A predictive study of the digital level of 100 Yard butterfly swimmers based on biomechanical analysis

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First, the research introduction:

The sports field is one of the fields that has witnessed great development in various specializations. This has come through extensive studies and research that have greatly contributed to the development and supply of this field with important and abundant information, and have provided coaches with a solid basis for work, creativity, and moving the training process with codified scientific steps to reach the best sports levels.

Fouad Abu Hatab and Amal Sadiq (2010 AD) point out that the future was not clearly defined in the scientific method of research except with the emergence of the concept of regression in modern statistics. This concept developed from the method of the correlation coefficient that appeared in its original form with the aim of describing... Relationships between variables, that is, within the (empirical approach) that deals with the current situation. Then, scientists quickly discovered the enormous potential included in this important statistical method, including estimating the value of an unknown variable from the known value of another variable as long as there is a relationship between them calculated for the correlation coefficient, and this is the essence Statistical prediction The statistical method used in this case is called regression analysis, which may be simple or multiple.(٦٨ :١٢)

Al-Sayyid Abu Hashem (2005 AD) states that one of the most widely used statistical methods in various sciences is the regression analysis method, as it defines and clarifies the relationship between variables in the form of a significant relationship expressed in the form of an equation, and the importance, strength, and direction of the relationship is inferred from estimating its coefficients. It is of great importance in planning and making sound decisions in research :١) (٤٩

M. George at al., MCGrawHill, (2005) states that tactical preparation means “learning and mastering the details of knowledge, instructions, movements and maneuvers that can be used according to the nature of competition requirements to achieve the goals of competition within the framework of the rules of the sport.” Tactical preparation is based on both physical, skill and psychological preparation. Intellectually, from the above it is clear that tactical preparation is the vessel in

which all types of preparation are mixed to achieve the goal of sports training .(٣٠:١٥)

Nasser Al-Hanafi (2004 AD) states that the sport of "Kung Fu" is one of the sports of self-defense, as it is divided into two parts: the methods, which are a set of sequential and arranged movements of attack and defense used in the arts of the game in accordance with the rules and foundations established by the International Federation. The second method is a realistic fight between two individuals. The player uses both types of motor skills (defensive and offensive), such as punching, kicking, and throwing(٢٥:٢) .

Nasser Al-Hanafi (2004 AD) adds that the sport of swimming (techniques) is unique in a way of performance that differs from other combat sports, as skillful performance during play (competition) is not legally counted unless the skills influence the opponent through sound or displacement, which places a burden on the player. High physical and skill level, it makes the player exhaust his energy and exert great effort while attacking the opponent(٢٥:١٥) .

Johannes Reh and Angeorg Ritter (2004 AD) add that in recent years, there has been a great focus in specialized research on the issue of motor coordination capabilities, which in some specialized research is known as coordination motoric capabilities" or "CMC."), which may be known as "the psychomotor factors that determine the optimal readiness to organize and control motor activities." (27:15(

Essam El-Din Abdel Khaleq (2005), citing Raczek (1991), believes that mechanical analysis reflects "the complex relationships between neuropsychological factors, which enable the organization and control of motor activities in complex, multi-level systems based on biological foundations." There have been attempts to identify the specific elements of its internal structure and to determine its biological foundations (predispositions). This task is not as easy as the processes associated with energy capabilities(١٤:٣١) .

The International Swimming Federation has divided the skills according to their degrees of difficulty into four levels: (A, B, C, D). These difficulties have been implemented in international championships. The skill of jumping inward (720 degrees + front pelvis) is one of the skills of level D (the highest level in the grades), which requires jumping and twisting 720 degrees around the longitudinal axis of the body and performing an inward circular kick while flying at its full extension and touching The left hand is at the highest point, then lowered into the anterior pelvis position(٢:٥٢) .

The phenomenon of difficulty in implementing this advanced skill is increasing, especially among Egyptian players, based on the fact that it is a modern skill, and Egyptian coaches often do not have the references that help them understand the technical methods of performing it in a scientific manner, in addition to the lack of specific models of performance training for this type of skill, and that is what is currently being done. These are nothing but personal efforts on the part of the coaches.

