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Study some mechanical variables for water polo players

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Abstract:

Reliance on applied sciences such as mechanics, physiology, kinetic analysis, and others contributed to improving sports achievement and raising the level of players 'performance, as well as relying on modern techniques in analysis. Water sports of all kinds are among the most important sports in which biomechanics plays an important role in improving achievement.

This research aims to design a test for the skill of free swimming with the ball and to identify the values of some kinematic variables for the skill of free swimming with the ball in addition to identifying the relationship between the values of some kinematic variables of the skill of free swimming with the ball.

The research sample consisted of registered water polo players in the Alexandria region, and the best (30) players were selected in the free-swimming ball for analysis. The researcher used testing, scientific observation, measurement, and analysis means to collect data, and a video camera was used and quickly (25pictures) per second to extract the research variables. The descriptive approach was used for its relevance to the nature of the research, and statistical treatments were used (arithmetic mean, standard deviation, and simple correlation coefficient (Pearson). The researcher concluded:

• There was a positive significant correlation between achievement and the total number of strokes of the swimming arm with the ball.

• There is a positive significant correlation between the total speed of swimming with the ball and the average length of the stroke with the ball.

The researcher recommended the following:

- *To improve the speed of water polo players, emphasis must be placed on increasing the frequency of the stroke with an increase in the length of the stroke with the ball.*
- *Emphasis on free-swimming exercises with the ball and at different distances to control the ball while swimming.*
- *Emphasis on developing the horizontal speed of the water polo player while keeping the ball between the arms.*

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- *Paying attention to exercises that carry speed with the ball and exercises to control the ball between the arms.*
- *Conducting other studies, such as studying other types of swimming with the ball that a water polo player needs.*

Keywords: *Biomechanics - Water polo - Freestyle swimming with the ball - Kinetic analysis.*

I. Introduction and Importance of Research:

There is no doubt that the scientific and technical developments that the world witnessed at the present time had a great role in applying the modern scientific and technological foundations that contributed to raising the scientific level in general and the sporting level in particular, and there is no doubt that the game of water polo is one of the games included in this development As a result of the world's competition in creating modern scientific foundations in training, through conducting studies and research in various scientific fields, including mechanical research through which the level of technical, physical and functional performance can be developed, and that the use of biomechanics as one of the mathematical sciences that works to achieve advanced results in performance Various sports skills as well as studying the forces affecting them through the use of different methods, tools and devices that enable students to identify the most important steps of basic skills in water polo in a large way, which imposes more than one way of playing until the basis now is how to build an integrated team that invests all match opportunities And due to the lack of availability of tests that measure basic skills in water polo, hence the importance of research in designing a test for the skill of free swimming The ball and then the kinematic analysis for this skill and in the study of some mechanical variables that have a role in the performance of the skill of free swimming with the ball through which it seeks to obtain specifications that enable us to rely on it in training to perform this skill.[1,2]

II. Research methodology:

The descriptive approach was used to suit the nature of the research and its objectives.

- **Research community and sample:**

The research community was represented by registered water polo players in Alexandria. The best (30) players were selected in the free-swimming ball test for analysis.

- **Methods of data collection:**

Given that the study was based on test-building, this prompted the researcher to use a set of research methods that facilitate the way to access the best data and statistics required, but the game is one of the games that has not been adequately covered in the research, so the researcher sought to analyze the content of the available resources as well Using questionnaires, tests, measures, and technical-scientific observation and analysis as methods of data collection.[3,4]

Specifications of the skill test

- **Test name:**

measuring the speed and skill of a free swimmer with the ball.

- **The purpose of the test**:

to measure the speed and skill of free swimming with the ball.

- **Tools used:**

water polo field - legal water ball - stopwatch - whistle

- **Performance description**:

The tester stands on the mark of the (2) meter line in the middle of the field and the ball is in his possession and when he hears the starting whistle the player starts and the timer sets the timing for the tester who is free-swimming the ball legally and in a straight line until any part of the tester's body reaches the finish line mark for the test as in the figure below.[5,6]

Register:

- The performance time shall be recorded to the selected person to the nearest fraction of a second.
- The laboratory is given two attempts that count the best of them.
- **Selection of search variables:**

The researcher relied on analyzing the content of scientific sources in selecting the biochemical variables under study. The research variables (kinematics) included the following:

1. The total distance to swim with the ball.
2. The total time for swimming 15 meters freestyle with the ball.
3. The total speed of swimming 15 meters freestyle with the ball.
4. The total number of strokes of the arms of the swim.
5. The length of a single stroke is adjusted for a 15-meter free-ball swim.
6. The average time of one stroke for a 15-meter swim free with the ball.
7. The average frequency of a single stroke for a 15-meter swimming free ball.
8. The average velocity of a single stroke for a 15-meter free swim with the ball.
9. The distance of one real hit of the ball.
10. The real single stroke time of the ball.
11. The speed of one real hit of the ball.
12. The average angular velocity of the two players swimming 15 meters freestyle with the ball.[7,8]

Devices and tools used in the research: The researcher used the following devices and tools to obtain the best data accuracy:

1- (1) DVD Sony video camera.

