

The relationship between the Explosive Power of the lower limbs and the speed of reaction and achievement 100m race.

العلاقة بين القوة الانفجارية للأطراف السفلية وسرعة رد الفعل وإنجاز سباق 100 متر

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Received: 14/06/2025

Accepted: 23/07/2025

Published: 30/09/2025

Abstract The Study aims to determine the relationship between the Explosive Power of the lower limbs and the speed of reaction and their relationship to the achievement OF the 100m race, which is considered among the important physical elements in track games.

The researcher used the descriptive approach to suit the nature of the study, representing our research community of runners short 100m across the Algerian country, while the research sample was represented in the Bourj Bou Arreridj Youth Club, which consists of 12 runners under 19 years old.

The sample was chosen in a deliberate manner for the sports season 2024/2025, and the SPSS statistical packages program was used to calculate the results and the most important results were:

- There is a statistically significant average positive direct correlation between -the explosive power of the lower limbs -reaction speed- and the achievement of the 100m race.

KEYWORDS: Explosive Power, Reaction Speed, 100 Race

الملخص: هدفت الدراسة إلى تحديد العلاقة بين القوة الانفجارية للأطراف السفلية وسرعة رد الفعل وعلاقتها بإنجاز فعالية 100 م والتي تعتبر من بين العناصر البدنية المهمة في ألعاب المضمار. استخدم الباحث المنهج الوصفي للملائمة طبيعة الدراسة، تمثل مجتمع بحثنا من عدائي السباقات القصيرة 100 م عبر القطر الجزائري، أما عينة البحث فتمثلت في نادي شباب برج بوعريريج والمتكون من 12 عداء تحت 19 سنة اختيرت العينة بالطريقة العمدية للموسم الرياضي 2025/2024، وتم استخدام برنامج الحزم الإحصائية للعلوم الاجتماعية SPSS لحساب النتائج، وكانت أهم النتائج:

- توجد علاقة طردية إيجابية متوسطة ذات دلالة إحصائية بين القوة الانفجارية للأطراف السفلية وإنجاز سباق 100 م.
- توجد علاقة طردية إيجابية قوية ذات دلالة إحصائية بين سرعة رد الفعل وإنجاز سباق 100 م.

الكلمات المفتاحية: القوة الانفجارية، سرعة رد الفعل، سباق 100 م.

1- Definition of search:

1-1-Introduction and problematic of study:

The Science of Sports Training is one of the Sciences that are developing day after day like other Sciences, through which physical performance, skills and plans can be developed to achieve better, as scientists have made many efforts to develop the training process in all respects (Physical, Skillful, Planned, Physiological, and Psychological). (Allawi, 1992, p. 35)

Research was conducted to develop physical qualities and basic skills, as well as to find ways and means of training that would develop these qualities (hazaa, 1997, p. 38), and then linking the body and skill by diagnosing the causes that lead to a decline in the technical and physical level and addressing them through the development of physical qualities specific to a type of activity, or internal changes that occur as a result of sports training, which include functional changes to different body system.

Among the capabilities that contributed to the achievement of fast racing is explosive force by developing the ability of the neuromuscular system to reach maximum muscle strength, through rebound jumping and jumping exercises that are performed in different forms and accompany activities in which muscles perform eccentric contraction in order to develop explosive force and the ability of the athlete to react (zaki, 1998, p. 63).

The 100m Run is one of the most exciting and exciting competitions in athletics competitions, as it is characterized by fast motor performance and neuromuscular compatibility(fadli & hikmat, 2014, pp. 47-57), in addition to the fact that the 100m race is one of the events with frequent rhythms that require fast performance and strength, where performance and achievement depend on these variables. (lazim kamash, 2002, p. 21)

Training science means "the science that gives a description and explanation of the physiological indicators resulting from performing one-time training or repeating the training several times with the aim of improving the responses of the body's organs. (abou elalaa, 2003, p. 132)

Due to the importance of the explosive power of the lower limbs and the speed of reaction in speed races in general and the 100m race in particular, this study came to reveal the nature of the relationship between these variables and the performance of the 100m event.

