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Predicting the 200m Sprint Achievement Based on Some Functional Indicators and the Level of Certain Physical Abilities in Athletics for Youth

Rasha Hussein Ahmed[1]
[1] *Al-Diwaniyah Technical Institute, Middle Euphrates University, Iraq*

Corresponding Author: *Rasha Hussein Ahmed

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Abstract

The field of sports training and its scientific principles is among the fields that have shown interest in the realm of physical education alongside other sciences in terms of field applications aimed at enhancing athletic levels across various skills and activities. Achieving high athletic standards and victories has become not an easy feat, as the athletic level in most activities has reached high standards in terms of technique and tactics. Among these sports is the athletics event in general and the 200m sprint for youth in particular, which has seen significant the majority of countries have experienced some form of development around the world. Recent years have witnessed increased interest in researching and investigating new methods and approaches in training athletes, in addition to relying on scientific foundations for determining the selection process of athletes who possess the predispositions and capabilities to practice the sport and predict their future levels. The descriptive method with correlational and predictive styles was used to suit the nature of the problem on athletes of Al-Tadamun Sports Club in athletics for the season (2023), with a total of (15) players. The researcher used the following tests: speed and agility measurement, heart rate measurement, blood pressure measurement, and respiratory rate measurement. The researcher concluded with deriving a final predictive equation that can predict the achievement level in the 200m sprint based on some functional indicators and the level of certain motor abilities of the runners. The researcher recommended that the research results be adopted and utilized by athletics coaches to understand the level and expected achievement of runners based on the measurement of some functional variables and physical abilities, and conducting similar research and studies by researchers to study the prediction of skill performance level based on some functional indicators in runners.

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Introduction

The science of sports training is among the fields that have shown significant interest in the realm of physical education, alongside other sciences, through its field applications aimed at enhancing athletic levels across various skills and activities. Achieving high athletic standards and victories is not an easy feat, as the athletic level in most activities has reached high standards in terms of technique and tactics. Among these sports,

the athletics event has seen significant development in most countries around the world, with recent years witnessing increased interest in researching and investigating new methods and approaches in training athletes. This interest also extends to the reliance on scientific foundations for the selection process of athletes who possess the predispositions and capabilities to practice athletics in general and the 200m sprint in particular, and to predict their future levels. The physical performance and the development of functional indicators are primary requirements in athletics, and the interrelation and integration between them lead to enhancing the achievement level to reach the best results. [1] The significance of this study becomes evident from identifying the physical and functional levels of runners, as each plays a significant role in achieving the best results. Athletes in athletics are influenced by the level of some functional indicators as a result of physical effort, and it can be said that studying the degree of physical prowess exhibited and understanding its impact on functional indicators is crucial for a coach. This knowledge allows the coach to predict these levels based on functional indicators, which facilitates much effort and time, aiding in building the training program and identifying potential errors for further correction.

Prediction has several definitions, including "the inferential process conducted by a researcher based on their prior knowledge of a particular phenomenon, and this inference is not considered correct unless its validity can be experimentally proven" [2]. "Prediction is a logical thinking built on assumptions set by a coach based on experience and study, occurring as a result of the cumulative experience of a person when they study phenomena, their past and present, scientifically linking them and predicting their future development and study as a phenomenon" [3].

Practical Part

Research Field Procedures

The researcher employed a descriptive methodology with correlational and predictive styles, suitable for the nature of the problem, on (15) youth category sprinters representing AlTadamun Sports Club in the 200m sprint competition, with ages ranging from (15-17) years.

Tests

Firstly: Determination of Physical Variables

After conducting a survey of the content of numerous scientific references to identify physical abilities and to determine their importance, a pilot questionnaire was distributed among a panel consisting of highly skilled professors and experts has been assembled to make the determination the significance of these abilities according to their priority and necessity for the players. "There are different importance, priorities, and percentages according to the requirements of each competition"[1] and by assigning a score for each physical ability using a questionnaire form prepared for this purpose [4]. After data collection and analysis, the results were presented as in Table (1).

Table 1: Shows the total scores and percentage for selected physical abilities according to the experts' opinions.

No.	Selected Physical Abilities	Total Score (100)	Percentage
1	Explosive strength of the legs	94	94%
2	Speed-specific strength of the legs	22	22%
3	Transitional speed	96	96%
4	Agility	92	92%

The table illustrates that the scientific relative importance of the physical abilities chosen by the researcher ranged between (94%-96%) except for the variable of speed-specific strength, which "can be assigned a specific percentage less or more than 25%".