2- A magnetic disc (DVD.)

3- Scale (1 meter long).

4- Stand to install the camera.

5- A tape measures.

6- Water ball, count (5).

7- Stopwatch to the nearest fractions of a second.

8- A computer.

9- A water polo field.

III. Statistical methods the following statistical methods were used:

(Arithmetic mean - standard deviation - mode - t-test torsion coefficient - percentage - simple correlation coefficient "Pearson") To reach statistical applications for extracting the necessary data for the research sample, the researcher used the statistics package (SPSS) to reach the final solutions for the data in question.

Table No. (1) the arithmetic means and standard deviation of the mechanical variables of the research sample.

Variables	measuring unit	SMA	standard deviation
Achievement	a second	10.791	0.887
The total velocity with the ball	Meters / second	1.432	0.137
Total arm hits with the ball	Number	11.773	1.733
Average hit time with the ball	Time/number of cycles	0.938	0.091
Average hit length with the ball	Distance/number of turns	1.327	0.208
The average frequency of the hit with the ball	Number / time	12.989	3.233
The average velocity of one hit with the ball	Meters / second	16.555	1.761
The time of the single hit with the ball	a second	0.986	0.097
Real strike distance	Prosaic	2.834	0.627
The speed of a single-arm stroke with the ball	Meters / second	3.071	0.608

IV. Presenting and discussing the results

4-1 Presentation of results:

From Table 1 it becomes clear that:

1- The existence of a negative moral correlation between achievement and between the total speed of swimming with the ball and the average length of the stroke for swimming with the ball. It is the result of dividing the distance traveled by the time taken, so if the time decreases, the rate of speed increases in return, and the length of the stroke for the arms increases [2,4,9–13].

2- The presence of a positive significant correlation between achievement and the number of total arm strokes of swimming with the ball. The researcher attributes that the increase in the number of arm rotations leads to an increase in the stroke frequency on the basis that the frequency of the stroke is the result of dividing the number of revolutions by the time taken and where the method of swimming with the ball in the water ball the head is raised out of the water while keeping the elbows elevated during movement, which in turn increases the number of arm strokes while swimming with the ball [14,15].

3- There is a negative significant correlation between the total speed of swimming with the ball and the number of total arm strokes of swimming with the ball, and the researcher attributes this to the that the smaller the number of arm strokes, the performance time decreases due to an increase in the length of the stroke, and thus the total speed of swimming with the ball increases because the player's speed is equal to the average length the hit is the rate at which the hit is repeated.

4- The existence of a positive significant correlation between the total speed of swimming with the ball and the average length of the stroke with the ball, and the researcher attributes this to the security of the increase in the length of the stroke, which leads to an increase in the player's speed as a result of reducing the distance traveled because the arms turn time equals the time taken over the number of arm revolutions [11,12].

5- There is a negative significant correlation between the number of total arm strokes for swimming with the ball and between the average time of one stroke for swimming with the ball and between the average length of a single stroke of swimming with the ball and the researcher attributes this to that the increase in the average time of one stroke leads to a decrease in the number of strokes of the arm and thus leads to travel a greater distance to swim with the ball in the least possible time and since:

V. Arm Cycle Time = (Time Duration) / (Arm Cycles Number).

Likewise, the increase in the average stroke length affects its number and thus reduces the total number of arms strikes with the ball, meaning that the smaller the number of arms strokes the greater the length of the strokes and vice versa.[13,16]

6- The existence of a positive significant correlation between the number of total arm strokes of swimming with the ball and between the average frequency of one stroke of swimming with the ball and the average speed of one stroke for swimming at a time. The researcher attributes this to the that the movements of the arms of the water polo player lead a fast and powerful timing, as well as the range of motion of the movements of the arms It is simple and not deep, with continuous movement without stopping, and the backward movement of the arm out of

the water is fast, and accordingly, the increase in the number of strokes of the arm with the ball will lead to an increase in the rate of one stroke as well as an increase in the rate of the stroke with the ball[17]

7- There is a positive significant correlation between the number of total arm strokes and the angular velocity of the arm with the ball. The researcher attributes that to the reason for the increase in the number of arm strokes due to the lack of its time and that time is part of the angular velocity equation. Therefore, the greater the angular velocity, the greater the number of arm rotations. The arm movements of a water polo player led to rapid timing, force, and continuous motion without stopping [16,18]