When learning many jumping and jumping skills, it is necessary to master the phenomenon of increasing or decreasing the length of the radius of failure voluntarily and thus increasing or decreasing the speed of rotation :٦) . (٣٥٨

Paul & Duane (1999) state that using biomechanical analysis is the scientific way to develop training and performance programs, as it improves performance and corrects errors, as well as develops technical performance and physical fitness training programs for the player, and prevents injuries .(١٢:١٣)

Owais Al-Habali (2000 AD) points out that using analysis methods can help us reach the subtleties and details of the movement, identify the form of the performance, and master its details in a way that achieves economy of effort(٤:٦٥) .

Search procedures

First: Research methodology:

The researcher used the descriptive method using kinetic analysis (two-dimensional) and then the survey method due to its suitability to the nature of this research.

Second: Research population and sample:

Description of the research population and sample:

Research sample - The sample was deliberately chosen for one of the world-class players (an Egyptian player), one of the players of the Egyptian national team, 100 yards, who has a distinguished style and high performance of technical skills (as a case) to develop the skill performance to determine the biomechanical characteristics of the skill of jumping in (720 degrees).

Third: Tools and means of collecting data:

search tools-

- 2 cameras at a speed of 25 frames/s0

- 2 tripods - Monitor imaging processing unit

- A computer equipped with a motion analysis program

- Education and training aids (mattresses - weight jackets - wall ladder - boxes - of different heights)

Imaging procedures

The researcher verified the photography procedures and the experiment was carried out on Thursday, May 5, 2019 AD at the International Swimming Academy in Menoufia Governorate, taking into account the following:

- Preparing the filming location in terms of lighting, as well as determining the most appropriate place to place the cameras so that the player's image appears in an appropriate and clear size

- Determine the beginning and end of performing the skill with the player so that it is within the camera frame

- Photographing the calibration unit inside the frame for five seconds before the performance begins.

- The teen camera was synchronized using a "sound" effect.

Experiment implementation:

- The player performed 3 attempts, taking into account the rest periods between attempts.

The researcher chose the best attempt at the player's performance for the purpose of analysis.

- Conducting the analysis process to extract biomechanical variables.

- Technical description of the skill using scientific observation.

- Extracting results and describing the biomechanical characteristics of the skill.

Determine the biokinetic variables being analyzed

- Vertical displacements (m.s - head - foot of the kicking leg)

- Resulted speed (m/s – kicking foot – m/left hand)

The researcher ensured the integrity of the imaging procedures, and imaging was carried out for the two measurements (pre-post) on (5/20/2019) and (8/25/2019), respectively, at the International Kung Fu Academy.

Seventh: Basic Study:

The researcher applied it to the study sample in the period from 11/10/2019 to 11/20/2019, and then processed the data statistically.

Eighth: Statistical treatments:

In light of the research objectives and questions, the researcher used the following statistical treatments:

- SMA.

standard deviation.

percentage. Pearson's simple correlation coefficient. Mediator.

Linear regression coefficient

The skewness coefficient, and the researcher accepted a significance level of (0.05).

Present and discuss the results

Presenting and discussing the results of the first hypothesis, which states: Is it possible to predict the skill level of 100-yard swimmers (methods) based on some of the mechanical analysis under investigation?

First: Description of the data under research

It is clear from Table ( ) that the total time values for performing the skill increase individually as the difficulty of the skill increases. The performance times ranged from (1.28 seconds) to swimming 720 degrees

Table (2)

Vertical distance (meters) for 100 yards (720 degrees) + Mapo skills in Kung Fu

١	٠,٠٠	١,٠٢	٠,٧١	٠,٠١-
٢	٠,٠٨	١,٠٧	٠,٦٦	٠,٠١
٣	٠,١٦	١,٢١	٠,٧٤	٠,٠٢
٤	٠,٢٤	١,٤٥	٠,٩١	٠,٠٢
٥	٠,٣٢	١,٧٣	١,١٧	٠,٢٢
٦	٠,٤٠	١,٨٧	١,٣٤	٠,٩٩
٧	٠,٤٨	١,٨٩	١,٤٧	١,٦٩
٨	٠,٥٦	١,٩٦	١,٥٢	١,٦٨
٩	٠,٦٤	٢,٠٥	١,٥٢	١,٠٨
١٠	٠,٧٢	١,٩٩	١,٤٦	٠,٥٣
١١	٠,٨٠	١,٨٨	١,٣٠	٠,٢٩
١٢	٠,٨٨	١,٦٥	١,١١	٠,١٢
١٣	٠,٩٦	١,٣١	٠,٨٣	٠,٠١
١٤	١,٠٤	٠,٩٣	٠,٥٦	٠,٢١-
١٥	١,١٢	٠,٦٢	٠,٣٨	٠,١٨-
١٦	١,٢٠	٠,٥٣	٠,٢٨	٠,١٩-
١٧	١,٢٨	٠,٥٧	٠,٢٧	٠,٢٢-