Secondly: Determination of Functional Indicators Used in the Research

Through reviewing scientific literature and previous research in order to determine the key physiological indicators and physical abilities that have a significant impact on performance in the 200m sprint, the researcher engaged in one-on-one interviews with multiple experts in the fields of sports medicine and sports training physiology. A comprehensive questionnaire was developed to identify the most vital functional indicators, which were then distributed to a panel of 15 physical education experts and specialists for their input in determining the most critical factors, by marking (√) in the selected score box for each of the functional variables presented on a scale (0-10), noting that the highest scale scores are (10) and the lowest are (1), with zero indicating no significance. Any significant observations not included in the form were also considered. After collecting and analyzing the data statistically, variables that received a relative importance percentage of more than (53.33)% of the importance score were accepted, and the exclusion of variables such as vital capacity and maximum oxygen consumption resulted in the calculation of the percentage, which was determined by taking half of the maximum score achieved through the multiplication of the range. (10) × number of experts (15) + half of the range (5), resulting in a total (80) out of (150), with a percentage of (53.33%) [5].

Table (2) shows the total scores according to importance and percentages for the functional variables.

Table 2: Total Scores According to Importance and Percentages for Functional Variables

Variables	Achieved Score	Importance Percentage	Significance
The measurement of one's heart rate.	140	94%	Agree
Systolic Blood Pressure	138	91%	Agree
Diastolic Blood Pressure	122	82%	Agree
Respiratory Rate	118	78.7%	Agree
Red Blood Cells	27	17%	Disagree
Hemoglobin	24	18%	Disagree
Vital Capacity	36	23%	Disagree
VO2max	22	15%	Disagree

Based on the information presented in Table 2, it can be concluded that the functional variables considered by experts are perceived to have a relative importance of more than 53.33%, which is an acceptable threshold for variable acceptance except for (red blood cells, hemoglobin, vital capacity, and maximum oxygen consumption), thus, the variables approved by the experts were chosen.

Thirdly: Measurement of the 200m Sprint Achievement Level

The researcher recorded the sprinters' results in a form for the 200m race through their participation in the national club championship held at the College of Physical Education and Sports Science Al-Jadiriyah in Baghdad for the period from 24-27/6/2023, with clubs from all over Iraq participating. The sprinters representing their clubs in this championship were the research sample, and through this championship organized by the Iraqi Athletics Federation, the sprinters' achievement levels were measured.

Determination of Selected Physical Abilities Tests

Upon identifying the chosen physical abilities, representative tests were selected for them. In light of the numerous recommended tests, a questionnaire was distributed among specialized teachers and experts in such a way that it reached a total of 20 experts. They were asked to choose, from their point of view, what they considered suitable for players by marking (√) against the test most suited for each variable and adding any test they found appropriate that did not appear on the form.
After data collection, analysis, and presentation as in Table (3).

Table 3: Shows the total repetitions and percentages for the selected tests to measure the chosen physical abilities according to the opinions of (20) specialists and experts.

Selected Physical Abilities	Selected Tests	Total Repetitions (20)	Percentage
Explosive strength of the legs	Long jump from standstill	16	80%
Transitional speed	30m sprint from high start	15	75%
Agility	Zigzag running between (4) benches back and forth	13	65%

Determination of Functional Measurements Tests

Heart rate and blood pressure measurement

Heart rate and blood pressure were measured using a German-made roogicplio 10 p device, which is attached to the wrist and provides pulse and pressure measurements so that measurements are taken immediately after physical effort as quickly as possible. It is important to ensure that the person being measured is sitting when measuring blood pressure [6].

Respiratory rate measurement

There is an indirect way of calculating the respiratory rate that involves observing the number of inhalations and exhalations per minute. This can be observed through external observation where the patient sits on a chair, with each inhalation and exhalation counting as one. After a ten-second count, this value is multiplied by 6 to derive the final value, while the respiratory rate is taken before exertion.

Main Experiment

The researcher the central experiment was carried out at the College of Physical Education and Sports Science Al-Jadiriyah on the sample participants on 25/6/2023, and before conducting the experiment, the following was ensured:

1. The participants were asked about getting at least (7) hours of sleep before the examination.
2. They were required to have breakfast.
3. All internal and external variables were controlled (temperature 9-14), and noise and lighting were adequately managed.

Heart rate was determined by observing the pulse, blood pressure was measured using a device placed on the wrist, and functional variables were assessed before warm-up and then analyzed statistically.

Statistical Methods

The researcher used the Statistical Package for the Social Sciences (SPSS).

Results and Discussion

This section includes the presentation of descriptive statistical results among the physical and functional variables after their statistical processing, in alignment with the goals.
Statistical Estimates for Physical and Functional Variables and the 200m Sprint Achievement for the Sample Subjects:

The sample subjects' results in the variables of interest were presented along with a correlation matrix showing how these variables relate to one another. Such variables include physical characteristics and functional parameters on the one hand, while achievement is related to physical traits and functional measures on the other. Subsequently, predictive equations were generated to forecast levels of achievement in 200m sprint events using functional indicators and physical capabilities, followed by assessing the reliability of measurement estimates based on physical variables and functional indicators.