The maximum consumption of oxygen and its relationship to the physical specifications of the player according to each specialty, and what this success

imposes in individual games is the presence of selected practitioners based on accurate scientific foundations that achieve the development of that sport.

Research and studies reveal day after day new results in the field of sports and still need more information in order to reach other scientific facts for the basics of sports activities, the most important of which is related to the explosive power of the lower limbs(dahbazi & jabali, 2020, pp. 380-398), and the speed of reaction that may improve the latency time, as well as performance tolerance, which appears in the penultimate stage in the speed race, which is called performance decline and speed tolerance, which is seen as a distinctive force of speed (repetitive movements), As for the explosive power of the lower limbs, it appears in the only movements.

The speed of reaction and the muscular strength of the lower limbs share the fact that they depend on the time factor for success in (madjedi & khodir, 2022, pp. 850-859) implementing the movement. The development of these two qualities in the player is one of his common goals, which leads to an increase in the speed of contraction and muscular expansion with the speed of reaction. Therefore, the reliance of these two qualities on each other and their effectiveness is what requires research to reveal the relationship between them and mathematical achievement?

Is there a relationship between the explosive power of the lower limbs and the speed of reaction to the achievement of the 100m?

1- Is there a relationship between the explosive power of the lower limbs to the achievement of the 100m event?

2- Is there a relationship between the speed of reaction and the achievement of the 100m?

2-1-The general and Partial hypotheses:

2-1-1-The general hypothesis:

There is a statistically significant direct correlation between the explosive power of the lower limbs, reaction speed, and the completion of the 100m race.

Partial hypotheses:

There is a statistically significant direct correlation between the explosive power of the lower limbs and the achievement of the 100m race.

There is a statistically significant direct relationship between the reaction speed and the completion of the 100m race.

1-3- Aim of the search: Each study has a goal that makes it of scientific value and the objective of the study is why we have prepared this study and our study aims to:

Reveal the naturalness of the relationship between the explosive power of the lower limbs and the completion of the 100m race.

Reveal the nature of the relationship between reaction speed and the completion of the 100m race.

1-4-Importance of search:

Highlighting the role of physical abilities in achieving excellence in sprints (100m) according to the nature of the relationship and the degree of attachment. Referring to the development of some abilities and qualities that are closely related to this sport.

1-5-Determination of terms and concepts:

Explosive power: "It is the highest power that Riyadh gets in the shortest time and at once." (daroish, 2007, p. 105)

Reaction speed: It is the period between the appearance of the stimulus (auditory or visual) and the moment of response to it in motion. Some believe that the reaction speed is the speed of moving or starting at full speed, This concept is incorrect because the reaction speed is a physiological state whose processes lie only within the body and begin the course of its processes from the brain to the nervous system and then to the muscular system. " (hammad mofti , 2008, p. 19)

100M SPRINT: The shortest sprint distance on an open track, the winner of this race is usually called the fastest man/woman in the world. (kasim & kais nadj, 1994, p. 118)

3-Similar studies:

3-1-Study by Majadi Moftah and Saadi Khudair 2022:

Study Title: The Relation of Muscular Ability (Strength Characterized by Speed - Explosive Force) of the Lower Limbs to the Transitional Speed of Football Players.

Aim of the study: The aim of the study is to find out the relationship between the two qualities of muscular ability of the muscles of the legs and the transitional speed of football players.

Scientific method used: The two researchers used the descriptive method in the style of correlational relationships.

Study sample: The research sample consisted of 18 football players in the reserve class (U21) who are active in the "Shabab Ain-Oussara" team belonging to the second national division, which was deliberately selected.

The results of the study: The results concluded that there is a positive correlation between the transitional speed and the muscular capacity of the muscles of the lower limbs, where there is a strong correlation with the strength characterized by speed and explosive force. (madjedi & khodir, 2022)

3-2-Study of Osama Ismail Muhammad Al-Shaer and Muhammad Ibrahim Abdul Khaliq 2022:

The title of the study: The relationship between reaction speed and some psychomotor abilities of runners.

Objective of the study: The study aimed to identify the reaction time and psychomotor abilities of run contestants, as well as to identify the relationship between reaction time and psychomotor abilities of run contestants.

Scientific method used: The two researchers used the descriptive method.