It is clear from the table ( ) that the height of the head in the lowest position of the body in the position of the body to rise reached (1.02) swimming (720) degrees

At the moment of liberation, the height of the head at 100 yards reached (1.45).

At the moment of completing the kick, the head height in the 100-yard skill was (720) and it reached (1.96), and at the top of the path, the head height in the 100-yard skill was (720) and it reached (2.05).

At the moment of contact (landing), the height of the swimming head (720) had reached (1.31), respectively.

Table (3)

Launch variables for the body's center of gravity for 100 yards (720 degrees) + Mapo skills in Kung Fu

١	٠,٠٠	٠,٠٠	٠,٧١	٠,٠٠
٢	٠,٠٨	١,١٨	٠,٦٦	٦٤,٧٦
٣	٠,١٦	١,٣٩	٠,٧٤	٦٤,٦٠
٤	٠,٢٤	٢,٠٧	٠,٩١	٦٨,٠١
٥	٠,٣٢	٣,٢٧	١,١٧	٧١,٤١
٦	٠,٤٠	٢,٥٨	١,٣٤	٧٤,٩٧
٧	٠,٤٨	١,٦٧	١,٤٧	٧٦,٦٠
٨	٠,٥٦	١,٧٩	١,٥٢	٧٦,٢٤
٩	٠,٦٤	٠,٨٥	١,٥٢	٧٥,٢٣
١٠	٠,٧٢	٠,٩٤	١,٤٦	٧٣,٢٧
١١	٠,٨٠	٢,١٣	١,٣٠	٧٠,٤١
١٢	٠,٨٨	٢,٣٤	١,١١	٦٦,٥٥
١٣	٠,٩٦	٣,٨٩	٠,٨٣	٦٠,٣٩
١٤	١,٠٤	٣,٥٠	٠,٥٦	٥٠,٦٧
١٥	١,١٢	٢,٤٦	٠,٣٨	٣٦,٨٨
١٦	١,٢٠	١,٤٠	٠,٢٨	٢٦,٢٨
١٧	١,٢٨	٠,٢٦	٠,٢٧	١٨,١٢

Figure (1) The movement sequence: 720 degrees swimming + Mapo - in Kung Fu

Third: Predictive variables for 100-yard skills

Linear regression of mechanical variables on 100-yard skills stepwise

Number of the contributing variable. Name of the contributing variable. Multiple correlation coefficient. Square of multiple correlation coefficient. Square of adjusted correlation coefficient. Standard error of estimate. Value

f value

t Total percentage of contribution

1 Time structure 0.722 0.521 0.504 0.55651 30.49 10.673 52.10%

2 Vertical distance 0.841 0.707 0.685 0.44352 32.544 7.457 70.70%

3 Starting from the body's center of gravity 0.923 0.853 0.836 0.32046 50.13 10.911 85.30%

4 Inertia 0.95 0.903 0.887 0.26578 57.858 7.277 90.30%

The results of Table (10) and Figure (3) indicate that there is a strong correlation between mechanical variables and 100-yard skills, as in the time structure test the multiple correlation coefficient reached (0.722), with a contribution rate of (52.10%), and the adjusted correlation coefficient reached (0.504). The variance of the equation was (30.49) and the t-value of the equation was (10.673). The vertical distance test had a multiple correlation coefficient of (0.841) with a contribution rate of (70.7%). The adjusted correlation coefficient was also (0.685). The variance of the equation was (32.544) and the t-value of the equation was (7.457). The test of the number of times punches and kicks were repeated in 20 seconds, the multiple correlation coefficient reached (.923), with a contribution rate of (85.3%), the adjusted correlation coefficient reached (.836), the variance of the equation (50.130), and the t-value of the equation (10.911). The inertia test also reached (10.911). The multiple correlation coefficient was (.950), with a contribution rate of (90.3%). The adjusted correlation coefficient was (.887), the variance of the equation was (57.858), and the t-value of the equation was (7.277).