Statistical Estimates for Physical and Functional Variables and Achievement for the Sample Subjects:

Table 4: Shows the descriptive statistics for the sample subjects' results in the investigated variables

Variables	Research Variables	Mean	Standard Deviation
Physical Abilities	Explosive strength of the legs	5.1	0.6
	Transitional speed	5.7	0.4
	Agility	11.5	1.9
Functional Variables	Heart rate	87.9	11.2
	High blood pressure	13.2	1.2
	Low blood pressure	8.03	1.5
	Respiration rate	15	2.7
200m Sprint Achievement	Seconds	22.2	1.3

Matrix of Correlation Concerning the Relationships between Functional and Physical Variables

After utilizing Pearson's correlation coefficient among the Investigated variables, the inter-correlation matrix between the functional, physical variables, and achievement was obtained, as in Table (5).

Table 5: The table illustrates the correlation matrix pertaining to the associations among the variables under consideration (physical-functional)

Variables	Explosive strength (R)	Transitional speed	Agility	Heart rate	High blood pressure	Low blood pressure	Respiration rate	Achievement
Explosive strength (R)	1	0.547	0.412	0.539	0.467	0.344	0.469	0.687
Transitional speed		1	0.44	0.54	0.47	0.32	0.48	0.489
Agility			1	0.66	0.31	0.3	0.4	0.477
Heart rate				1	0.583	0.340	0.075	0.493
High blood pressure					1	0.4	0.44	0.412
Low blood pressure						1	0.2	0.271
Respiration rate							1	0.632
Achievement								1

By perusing the table, forty-five correlation coefficients stood out. With an intensity of 0.547, the greatest relationship coefficient was found to be between explosive strength and transition speed. It also emerged from these simple relationships that we can predict simple predictive equations... which are different complex formulas used in predicting result values by observing the level or measurement of any of these variables, which are physical and functional indicators.... This allows us to know the composite predictive equations... This complex matter may not serve us in work. Therefore, the researcher resorted to using the method of preferential simple and composite relationships that could predict achievement through any of the researched functional variables, as we will see later in the topics [7]. To determine the reliability of the correlation coefficients computed earlier or to know how one variable can be predicted based on other variables, the researcher also used the coefficient of determination that reflects the amount of information two variables share and do not share. The obtained confidence levels were 5.47% for the relationship between explosive strength and functional indices of heart rate, 4.13% for the relationship between explosive strength and functional indices of high blood pressure, 4.24% for the relationship between explosive strength and low blood pressure measurement, 4.14% for the relationship between explosive strength and respiratory rate number, and 3.99% for the relationship between explosive strength and heart rate.

1. Presentation, analysis, and discussion of the results of the 200m sprint achievement and its relationship with heart rate and its contribution percentage:

The researcher attributes that the explosive strength of the legs has a direct effect on the achievement because the presence of explosive strength is a result and an indicator of the adaptation in the functional variables that assisted the player in producing high explosive force. This was pointed out by Essam El-Din Abdel Khalik Mustafa (that the player highly develops the physical abilities that correspond with the nature of his activity). From the previous presentation, the regression line equation between the heart rate as a functional variable, which obtained the highest correlation with achievement, is as follows:

Achievement = 5.904 + (1.848 × Heart rate)

2. Presentation, analysis, and discussion of the results in the 200m sprint achievement level and its relationship with transitional speed and its contribution percentage:

Mohamed Abdullah Ahmed and others indicate that "transitional

speed is of great importance in the success of movements and skills to a large extent since transitional speed is also a result of the adaptation of functional variables during performance" [8].
From the previous presentation, the regression line equation between transitional speed, which obtained the highest correlation with the 200m sprint achievement, is as follows:

Achievement = 16.243 + (-0.153 × Transitional speed)

3. Presentation, analysis, and discussion of the results of agility and its contribution percentage to the 200m sprint achievement level:
The researcher attributes the importance of agility for athletes in 200m sprints as it results from performing with coordination, harmony, speed, and repetitive and multiple uses of muscle groups during motor performance. Due to daily training, the player's agility increases [9].
Suleiman Ali Hassan and Awatif Mohamed Labib indicate that (agility gives us a feature for motor ability as it is about maintaining muscle tension for a long time at a steady balanced level without a drop in work effectiveness).
The fact that should not be overlooked is that the 200m sprint athlete who possesses good agility is in a state where he can constantly execute the required duty and perform the required task at a high level.[10]

From this presentation, the regression line equation is as follows

Achievement = 6.451 + (0.205 × Agility)

Conclusions
Deriving a final predictive equation through which the achievement level in the 200m sprint can be predicted based on physical performance and functional indicators for athletics players.

Recommendations
Adopting the research results and benefiting from them by athletics coaches to understand the players' achievement level based on physical abilities and some functional variables of athletics players, and conducting similar research and studies by researchers to study the prediction of skill performance level based on some functional indicators in athletics players.

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