Study sample: The baseline study was applied to a deliberate sample of (15) high-level contestants.

Findings:

There is a relationship between the variables of attention speed, concentration, Determination Test (DT), 10m time, and reaction time.

There is a direct correlation between the number of Incorrect (Raw) responses and the time of 10 m for sprint racers.

There is a direct correlation between the number of Incorrect (Raw) responses and the reaction time of the sprint racers.

There is an inverse relationship between both the number of Incorrect (PR) responses and the reaction time of the sprint racers.

There is a correlation between reaction time (RT), 10m and reaction time variables.

There is an inverse relationship between No reaction (Raw) and the reaction time of the sprint racers.

Lack of correlation between Cognitrone variables (cog) Attention, concentration, 10m time and reaction time. (Elshaair & Rida, 2022, pp. 240-259)

3-3-Study: Boushrit Shahir 2019

The title of the study: Determining the level of some physical qualities and their relationship to the digital level of elite runners 100 meters.

Aim of the study: The study aimed to conduct a set of physical tests to measure velocity, explosive force and force characteristic of velocity and their relationship to the digital level of the 100-meter runners.

Scientific method used: The researcher used the descriptive method in the style of correlational relationships.

Study sample: The researcher chose the sample in a deliberate way, which included 27 runners from high school athletic students for the academic season 2014-2015.

Findings:

There is a strong relationship between speed and strength tests characterized by speed at the digital level of 100m.

There is no relationship between explosive force tests at the digital level of 100m. (boushrit, 2019, pp. 282-301)

3-4-Study: Faleh Jalash, Moayad AbdulRahman2017.

Study Title: The Relationship of Some Transition Speed Tests to the Achievement of a100m Runner.

Objective of the study: To identify the impact of some transitional speed tests by completing a 100m run

Scientific method used: The researcher used the descriptive method.

The study sample:

The research sample was randomly selected, as the research sample was (25) students out of (45) students.

Findings:

One of the most prominent results reached was the absence of a correlation between body mass and the achievement of the 100m run.

There is no real correlation between the 20m and30m run tests with the achievement of the 100m run.

There is a correlation between the tests of the moving speed of 50 m and the run of 4 seconds and the run of 6 seconds by completing the run of 100 m. (jaaz & moaid, 2017, pp. 99-113)

2-Research procedures:

1-The exploratory study: At this stage, we have learned more about the study sample, adjusting and defining the conditions knowing the appropriate conditions for applying measurements and tests, the suitability of the tools, calculating the scientific parameters of the tools, identifying the nature of the sample and how to deal with it, as well as identifying the nature of the attached data and instructions.

2. Research Methodology: We used **the** descriptive approach in the style of correlational relationships.

3- The research Society and sample: Our research community consists of runners short 100m across the Algerian country, while the research sample was represented in the Bourj Bou Arreridj Youth Club, which consists of 12 runners under 19 years old. The sample was chosen in a deliberate way, and in order to determine the homogeneity of the research sample, we calculated the coefficient of variation for some variables (height, weight, age, training age), as it was found that the sample members are homogeneous as shown in the following table:

Table No. (1) shows the arithmetic mean, standard deviation and coefficient of variation for the variables (height, weight, age, training age).

Variables	Measurement Unit	— X	Std.dev	Coef-variation
Height	Centimeter	0.169	0.77	0.8
Weight	Klg	71.82%	0.95	1.53
Age	Year	20.5	0.6	3,44
Experience	Year	6	1.2	0.74

4-Fields of Research:

The human field: Includes the number of individuals who registered in the Bourj Bou Arreridj Youth Club session 2024/2025, which consists of 12 runners under 19 years old.

The field of space: Ras El Wad Stadium, Bourj Bou Arreridj.

Time Range: The period between 10/10/2024 to 25/10/2024.

5- Research tools: The following tests were applied to collect data after presenting them to a group of experts in order to nominate the most appropriate tests for the study.

