)

1.6.2 Initiation Phase:

 It is the period of time that begins from the moment the official start signal is issued (such as the start whistle or the sound of the alarm) and ends when the runner lifts his foot from the starting mass and turns into an actual running motion, and this stage represents the main factor that affects the speed of performance over a distance of 200 meters, and is measured in seconds with high accuracy. (6: 78)

1.6.3 200 Meters Event:

It is a sprint (short sprint) that takes place on a 200-meter track, and it is a race that requires a combination of top speed, fast endurance, and the correct technique for starting and bending, and is one of the sporting events that is of great importance in athletics. (7: 134)

3. Research methodology and field procedures

3.1 Research Methodology

In her study, the researcher relied on the descriptive-relational approach, as it is one of the appropriate approaches for research that aims to reveal the relationship between two or more variables, without controlling or manipulating any of them. This method was chosen because it is the best to achieve the objectives of the current research of studying the relationship between motor reaction speed and the initiation stage of the 200-meter running event for females, which allows the possibility of explaining the nature of this relationship as it appears in the real field among female students of the Faculty of Physical Education and Sport Sciences.

He points out (4: 58) that "the descriptive method is one of the scientific methods used to describe phenomena as they are, and to try to explain and analyze the relationships between them."

3.2 Research population and sample

The research community represents the first stage female students at the College of Physical Education and Sport Sciences for Girls – University of Baghdad for the academic year (2023-2024), where the 200-meter running event is studied within the vocabulary of the practical athletics lesson, which provides a suitable environment for the application of research procedures and achieving its goals.

A simple random sample of (30) female students was selected from the original research population, taking into account the homogeneity in some characteristics such as age, height, weight, and training background. Considering the selection of the sample to be regular in the study, and it has completed the short running lessons and the effectiveness of 200 meters within the practical curriculum and is free of muscular or joint injuries that may affect the performance of the tests, and this sample size is sufficient for the statistical analysis required within the correlational studies, especially with the availability of the conditions of homogeneity and appropriate representation.

3.3 Research Tools and Means

The researcher relied on a set of accurate scientific tools and means to collect data, including the following:

First- Simple motor reaction speed test: It was performed using an electronic device to measure the response time of an auditory stimulus, where the student's hand is placed on the button and asked to press as soon as the sound signal is heard.

The device records the response time in units of seconds (s).

Second- Kinetic imaging of the starting stage: A digital camera with a slow shooting of at least (120 frames/second), which is fixed in front of the starting line at a side angle, was used to record the details of the start and start.

Kinovea software is used to analyze video and extract data for kinetic time, tilt angle, and number of first steps.

Third- Documentation Forms:

To record the raw data (age, height, weight, specialization, training history).

To record the results of the tests (response time, start time, 200 minar run achievement).

Fourth: Supporting Tools:

1-   Accurate stopwatch (chronometer).

2-   Meter Tape.

3-   A computer loaded with kinetic analysis software.

4-   Whistle.

3.4 Field Tests

First: Simple Reaction Time Test

Objective: To measure the time it takes for the student to respond to a sound stimulus.

Steps:

The student sits in a fixed position in front of the machine.

When you hear the whistle, press the button as fast as you can.

Time is counted in seconds, and three attempts are taken and the best ones are scored.

Reliability: Studies have shown that this method is very reliable in measuring simple latency.

Second: Test the Stage of Starting the 200 Meter Run

Objective: To analyze the motor and technical characteristics of the initiation phase.

Procedure:

Photograph the student from a side angle as she starts her run.

The video is analyzed to extract:

The start time from the moment of signal until the feet are separated from the ground.

The angle of inclination of the trunk.

The number of steps in the first 10 meters.

Third: 200-meter running achievement test

Objective: This test aims to measure the total time it takes for a student to cover a distance of 200 meters, as an important indicator of the level of actual achievement in the 200-meter running event, and the extent to which it is related to both motor reaction speed and the characteristics of the starting phase.

Testing Procedures:

The student is required to perform a 200-meter sprint on an approved outdoor track.

The test is performed from the high start mode to ensure uniformity of performance conditions for all sample members.

The timing starts from the moment the audio signal (whistle) is played until the student crosses the finish line.

An accurate electronic stopwatch (chronometer) is used to record time in units of seconds.

Only one attempt is made per student to avoid the effects of fatigue, and the result of that attempt is adopted as an official indicator of achievement.

3-5   Field Procedures

3-5-1   Exploratory Experience:

The researcher conducted an exploratory experiment on Tuesday, 4/4/2023, on (6) female students who are not participating in the research sample, to apply the tests to them, with the help of the assistant work staff, at the Faculty of Physical Education and Sport Sciences for Girls, University of Baghdad, to implement these tests, as well as to identify the following:-. The aim is to test the validity of instruments, stabilize performance timing, and ensure the accuracy of measurements.

3-5-2   Main Actions:

Coordinating with the activities department at the college to allocate time and space.

Explain the instructions to the student accurately before each test.

Implementation of the reaction speed test in a closed hall, then the start test in the college track on the research sample of (30) female students on Wednesday, 5/12/2023.

Results are recorded live and documented for accuracy.

