THE EFFECT OF SPECIAL EXERCISES ACCORDING TO THE PATH ANALYSIS OF THE BIOMECHANICAL VARIABLES OF THE STARTING STAGE WITH A 100-METER RUNNER UNDER THE AGE OF 20 YEARS

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RESEARCH SUMMARY:

The integration of the sports training process must be the use of training methods and methods that are compatible with the potential of the players, as the special exercises work on the direct construction of the high sports level of the players. The event of running (100 meters) freestyle is one of the most interesting races in recent times within the athletics races, and this interest is due to the suspense and excitement that this event achieves, and the importance of the research is highlighted through the preparation of special exercises prepared according to the direct and indirect effects using the path analysis of biomechanical variables. For the starting and completion phase of the (100-meter) freestyle for players under the age of (20 years), and through the researcher’s experience in the field of his studies of athletics and his work as a coach for age groups, he noticed that there is a clear weakness for players under the age of (20 years) in the important stage of running stages (100 meters) (the starting stage) and the lack of interest in determining the biomechanical variables (direct and indirect) that affect performance and that play an “important” role in achieving achievement by achieving the best motor performance at this stage by focusing on the corners of the body or the speed of performance. From the foregoing, the researcher decided to prepare special exercises based on the direct and indirect biomechanical variables of the starting stage, which play a “big” role in achieving the best technical performance, which in turn reflects on Better achievement by effectively achieving (100 meters) for players under the age of (20 years).

1. Identification of the biomechanical variables (direct and indirect) using path analysis for the starting phase with the completion of 100m for players under 20 years old.

2. Preparing special exercises according to the path analysis model for the biomechanical variables of the starting stage by completing the 100 meters effectiveness for players under the age of (20 years) and identifying their impact on this stage. The research community was determined by the players of the Babylon Governorate clubs for the effectiveness of running 100 meters freestyle under the age of 20 years. The researcher worked on preparing special exercises to improve the starting and completion phase of the 100-meter freestyle event, depending on the direct and indirect biomechanical variables extracted through the path analysis model and identifying weaknesses and strengths in them in proportion to the research sample as it was prepared according to the foundations. After conducting the statistical operations of the tribal and remote tests of the research sample, he reached the following conclusion the most important of which are:

1. There is a positive effect of the special exercises prepared according to the path analysis of the biomechanical variables of the starting and completion phase for the 100-meter effectiveness.

2. Special exercises prepared according to the scientific bases of sports training and kinetic analysis have proven their effectiveness in improving the biomechanical variables for the starting and completion phase of the 100-meter effectiveness.

3. The correctness of building the path analysis model in determining the direct and indirect biomechanical variables and their precedence for the starting and completion phase of the 100-meter effectiveness.

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I. INTRODUCTION TO RESEARCH:

1.1 Introduction and importance of the research:

The integration of the sports training process must be the use of training methods and methods that are compatible with the ability of the players, so special exercises work on the direct construction of the high level of sports for the players. In addition to developing special abilities, they work on the integration of skillful performance. As the process of kinetic analysis is the sure key that leads us to know the minutes of the sports movement and its mechanical requirements through the relationship between the stages of effective performance (100 meters), their interval times and their biomechanical variables, the effectiveness of running (100 meters) freestyle is one of the most interesting races in recent times. Within the athletics races, this interest is due to the development taking place in this race in all physical and kinetic aspects, where competition and technical performance are of a high level because this event deals with the maximum effort of the contestant in addition to the accuracy of performance from the first moment, preparation until reaching the finish line. The starting stage is one of the important stages in the sprint, especially the 100-meter event, as it depends on the speed of reactions and the shape of the angles of the body of the runner the moment he leaves the starting cube, and on it it becomes clear to us the great importance in determining the variables and indicators of the Bay-mechanical responsible for this and employing them in order to improve results and achieve achievement. The importance of the research is highlighted through the preparation of special exercises prepared according to the direct and indirect effects using the path analysis of the biomechanical variables for the starting and completion phase of the (100 meters) freestyle for players under the age of (20 years).

