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Explosive Leg Power and Its Relationship with Start and Turn Times in the 50-Meter Butterfly Swimming Performance of Youth Swimmers

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Abstract

The first chapter of the research addressed the importance of the basic requirements for athletic success in butterfly swimming, especially in 50m races that are decided by fractions of a second; the research problem is highlighted by the disparity in the levels of young swimmers at the North Gas Club, Despite possessing good speed, they lack competitiveness due to weak starts and slow turns, which the researcher attributes to a deficiency in the two men's explosive power. The research aimed to measure this power, along with the start time (15m) and the turn time (10m), to establish a statistical correlation between them. Methodologically, the descriptive approach using correlational analysis was employed. On a sample of (10) swimmers aged (15-18 years), the results of the fourth chapter showed that the data followed a normal distribution, with a strong and significant correlation between explosive power and start time (+0.89), turn time (+0.81), and overall achievement. In conclusion, the research concluded that the explosive power of the legs is the main driver of excellence in butterfly swimming.

Keywords: e Strength, Leg Muscles, Start and Turn, Swimming

Introduction

Excellence in various vital activities practiced by humans requires the availability of several essential requirements that enable the individual to perform these activities to the fullest extent. The greater the availability of these requirements, the more Progress towards the desired level and reaching a higher rank is possible. Swimming is one of the sports characterized by individual competition and racing against time to cover distances in the shortest possible time. Therefore, the need arises to improve basic requirements and provide good preparation. Butterfly stroke is considered one of the most difficult and beautiful swimming strokes, as it requires coordination. High neuromuscular strength and exceptional physical ability. In short-distance (sprint) races, specifically the 50-meter race, victory is not solely determined by swimming speed in the water; rather, skill (start and turn) plays a crucial role in deciding the race time, often in fractions of a second. The explosive power of the legs is the primary driver of the start and turn processes, ensuring a successful start. The explosive power relies on the force exerted from the starting platform, while the rapid spin relies on the force exerted from the pool wall. The greater the explosive power, the greater the underwater distance covered and the higher the initial speed, thus reducing the overall race time.

The significance of this research lies in determining the extent to which the explosive power of the two men, as a physical component, influences the start time, spin time, and overall performance. Coaches utilize a scientific database to design training programs focused on explosive power to improve the performance of young swimmers.

Research Problem

Based on the introduction to the research, which highlighted the importance of the basic requirements for sports activities in general and physical abilities in particular. In particular, given that the (50m) butterfly swimming event for men is one of the activities that requires high physical abilities such as explosive power of the legs.

These parts are the foundation for forward propulsion in the water. Improved explosive power in the legs is a positive indicator of effective and advanced training, which in turn significantly impacts performance. Observing youth swimming championships, researchers noted a clear disparity in swimmer levels, with some losing... Many of them miss out on competition due to weak starts from the platform or slow turns, despite possessing good speed in freestyle swimming. The researcher believes this weakness may stem from a lack of attention to developing the explosive power of the legs or a lack of Recognizing the close link between them and these skills, this necessitated studying this relationship statistically to identify the causes of digital development.

Research Objectives

1. To identify the leg explosive power values of young 50-meter butterfly swimmers.
2. To determine the start time (from the cue to 15 meters) and the turn time (from 5 meters before the wall to 10 meters after it).
3. To establish the correlation between leg explosive power and start and turn times in the 50-meter butterfly.

Research Hypotheses

1. There is a statistically significant correlation between the explosive power of the legs and the start time in the 50m butterfly for young swimmers.
2. There is a statistically significant correlation between the explosive power of the legs and the turn time in the 50m butterfly for young swimmers.

Research Areas:

Human Scope

Swimmers of the North Gas Sports Club.

Temporal Scope

From June 10, 2025 to September 10, 2025.

Spatial Scope

The People's Olympic Indoor Swimming Pool.

Materials and Methods

Research Methodology

The methodology is the path the researcher chooses to arrive at the truth, and the nature of the problem determines the methodology used. Therefore, the problem necessitated the researcher's use of the descriptive method with a correlational approach (which examines the relationship between two variables). Or more, and the correlation coefficient gives an idea of whether this relationship is strong, weak, or non-existent (Qasim Hassan Hussein, 1998).

Although the 50m butterfly race in Olympic (long) pools does not involve a rotation, the researcher chose to test the (10m rotation time) as a key skill variable to find the correlation between the explosive power of the legs and the efficiency of the swimmer's skill performance, since rotation is an integral part of the skill requirements for butterfly swimming.

Research Sample

(The objectives set by the researcher and the procedures used will determine the nature of the sample to be chosen)) (Risan Khuraibat Majeed, 1987). The sample was chosen purposively, ensuring that the participants met the specialization requirements necessary to achieve the objectives, as. ((The researcher selects the sample that best suits his research and assesses his need for the information that will fulfill his purpose)) (Abdul Rahman Adas et al., 1988). The sample consisted of (10) young swimmers representing the North Gas Sports Club butterfly swimming team, aged between (15-18) years. The researcher selected the research sample as the research population, and the sample size constituted (100%).