3.6 Statistical methods used

After the data was collected, it was analyzed using SPSS software version 26:

4- Presenting, analyzing and discussing the results:

4.1 Analysis of the results

4.1.1 Analysis of the arithmetic mean, standard deviation and T value of the research variables

The following table shows the statistical values of the variables of motor reaction speed, starting stage, and completion of the 200-meter run:

Table (1)

Arithmetic mean, standard deviation, calculated and tabular T-value of the variables in the research sample

Statistical significance	Significance Level	Correlation coefficient value	Standard deviation	Arithmetic mean	Unit of Measurement	Variable	t
D	0.000		0.02	0.31	Second	Motor reaction speed	1
D	0.000	0.67	0.21	1.62	Second	Getting Started	2
D	0.000	0.72	1.44	27.85	Second	200m Run Achievement	3

Through Table (1), it was found that the arithmetic mean of the motor reaction speed is (0.31) with a standard deviation of (0.02), while the arithmetic mean of the starting stage is (1.62) with a standard deviation of (0.21), and the calculated value of (correlation coefficient) is (0.67), which is a significant correlation coefficient because the SIG value was less than (0.05), which

indicates that there is a significant correlation between the motor reaction speed and the initiation stage.

The mean of the achievement of the 200 m run was (27.85) with a standard deviation of (1.44), and the calculated value of (correlation coefficient) was (0.72), which is a significant correlation coefficient because the SIG value was less than (0.05), which indicates that there is a significant correlation between the speed of the motor reaction and the achievement of the 200 meter run.

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4.2 **Discussion of the results**

The results of the research showed that there is a significant correlation between **motor reaction speed** and **the starting stage**, as well as between reaction speed and overall achievement in the (200) meter race for female students, a result that is consistent with what a number of researchers pointed out that the effectiveness of the short sprint depends to a great extent on the speed of the neuromuscular response at the moment of starting, because of its direct effect on achieving a fast start that paves the way for gaining a high speed during the first meters of the race.

The start phase **is** one of the most crucial stages in sprint events, as it is closely related to how quickly the runner responds to the start signal. The shorter the reaction time, the faster the runner will leave the blocks and achieve a better initial acceleration. **Hamid Abdel Zahra (2022) pointed out** that reaction speed is a key indicator in determining the start time and contributes to approximately (30%) of the overall achievement of runners (Hamid, 2022, p. 45).

The results of **Kazem Hussain et al. (2021) also showed** that runners with short response times have a higher ability to produce instant acceleration during the first 20 meters of the race, which reflects positively on the overall completion time, which is consistent with the results of

the current research that confirmed the existence of a significant correlation between reaction speed and achievement (Kazim et al., 2021, p. 63).

On the other hand, the relationship between reaction speed and final achievement can be explained by the fact that a runner with high neuromuscular efficiency is also characterized by a high degree of motor coordination and muscular control, which makes her able to maintain her starting speed and convert it into a gradual acceleration during the later stages of the race. **Ali Abdul Wahid (2020) pointed out** that neuromotor efficiency does not only affect the starting phase, but its effects extend to the stages of acceleration and speed maintenance, as it is related to the ability of The central nervous system controls the sequence of micromuscular contractions (Abdul Wahid, 2020, p. 78).

These results are also consistent with the view **of Hassan Jabbar et al . (2019)** where they found that there is a significant correlation between muscular reaction speed and start time, with a correlation coefficient value of (0.71), suggesting that improving response speed can contribute to improving the overall performance of runners (Hassan et al., 2019, p. 91).

In addition, the results of the current research confirm that the starting stage represents the cornerstone of speed races, and that physical preparation alone is not enough to achieve a distinguished achievement unless it is supported by high neuromotor abilities, especially in events such as (200) meters, which require a high response speed at the beginning and the ability to maintain speed in the final curve and straight. This is what **Iman Mohamed (2023) pointed** out, as it found that the accuracy of the response and the speed of the start were among the most influential factors in the differences Between the distinguished and the non-distinguished (Iman, 2023, p. 54).

The positive relationship between reaction speed and start can be said to be due to the fact that reducing motor response time shortens the time between the start signal and the actual movement, which increases the starting speed and reduces time loss in the first stage of the race. The existence of a significant relationship between reaction speed and overall achievement also shows that a runner with high neuromuscular efficiency can maintain quality performance throughout the race, including the acceleration, cornering and finish stages.

4. Conclusions and recommendations
4.1 Conclusions

In light of the results of the statistical analysis and the scientific discussion that dealt with the relationship between motor reaction speed and the time of the start stage of the 200-meter running event for first-grade female students at the Faculty of Physical Education and Sport Sciences for Girls – University of Baghdad, the following conclusions can be reached:

1- The results of the research showed that there is a strong and positive correlation and a statistically significant correlation between motor reaction speed and start stage time, which indicates that improving response speed directly contributes to improving the start time.

2- The results of the sample members were close in both variables, indicating a homogeneity in the physical and motor performance of female students.

3- Field data showed that the distribution of results was almost normal, reinforcing the validity of the measurements used.

4- Hands-on exercises that rely on improving response speed and start may be effective in improving performance in short events such as the 200 meters.

5- Students who scored the fastest time in reacting were also the fastest in the starting phase, highlighting the importance of paying attention to this aspect in training plans.

5.2 Recommendations

Based on the findings and conclusions, the researcher recommends the following:

1- Adopting exercises aimed at improving the speed of motor reaction within the study units for female students, as they have a positive impact on improving the starting stage.

2- Conduct similar studies on larger samples and at different age stages (e.g., young or elite) to compare and reinforce the results.

3- Introducing digital performance analysis techniques into practical field lessons to assess the speed of initiation and reaction more accurately and objectively.

4-   Encouraging students to pay attention to mental and psychological preparation before performing events, as it plays a role in improving motor response.

5-   Specialized exercises to develop motor reflex speed should be included in students' training programs (e.g., auditory and visual response exercises and surprise exercises).

6-   Using precise electronic devices to measure reaction time to accurately assess trainees' progress.

7-   Focus on the start stage of training programs for speed events, especially for female students at the university stages.

8-   Conduct future studies that link reaction speed to other physiological variables such as nerve conduction speed, muscle stimulation time, and anaerobic capacity.

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