1.2 Research problem:

In the effectiveness of speed (running 100 meters), the biomechanical variables play a clear role in improving the achievement. Therefore, the focus is on all performance details, as each stage is translated into time. Therefore, it has become a duty to pay attention to every part, including the biomechanical variables that directly and indirectly affect each stage of performance. In order to reach the perfect technique for performance in order to reduce the total time for completion. Through the researcher’s experience and his work as a coach for age groups, he noticed that there is a clear weakness in the players under the age of (20 years) in the important stage of running (100 meters) (the starting stage) and the lack of interest in determining the biomechanical variables (direct and indirect) affecting In performance during the preparation of the training curriculum, which helps in identifying strengths and weaknesses, and thus the speed of mastering technical performance, which plays an “important” role in achieving achievement by achieving the best motor performance in the two stages of starting and increasing speed by focusing on the corners of the body or the speed of performance. From the foregoing, the researcher decided to prepare special exercises based on the direct and indirect biomechanical variables of the starting stage, which play a “large” role in achieving the best technical performance, which in turn reflects a better achievement by effectively achieving (100 meters) for players under the age of (20 years).

1.3 Research Objectives:

1. Identification of the biomechanical variables (direct and indirect) using path analysis for the starting phase with the completion of 100m for players under 20 years old.

2. Preparing special exercises according to the path analysis model for the biomechanical variables for the starting stage by completing the (100 meters) activity for players under the age of (20 years).

3. Identifying the effect of special exercises prepared according to the path analysis model in improving the starting stage by completing (100 meters) for players under the age of (20 years).

1.4 Research hypotheses:

1. Special exercises prepared according to the path analysis of biomechanical variables have an effect on improving the starting stage by completing a run (100 meters) under the age of (20 years).

2. There is a preference in effect for special exercises prepared according to the path analysis of biomechanical variables in the starting stage by completing a 100m run for the players and in favor of the post tests.

1.5 Research Areas

1.5.1 The human field: Babil Governorate club players for the youth category under the age of 20 years

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1.5.2 Time range: for the period from 15/12/2020 to 25/7/2021

1.5.3 The spatial domain: Al-Hashmiya Sports Club Stadium

II. RESEARCH METHODOLOGY AND FIELD PROCEDURES:

2.1 Research Methodology:
The researcher used two approaches in this study, the first of which is (the descriptive approach), and the aim of it was to extract the direct and indirect effects of the biomechanical variables of the starting stage of the 100-meter effectiveness by the two methods (interrelationships) and (causal and comparative studies). And then the experimental method was used to fit the research problem, and the experimental method is the closest research method to solving problems in the scientific way, as it is the only method that can test the real purpose of the cause and effect relationship[1]). The experimental method was used in the style of a single experimental group with a test Tribal and posterior.

2.2 The research community and its sample:

2.2.1 Research Population and Sample:
The research community was determined by the players of the Babylon Governorate clubs for the effectiveness of running 100 meters freestyle under the age of 20 years, and their number was (4) players. The research sample was chosen by the intentional method represented by the players of the Babylon Governorate clubs for the effectiveness of running 100 meters under the age of 20 years, and their number is (4) players who represent the research community by (100%) and (5) attempts will be given to each player. Therefore, the total number of the research sample becomes (20) player for easy statistical integration with the sample.

2.3 Tools, means and devices used

2.3.1 Research Tools:
Questionnaire.
- Observation .
- personal interview .* Test and measurement. Arab and foreign sources and references.
- The International Information Network (Internet).

2.3.2 The means and devices used in the research
1. Sources and references.
2. A medical scale for measuring weight and length.
3. Papers and pens to record information.
4. HP computer made in China numbering One (1).
5. Sony camera capacity of (60) images/second number (2), and Sony camera capacity of (1200) images/second number (1)
6. Starting cube device.
7. Two (2) electronic stopwatches.
8. Kinetic analysis program (Kenova)
10. Data dump form.
11. Measuring tape with a length of 50 meters
12. Whistle.
2.4 field research procedures:

2.4.1 Biomechanical variables related to the starting stage

Table (3) Biomechanical variables for the starting phase of the 100m run

<table>
<thead>
<tr>
<th>Table (3) Shows the biomechanical variables related to the starting stage:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ankle joint angle of the front and rear foot: It is the angle between the line of the foot (from the end point of the toes to the point of the ankle joint) and the line of the leg (from the point of the knee joint to the point of the ankle joint).</td>
</tr>
<tr>
<td>2. Angle of the anterior and posterior knee joint: It is the angle between the thigh line (from the point of the hip joint to the point of the knee joint) and the leg line (from the point of the knee joint to the point of the ankle joint) and it is measured only from the inside because it is a closed angle.</td>
</tr>
</tbody>
</table>
Anterior and posterior knee joint