It is clear from the table that mechanical variables can be relied upon to statistically predict variables in lotus skills

Fourth: Predicting 100-yard skills in terms of mechanical variables

Table (6)

The value of the constant and the regression coefficient for the 100-yard skill in prediction equations

Number of the contributing variable. Name of the contributing variable. Constant amount. Regression coefficient. Error percentage

1 Temporal structure 818 0.108 0.02

2 Time structure 3.539

0.088 0.475

Vertical distance 0.054 0.016

3 Time structure 5.252

0.083 0.013

Vertical distance 0.059 0.481

Starting point for the body's center of gravity -0.033 0.012

4 Time structure 3.942 0.077 0.01

Vertical distance 0.069 0.007

Starting point for the body's center of gravity -0.03 0.542

Inertia 0.025 0.01

It is clear from Table (6) regarding the equation of the predictive regression line and Figure (3) that it is:

1- The first contributing variable in the 100-yard skill level: Y = w + m x1

Y = (4.818) + (.108) Temporal structure

2- The second contributing variable in the 100-yard skill level: Y=s + ms1 + ms2

Y = (3.539) + (.088) time structure + (.054) vertical distance

3- The third contributing variable in the 100-yard skill level: Y = w + ms1 + ms2 + ms3

Y = (5.252) + (.083) time structure + (.059) vertical distance + (-.033) departure from the body's center of gravity

The fourth contributing variable in the 100-yard skill level: Y = w + ms1 + ms2 + ms3 + ms4

Y = (3.942) + (.077) total times, time structure + (.069) top of the track, head height in the 100-yard skill, vertical distance + (-.030) speed value for the launch of the body's center of gravity + (.025) vertical distance

Thus, the researcher has arrived at an equation for the predictive regression line for the standard sum of the 100-yard skills in terms of the constant value of the fourth contributor, and the equation is:

Y=(3.942) + mx1 + mx2 + mx3 + mx4

Y = (3.942) + (.077) inertia + (.069)) top of the path, head height in the 100-yard skill, vertical distance + (-.030) time structure test + (.025) inertia

The total contribution percentage of the mechanical variables under study reached (90.3%), with the rest of the contribution percentage due to other variables that the researcher was not able to identify. Therefore, the mechanical variables are considered important in predicting the level of 100-yard skills. The researcher attributes this to the fact that the mechanical variables represent different models. Of the skills, they merge with each other and overlap, and the mechanical

variables represent (90.3%) of the 100-yard skills. When performing, we cannot separate each variable and consider that the separate skill is represented by one variable, and even if we do that, one skill represents more than one contribution. As for the 100-yard skills, the player performs the skill. Successively and quickly until he completes the 100-yard skill and gets all the points.

This is consistent with what he mentioned

Thus, the researcher answered the research question, which is: Can the level of 100-yard skills of Sanda swimming players be predicted based on some of the biomechanical variables under investigation?

Conclusions and recommendations:

Conclusions:

1- The first contributing variable in the 100-yard skill level: Y = w + m x1

Y = (4.818) + (.108) Temporal structure

2- The second contributing variable in the 100-yard skill level: Y = w + ms1 + ms2

Y = (3.539) + (.088) time structure + (.054) vertical distance

3- The third contributing variable in the 100-yard skill level: Y = w + ms1 + ms2 + ms3

Y = (5.252) + (.083) time structure + (.059) vertical distance + (-.033) departure from the body's center of gravity

The fourth contributing variable in the 100-yard skill level: Y = w + ms1 + ms2 + ms3 + ms4

Y = (3.942) + (.077) inertia + (.069)) top of the path, head height in the 100-yard skill, vertical distance + (-.030) time structure test + (.025) inertia

Recommendations:

1- Using the derived prediction equation in the process of selecting swimming players every year on a regular and continuous basis.

2- Relying on the prediction equation used to evaluate the technical level

3- Conducting other similar studies to measure other aspects of Kong players (skills - anthropometrics - physiological - psychological - sense of movement).

4- Conducting other similar studies to measure the aspects (skills, physical, anthropometric, physiological, psychological, and kinesthetic) of male and female swimming players at different age levels.

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