8- There is a positive significant correlation between the average time for a single swim with the ball and the average length of a single swim stroke with the ball.[19]

9- The presence of a negative moral correlation between the average time of a single stroke of swimming with the ball and between each of the frequency of the hit with the ball and with the speed of the single stroke with the ball and the researcher attributes the reason for this that the movements of the arms in the free-swimming of the ball to the water polo player are fast timing and continuous movement without stopping and this means that The increase in the rate of the stroke frequency of swimming with the ball will lead to a decrease in the average time of one stroke with the ball, and this, in turn, leads to an increase in the velocity of one stroke, since time is one of the sides of the equation of the rotation speed of the arm equals[9,20]

1. Arm rotation speed with ball = (ball with arm rotation distance) / (. Its time).

10- The existence of a negative significant correlation between the average time of one swim with the ball and the angular velocity of the arm with the ball reached (-1.961). This reduces the radius of the arm out of the water and thus reduces the radial angle, which is one of the sides of the equation of angular velocity and is equal to:

2. Angular velocity = (angular change) / time.

11- There is a negative significant correlation between the average length of a single stroke in swimming with the ball and both the rate of the stroke frequency for swimming with the ball and the speed of the single stroke of swimming with the ball.

12- There is a negative significant correlation between the average length of a single stroke in swimming with the ball and the angular velocity of the arm for swimming with the ball.

13- The presence of a positive significant correlation between the rate of the single stroke frequency of swimming with the ball and the rate of one stroke of swimming with the ball. As the average speed of one-hit = the average of stroke length x frequency.

14- There is a positive significant correlation between the average frequency of one swim with the ball and the angular velocity of the arm.[7,12,18,19]

Presentation and discussion of the correlation matrix of kinematic variables of free-swimming ball

Correlation matrix for mechanic variables of the free-swimming ball.

Variables	**Achievement**	**Total velocity with The ball**	**Total arm hits with the ball**	**Average hit time with the ball**	**Average hit length with the ball**	**The average frequency of the hit with the ball**	**The average velocity of one hit with the ball**	**Single hit time with the ball**	**Real strike distance**	**Average angular velocity of the arm with the ball**	**The speed of a single arm's stroke with the ball**
Achievement	1	0,988 **	* 0,564	0.024	* 0,616-	0.343	0.032	0.036	0.065-	0.095	0.055-
The total velocity with the ball		1	- 0,576	0.021-	**0.631	0.336-	- 0.036	0.032 -	0.052	- 0.084	0.044
Total arm hits with the ball			1	- 0.767	- 0.986	0.960	0.817	- 0.346	– 0.254	0.756	- 0.117
Average hit time with the ball				1	0.768	0.927	0.982	0.483	0.231	-0.852	0.059
Average hit length with the ball					1	- 0.941	- 0.807	0.364	0.226	0.723	0.081
The average frequency of the hit with the ball						1	0.918	0.406	0.290	0.837	0.137
The average velocity of one hit with the ball							1	0.467 -	- 0.278	0.870	- 0.151
Single hit time with the ball								1	0.284	- 0.386	- 0.170
Real strike									1	- 0.469	0.878

distance											
The average angular velocity of the arm with the ball the										1	0
speed of a single arm's stroke with the ball										0.098	1

VI. Conclusions and recommendations:

5-1 Conclusion:

3. There was a positive significant correlation between achievement and the total number of strokes of the swimmer's arm with the ball.
4. There is a negative significant correlation between achievement and between the total speed of swimming with the ball and the average length of the stroke of swimming with the ball.
5. There is a positive significant correlation between the total speed of swimming with the ball and the average length of the stroke with the ball.
6. There is a negative significant correlation between the total speed of swimming with the ball and the number of strokes of the total arm of swimming with the ball.
7. There is a positive significant correlation between the number of total arm strokes of swimming with the ball and between the average frequency of one swim with the ball and the average speed of one stroke of swimming with the ball.
8. The presence of a negative significant correlation between the number of total arm strokes of swimming with the ball and between the average time of one stroke for swimming with the ball and between the rate of one stroke of swimming with the ball.
9. There was a positive significant correlation between the number of total arm strokes and the angular velocity of the arm with the ball.
10. There is a positive significant correlation between the average time for one swim with the ball and the average length of one swim stroke with the ball.
11. The presence of a negative moral correlation between the average time of a single swim stroke with the ball and between the frequency of the stroke with the ball and with the velocity of the single stroke with the ball.
12. There is a negative significant correlation between the average time of a single swim stroke with the ball and the angular velocity of the arm with the ball.