3. Hip joint angle: It is the angle between the torso line (from the point of the shoulder joint to the point of the hip joint) and the line of the thighs (right, left) (from the point of the hip joint to the point of the knee joint). This angle can be measured once with the right thigh and once with the left thigh in case there is an opening (side opening for the legs) and it can be measured from the inside or from the outside.

![Figure (3) hip joint angle](image1)

4. Shoulder joint angle: It is the angle between the humeral line (from the elbow joint point to the shoulder joint point) and the trunk line (from the shoulder joint point to the torso joint point), and it is measured from the inside or outside.

![Figure (4) shoulder joint angle](image2)

5. Elbow joint angle: It is the angle between the elbow line (from the point of the wrist joint to the point of the elbow joint) and the humeral line (from the point of the elbow joint to the point of the shoulder joint).

![Figure (5) elbow joint angle](image3)

6. Head angle: There are two ways to measure this angle, the first is based on the neck line (from the temporal point to the point of the shoulder joint) and the trunk line (from the point of the shoulder joint to the point of the hip joint), and the second is done by drawing a line connecting the temporal to the bottom of the palate and this angle is measured in terms of this line, either with the vertical line or with the horizontal line.
7. The starting angle: It is the angle between the horizontal line and the line connecting two points of the center of gravity of the body, the first (at the last moment of contact of the body with the ground) and the second (immediately after leaving the body) and it is measured from the front.

![Figure (6)](image)

starting angle

2.5 steps to implement the work: For the purpose of containing all mechanical aspects related to skill and at all stages of photography (exploratory experiment, pre and post tests), if the researcher uses two cameras as follows:

ü Camera No. (1): It was installed on the right side of the player during the starting phase, at a distance of 6.50 meters from the starting cube, and at a height of (1.60) meters. It is used to extract the kinematic variables of the starting phase. ü Camera No. (2): It was installed on the left side of the player during the starting phase, at a distance of (6.50) meters from the starting cube and at a height of (1.60) meters, and is used to extract the kinematic variables of the starting stage.

2.6 Tests used in the research:

2.6.1 achievement test of running 100 meters freestyle. The purpose of the test: to measure the time to complete a 100-meter run. Equipment used: The area designated for running 100 meters at Al-Hashmiya Sports Stadium. Performance specifications: The tester takes the standby position from the starting cubes, and when the signal is given, the tester runs at full speed to the finish line. Recording: records the time in which the player takes the race distance (100m).

2.7 Extraction of biomechanical variables (video imaging analysis)

After the imaging process was completed, the biomechanical variables of the research sample were extracted by the kinetic analysis program (Kinovea), after the imaging clips were collected from the cameras, and this program is one of the kinetic analysis programs that does not find measurements, dimensions, angles, speed and time, where the user achieves drawing the paths of body points. And analysis of the dimensions of movement.

2.8 Experimental Experiment: The reconnaissance experiment is important to find out the positives and negatives while conducting the tests to avoid them. The researcher conducted the reconnaissance experiment on Friday, February 15, 2021 AD at the Al-Hashmiya Sports Club stadium. He:

Determining the location of the camera and determining the appropriate angles for the appearance of the search variables. Determining the height of the camera position, through which the movement is filmed starting from the intersection step.

- Ensure the adequacy of the assistant work team, the accuracy of its work and the extent of its understanding of the work. Know the time each test takes.

2.9 Pre-test: The researcher conducted a pre-test for the research sample on Saturday, February 13, 2021 at ten in the morning and at the Al-Hashmiya Sports Club stadium after fixing all the conditions related to the tests, as the technical performance was filmed with the effectiveness of 100 meters, which includes the (starting) stage under research through the cameras that were Clarified previously with the presence of the assistant work team.
2.10 Stages of building the model for path analysis:

Causal models consist of a system of information that includes a set of internal and external variables and causal coefficients. When building a model, a scientific theory must be followed that determines the causal priority of the variables and the use of the chronology of accidents for the purpose of obtaining causal relationships or following the logical foundations in determining these relationships.