1. Nelson test for selective motor response:

- **Test Name:** Kinetic Response Speed Test (Nelson)
- **Purpose of the test:** Measuring the ability to respond.
- **The tools used:** an area of (20m) length and (2m) width free of obstacles, a measuring tape, a stopwatch.
- **Method of performance:** The laboratory stands at one end of the middle line in front of the timer, which stands at the other end of the line, holds a stopwatch in one of its hands, raises it up, and then quickly moves its arm , either to the left or right, and at the same time turns on the clock. At that time, the laboratory runs at full speed to the line of the side indicated by the timer, and when it reaches the line (6.4m), it stops the clock.
- **Registration:** The player records the lowest time to the right and the lowest time to the left from three attempts per side.

2- The wide jump test of stability:

Purpose of the test: Measuring the muscular capacity of the muscles of the legs.

Tools: A flat ground that does not expose the individual to slipping, a measuring tape, draws a line on the ground to start.

Performance specifications: The laboratory stands behind the starting line with the feet slightly apart and the arms high, the arms swing forward down behind with the knees bent in half and the torso leaning forward until it reaches what looks like starting to swim, and from this position the arms swing forward strongly with the legs extended along the torso and pushing the ground with the feet strongly in an attempt to jump as far as possible.

Directions

- The jump distance is measured from the starting line (inner edge) until the last trail left by the player near the starting line, or at the point of contact of the heels with the ground.

- In the event that the laboratory is unbalanced and touches the ground on another part of its body, the attempt shall be considered null and void and must be repeated.

- Feet should be in contact with the ground until the moment of ascension.

- The laboratory has two attempts, the best of which is recorded.

- Speed Test 100m (run)

Test Purpose: Transition Speed Measurement

Tools: Whistle, Stopwatch, Tape Measure, Start Line, End Line, run Track.

Performance

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- The laboratory takes the low start position behind the start line in the place assigned to it in the starting device.
- The call is made (take your place – get ready – go).
- When the laboratory hears the command to run, it starts at full speed in a straight line and continues to run until the end of the end line.

Grade calculation: The laboratory grade is the time to reach the finish line in percent meters.

- The scientific foundations of research tools:

Validity of the test: The researcher used the subjective validity of the tests by calculating the square root of the stability coefficient, which is shown in Table No. (2).

Test stability: The two researchers calculated the stability coefficient by reapplying the test to a sample of the research community consisting of (05) five runners who were excluded from the basic study within a period of four days between the application and reapplication of the tests, after which the Pearson correlation coefficient was calculated between the first and second test scores.

Examinations	Measurement Unit	First test		Second test		Coefficient Stability.	Trust level
		— X	Stand dev	— X	Stand-dev		
Nelson's test for motor response	sec	1.9	0.03	1.9	.029	0.89	0.94
Wide Jumping	Centimeter	38.3	1.04	38.4	0.97	0.91	0.95

100m	sec	11.58	0.14	11.57	0.13	0.92	0.96
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Significance level 0.05*

As shown in Table No. (2), the results indicate a high correlation between the Pearson coefficient between the two tests, as this indicates a high stability of the Nelson test for selective motor response, where the stability coefficient reached 0.89 at a significance level of 0.05. As for the wide jump test of stability, the stability coefficient reached 0.91, and the results of the 100m sprint test show that the stability of the test was 0.92, while the value of self validity was 0.96, which enables the tests to be applied in the basic study.

As for the validity of the test, the self-validity, which is the square root of stability, was calculated as 0.94,0.95, and0.96 for the Nelson tests for motor response, the wide jump test of stability, and the 100m run test, respectively.

- **Statistical methods:** The arithmetic mean, standard deviation and correlation test were calculated using **the SPSS program**.

Presentation and analysis of study results:

Presentation and analysis of the results of the correlation of the explosive force of the limbs and the speed of reaction to the completion of the 100m sprint.

Table (03) shows the results of the study tests:

Test	Unit of Measure	$\bar{X}$	Stand-dev
Nelson	Sec	1.86	0.03
Wide jump	centimeter	39	0.92

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100m	Sec	11.5	0.12
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From the results of Table (03) the results showed that Nelson's test for selective motor response had an arithmetic mean of 1.86 seconds and a standard deviation of 0.03, while the arithmetic mean of wide jump from stability was 39 cm and a standard deviation of 0.92, and the arithmetic mean of the 100m race was 11.5 seconds and a standard deviation of 0.12 .