13. There is a negative significant correlation between the average length of a single stroke in swimming with the ball and both the rate of the stroke frequency for swimming with the ball and the speed of the single stroke of swimming with the ball.

14. There is a negative significant correlation between the average length of a single stroke in swimming with the ball and the angular velocity of the arm for swimming with the ball.

15. There is a positive significant correlation between the average frequency of one swimming stroke with the ball and the average speed of one swim with the ball.

16. There is a positive significant correlation between the average frequency of a single swim with the ball and the angular velocity of the arm.

5-2 - Recommendations

1- To improve the speed of the water polo player, emphasis must be placed on increasing the frequency of the hit with the ball.

2- Emphasis on free-swimming exercises with the ball and at different distances to control the ball between the arms

3- Emphasis on developing the horizontal speed of the water polo player while keeping the ball between the arms.

4- Paying attention to exercises that carry speed with the ball and exercises to control the ball between the arms.

5- Conducting other studies, such as studying other types of swimming with the ball that a water polo player needs.

References:

1. Shalaby MN, Saad M, Akar S, Reda MAA, Shalgham A. The Role of Aerobic and Anaerobic Training Programs on CD34+ Stem Cells and Chosen Physiological Variables. *J Hum Kinet*. 2012;35(1):69-79.
2. Al Mayah A. *Biomechanics of Soft Tissues: Principles and Applications*. CRC Press; 2018.
3. Shalaby MN, Saad MM. Advanced Material Engineering and Nanotechnology for Improving Sports Performance and Equipment. *Int J Psychosoc Rehabil*. 2020;24(10).
4. Powers CM. The influence of altered lower-extremity kinematics on patellofemoral joint dysfunction: a theoretical perspective. *J Orthop Sports Phys Ther*. 2003;33(11):639-646.
5. Payton CJ, Burden A. *Biomechanical Evaluation of Movement in Sport and Exercise: The British Association of Sport and Exercise Sciences Guide*. Routledge; 2017.
6. Morais JE, Jesus S, Lopes V, et al. Linking selected kinematic, anthropometric and hydrodynamic variables to young swimmer performance. *Pediatr Exerc Sci*. 2012;24(4):649-664.

7. NaderShalaby M, Liu JY, Heshmat H, Shalaby NM, Salah M. The Effect of Aerobic and Anaerobic Exercise Bouts on CD34+ Stem Cells and Some Physiological Parameters. *Life Sci J*. 2012;9(2):1037-1043.

8. Hammam LG. Training effects of modern artistic exercises in improving some physical variables and sensory system among rhythmic gymnasts under (12) years. *J Appl Sport Sci*. 2020;10(01):38-52.

9. Shalaby MN, Sakoury MM, Kholif MA, Alsayed NI. The role of Amino Acids in improving immunity and growth factors of Volleyball players. *J Adv Pharm Educ Res Oct-Dec*. 2020;10(4):141.

10. Shalaby MN, Sakoury MMA, Alghamdi AM, Alzayani AK, Reem A-D. The effects of Exercise Program and Dietary Supplement on the Efficiency of the Dynamic System in Old Females. *PalArch's J Archaeol Egypt/Egyptology*. 2020;17(4):739-756.

11. Peterson DH, Bergmann TF. *Chiropractic Technique: Principles and Procedures*. Mosby Incorporated; 2002.

12. Sem MP. SCHOOL OF PHYSICAL EDUCATION DEVI AHILYA UNIVERSITY, INDORE.

13. Lees A. Technique analysis in sports: a critical review. *J Sports Sci*. 2002;20(10):813-828.

14. Shalaby MN, Liu JY, Kassem MM, Saad M. Circulating Hematopoietic Stem Cell and Some Physiological Parameters in Different Training Programs. *Life Sci J*. 2012;9(1):965-971.

15. Silverman S, Subramaniam PR. Student attitude toward physical education and physical activity: A review of measurement issues and outcomes. *J Teach Phys Educ*. 1999;19(1):97-125.

16. Shalaby MN, Liu JY, Saad M, Elaraby H. Impacts of Different Exercise Intensities on Hematopoietic Stem Cells and Certain Physiological Parameters on Handball Players and Non-Athletes. *Life Sci J*. 2012;9(3):2100-2105.

17. Musaiger AO, Takruri HR, Hassan AS, Abu-Tarboush H. Food-based dietary guidelines for the Arab Gulf countries. *J Nutr Metab*. 2012;2012.

18. Shepard L. The role of classroom assessment in teaching and learning. Published online 2001.

19. Downs FS, Fawcett J. *The Relationship of Theory and Research*. London: McGraw-Hill/Appleton & Lange; 1986.

20. Halliday D, Resnick R, Walker J. *Fundamentals of Physics*. John Wiley & Sons; 2013.