1. Determining the relationship between the variables based on the logical foundations, taking into account the time sequence when arranging the variables and the appropriateness of the data with the assumed model, which is one of the things to be followed when building causal models.

2. Determining the mathematical form of the model (transforming the theoretical hypotheses into a set of equations for the purpose of forming the causal model).

3. Finding statistical estimates for the information in the assumed model.

4. Analyze the model and interpret the results. All steps were done through the (Amos) program, which draws and gives the digital image and the mathematical form of the model.

2.11 Main experience:
The researcher worked on preparing special exercises to improve the starting and completion phase of the 100-meter freestyle event, depending on the direct and indirect biomechanical variables extracted through the path analysis model and identifying weaknesses and strengths in them in proportion to the research sample as it was prepared according to the following foundations and principles:

1. The exercises achieve the goals for which they were set.

2. Adaptation of exercises to the scientific foundations of sports training.

3. Implementation of exercises throughout the training units and in the main section of the training unit at a rate of (45-60) minutes.

4. Legalizing the training load to comply with the intensity of the training methods used (repetitive) and at 100% intensity.

5. Determining the rest time according to the training status of the players in accordance with the principles of sports training.

6. The special exercises prepared are diverse and affect the working muscle groups and work to improve the special physical abilities and the biomechanical variables that affect the starting phase and the completion of the 100-meter freestyle effectiveness.

7. Implementing the exercises, which aim to improve the biomechanical variables of the starting and completion stage by diversifying and using the necessary tools to implement the exercise and gradual from easy to difficult.

8. The implementation of the special exercises took (8 weeks) with two units of two weeks, so that the total of the training units was (16) units.

2.12 Posttests:
The researcher conducted the post tests on the research sample on Sunday (11-4-2021) at exactly two o'clock in the afternoon in the Al-Hashmiya Sports Club stadium after completing the implementation of (16) training units for exercises for (8) weeks for the sample, as the researcher was keen to provide and create conditions for the tests tribalism itself.

2.13 Statistical methods used:
The Statistical Package for Social Sciences (SPSS) program was used to analyze the data related to descriptive and inferential statistics, and the (Amos) software was used to process the path analysis method in examining the study hypotheses.

III. PRESENTATION, ANALYSIS AND DISCUSSION OF THE RESEARCH RESULTS:

3.1 Presentation of the arithmetic means of the biomechanical variables of the starting stage in the pre and post tests
Variables

Table (6) shows the arithmetic mean values of the angles of the body joints affected in the starting phase.

3.1.1 Presentation, analysis and discussion of the results of the pre and post test of the biomechanical variables of the starting stage:

Table (7)
The mean and quartile deviation of the biomechanical variables for the pre and post test of the starting stage

3.1.2 Path analysis model for the biomechanical variables of the starting stage:

The following theoretical study model shows the relationship of influence of stage, as it is possible through the study model to infer the nature of the effectstica of the study

![Path Analysis Model](image_url)

Figure (3) Explains the causal model of the biomechanical variables of the starting stage

Through the network of relationships between variables of all kinds and levels, direct effects between the biomechanical independent variables appear on the dependent variable, the achievement of the 100-meter run.

<table>
<thead>
<tr>
<th></th>
<th>Moral</th>
<th>Front Knee Angle</th>
<th>Back Knee Angle</th>
<th>Elbow Joint Angle</th>
<th>Shoulder Joint Angle</th>
<th>Hip Joint Angle</th>
<th>Head Angle</th>
<th>Hip Height Off the Ground</th>
<th>Shoulder Height Off the Ground</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>0.05</td>
<td>2.84</td>
<td>0.90921</td>
<td>98.2</td>
<td>1.29099</td>
<td>87.5</td>
<td>Degree</td>
<td>Head Angle</td>
<td></td>
</tr>
<tr>
<td>Post</td>
<td>0.05</td>
<td>2.826</td>
<td>2.16025</td>
<td>102</td>
<td>1.26886</td>
<td>82.45</td>
<td>CM</td>
<td>Hip Height Off the Ground</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.05</td>
<td>2.841</td>
<td>1.70783</td>
<td>83.25</td>
<td>1.29099</td>
<td>69.5</td>
<td>CM</td>
<td>Shoulder Height Off the Ground</td>
<td></td>
</tr>
</tbody>
</table>
The direct effects between the variables of the study are only an expression of the one-way causal relationships that the independent variables bring about on the dependent variable, that is, the independent variables determine the difference of the dependent variable.