Presentation and analysis of the results of the first hypothesis:

First Hypothesis Text: There is a statistically significant direct correlation between the explosive power of the lower limbs and the achievement of the 100m race.

Table (04) shows the correlation between the EXPLOSIVE POWER OF THE LOWER LIMBS AND THE COMPLETION of the 100M RACE.

Correlation Coefficient	moral significance	significance level	Statistical significance
0.61	0.01	0.05	There is a correlation

Through the results of Table No. (04), the value of the correlation between the two variables shows the explosive power of the lower limbs and the completion of the 100m race, which amounted to (0.61) and the intangible value reached 0.01 at a significance level of 0.05. Therefore, we accept the alternative hypothesis, which states that there is a statistically significant positive direct relationship between the explosive power of the lower limbs and the completion of the 100m race.

The researcher attributes this correlation between the explosive power of the lower limbs and the achievement of the 100M RACE to the fact that the explosive power is "the ability of the neuromuscular system to try to overcome resistance that requires a high degree of muscle contractility." (mandalawi & Ahmed said, 1979, p. 45)

As for Al-Mandalawi, he believes that the athlete who has the ability to exert maximum force in the shortest time has the instantaneous ability to lift his body weight horizontally or vertically in order to carry it to the farthest distance or the highest possible height, and (mandalawi & shati, Sports training and records, 1987, pp. 85-86) this is confirmed by some scientific studies and research such as the study of Majadi and Saadi, which concluded that there is a strong correlation between the force characterized by speed and explosive force, and the Bosharib (madjedi & khodir, 2022) study, which found a strong relationship between speed tests and the force characterized by speed at the digital level of 100m. (boushrit, 2019)

Thus, achieving the best start and reducing the latency time, which is between giving the signal and starting, and this is what contributes to improving the achievement of the 100m sprint race, especially the first phase of it.

Discussion of the results of the second hypothesis:

Hypothesis text: There is a statistically significant direct relationship Between Reaction speed and completion of the 100m RACE.

Table (05) shows the correlation between the reaction speed and the completion of the 100m race.

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Correlation Coefficient	moral significance	significance level	Statistical Decision
0.79	0.01	0.05	There is a correlation

Through the results of Table No. (05), the value of the correlation between the two variables shows the strength of the reaction speed and the completion of the 100m race, which amounted to (0.79) and the moral value reached 0.01 at a significance level of 0.05. Therefore, we reject the zero hypothesis and accept the alternative hypothesis, which states that there is a statistically significant positive direct relationship between the reaction speed and the completion of the 100m race.

The **researcher attributes this correlation** to the speed of reaction and the completion of the 100m race to the fact that knowing the details of athletic performance is very important, especially in events in which the importance of each part of the second is clear. It was confirmed that the starting stage of the race depends on the speed of the reaction and the shape and angles of the runner's body (tahsi, torki, & sbaa, 2016, pp. 83-89).

This has been confirmed by some studies and scientific research, such as the study of Osama Ibrahim Al-Shaer, where it indicated that there is a direct relationship between the number of erroneous responses Incorrect (Raw) and the time of 10 m for the run contestants, and the existence of a correlation between the variables of the reaction time Reaction Test (RT) and the time of 10m and the reaction time, and there is an inverse relationship between No reaction (Raw) and the reaction time of the run contestants, and (Elshaair & Rida,

2022) this contributes to improving and achieving the best start and thus may achieve digital superiority for the runner if the rest of the abilities are equal.

Results:

There is a statistically significant mean positive direct correlation between the explosive power of the lower limbs and the achievement of the 100m sprint.

There is a statistically significant strong positive direct correlation between reaction speed and achievement of the 100m sprint.

Recommendations: Through the results reached, we came up with the following recommendations:

- 1- Using the explosive power exercise of the lower limbs in order to develop this trait, as well as paying more attention to improving the reaction of runners.
- 2- The necessity of using the different methods of explosive force training and the speed of reaction and not relying on one method.
- 3- Athletics coaches at all age levels must follow a scientific approach when planning training programs.
- 4-When using the reaction exercise, you must choose the exercises that suit the speed race and the low starting position.

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