And a specific value called the path coefficient, as the value of the path coefficient that appears between two variables expresses the amount of difference that the independent variable makes on the dependent variable.

IV. RESEARCH AREAS

We note from Table (6) that all the values of the biomechanical variables have achieved significant statistically significant differences between the pre and post tests and in favor of the post test. The researcher attributes the reason for this development to the special exercises prepared by the researcher according to the biomechanical variables for the direct effect affecting the starting stage as well as for the training methods used. With the exercises according to the foundations and training principles, as the focus in formulating these exercises was on taking the appropriate angle positions according to the correct performance values for this stage, in which the first steps need an increase in the horizontal thrust than in relation to the vertical thrust due to the proximity of the center of gravity of the body to the ground and its inclination to. The forward is a transitional stage from the standby mode to the starting position.

In some special exercises, the researcher sought to increase the range of motion of the target joints at this stage, as the goal was to increase the flexibility and ability of the joints to perform the movement well. Because after leaving the starting cube, the first steps (except for the first step) are very short and fast until high frequency and good momentum are achieved, as Talha Husam al-Din mentions (1).

The training work used in special exercises was also focused on imposing specific timings for exercises and rest periods, and the main purpose of which was to tabulate the players’ abilities according to the exercises and tests used, followed or both in the emergence of overload, where the correct timing process for using pregnancy periods within the training program is related to the specifications of the adaptation process, as the It is known that the process of gradual increase in the training load, which is one of the most important principles of pregnancy, as it must take place during the period of time when the level of physiological processes reaches the level of recovery of recovery (2).

The exercises prepared according to the scientific foundations focused on developing the weak muscles as well as the correct positions of the angles of the body used in this stage and bringing them to the ideal values for correct performance and reaching the level of dynamic control i.e. choosing the best positions as it is the basis for maintaining the correct position when moving from the stage of readiness to the launch stage. The 100-meter activity combines speed and strength, and the link between them must be a direct correlation, and there should be an integration between force and speed (the force is the kinetic reality and the speed is the kinetic appearance, and the greater the force and the more it was exerted in the shortest possible time, the greater the resistance and benefit from starting and at full speed in the starting phase) (3).

The improvement of the starting speed through the exercises used was evident in improving the work of the muscles working in the legs, which in turn led to an improvement in the speed, which means the speed of muscle contractions when performing the movement. The researcher in formulating the vocabulary of the special exercises, which were designed in a scientific and thoughtful manner according to the proportions of the direct and indirect biomechanical variables of the starting stage with all its details and performance.

V. CONCLUSIONS:

1. There is a positive effect of the special exercises prepared according to the path analysis of the biomechanical variables of the starting and completion phase for the 100-meter effectiveness.
2. Special exercises prepared according to the scientific bases of sports training and kinetic analysis have proven their effectiveness in improving the biomechanical variables for the starting and completion phase of the 100-meter effectiveness.
3. The correctness of constructing the path analysis model in determining the direct and indirect biomechanical variables and their precedence for the starting and completion phase for the 100-meter effectiveness.
4. The achieved values of body joint angles in the starting stage directly affected the development of the variables of the stage of acceleration and the final outcome of the development of achievement.
Recommendations:
1. Working on analyzing the biomechanical variables and identifying the percentage of the contribution of the variables in the studied phenomenon, which constitutes a major role in analyzing and explaining the causes of this phenomenon.
2. Codification of training according to biomechanical variables that have a great contribution in the two phases of starting and increasing speed (acceleration) and completion of 100 meters.
3. Finding new exercises that are compatible with the development of each biomechanical variable and the percentage of its contribution to achievement.
4. Emphasis on the use of special exercises and auxiliary means according to the technical performance of the two phases of starting and accelerating (acceleration) when training young people in developing some biomechanical variables, and then developing achievement.

SOURCES