The researcher performed homogenization of the variables under study to determine the goodness of the normal distribution on the Gaussian curve, as shown in Table (1).

Table 1. hows the arithmetic mean, median, standard deviation, and skewness coefficient for the research sample (n =10

Skewness	s	Median	x	Unit of Measurement	Variables	Offside
0.95	0.63	17.00	17.20	Year	Age	1
0.38	3.12	176.00	176.40	cm	Height	2
0.61	2.45	68.00	68.50	kg	Body Weight	3
1.09	0.82	5.00	5.30	Year	Training Age	4
-0.28	4.15	59.00	58.60	cm	Explosive Power	5
0.44	0.34	6.80	6.85	Second	15 m Sprint Time	6
0.35	.42	8.90	8.95	Second	10 m Turn Time	7

The degree of homogeneity among the research sample members, which proves that the distribution is normal, is shown based on the convergence coefficient.

Devices and tools used

Research tools ((are the means by which the researcher can collect data and solve his problem to achieve the research objectives, regardless of what those tools are in terms of data, samples, devices, etc. (Wajih Mahjoub, 1988)).

Three electronic timing clocks; 1- Wall-mounted vertical jump measuring board;

3 Starting whistle;

4 Supporting staff;

5 Dell Inspiron Cor7 calculator;

6 Weight and height measuring device;

7 Data entry form;

8 Legal starting platforms (belonging to the Al-Shaab Olympic swimming pool)

Methods of Data Collection:

1. Arabic Sources
2. The World Wide Web (Internet)
3. Tests and Measurements
4. Personal Interviews

Field Research Procedures

Exploratory Experiments

First Exploratory Experiment:

The pilot study was conducted on (20/6/2025) in the closed Olympic swimming pool of Al Shaab on a sample of (3) swimmers from outside the research community. The objective was to identify the following:

1. The time period that the test takes
2. The adequacy of the support team
3. The operation and efficiency of the equipment and tools used.

Key findings from the initial pilot study:

1. The feasibility of conducting the tests.
2. Determining the time required for the sample.
3. The suitability of the tests for the sample. 4- The adequacy of the support team.

Second Exploratory Experiment

The second exploratory experiment was conducted on (June 27, 2025) at 11:00 AM at the Al-Shaab Olympic Indoor Swimming Pool in Baghdad Governorate. The test was administered to a sample of (3) swimmers representing the North Gas Sports Club. The purpose of the experiment was to establish the scientific basis for the test.

Test Validity

The validity coefficient was derived by adopting content validity, which is defined as "a test that measures what it was designed to measure" (Safwat Farah, 1980).

Test Reliability

A reliable test is defined as a test that yields similar or identical results when repeated multiple times under the same conditions (Khair Al-Din Ali Ahmed, 1999). The researcher calculated the reliability coefficient by administering and re-administering the test at two different times to a sample of three swimmers. The test was administered on June 27, 2025.

The test was re-administered to the same sample under the same conditions after seven days. Pearson's simple correlation coefficient was calculated between the scores of the first and second administrations, and the correlation coefficient was statistically significant.

Table 2. Shows the reliability of the test

Significance	Level of Significance	Reliability Coefficient	Unit of Measurement	Variables
Significant	**0.001**	**0.94**	cm	Explosive Power (Vertical Jump)
Significant	**0.003**	**0.91**	second	Time to Start and Reach 15 m
Significant	**0.012**	**0.89**	second	Skill Turn Time (10 m)
Significant	**0.024**	**0.84**	second	50 m Butterfly Performance

Objectivity of the test

This means "the absence of subjective judgments by the tester, or that objectivity is available without bias and subjective intervention by the tester. The greater the degree of subjectivity in the test judgments, the less objective it is, and the more the subjectivity of the judgments is free from influence, the greater the result of objectivity (Wajih Mahjoub, 1985).

The tests used in the research are highly objective because they are clear, easy to understand and apply by the participants, and free from self-assessment, as the scoring method is straightforward. The objectivity of the test was calculated by evaluating its reliability level; Hassanin indicates that a test is considered objective if its reliability score is higher than... (75%) (Mohamed Sobhi Hassanin, 2001).)

Tests Used

Explosive Leg Power Test.

Standing Vertical Jump (Mohamed Hassan Alawi and Nasr El-Din Radwan, 2001).

1. Test Name:
2. Test Purpose: To measure the explosive power (speed-strength) of the leg muscles in the vertical direction

Tools used

1. A smooth wall of suitable height
2. A measuring tape (marked in centimeters) fixed vertically to the wall, or a marking board
3. Chalk powder for attaching the artifact to the wall

Performance Specifications

1. The swimmer stands facing the wall with both feet flat on the ground.
2. The swimmer extends the arm closest to the wall as far upwards as possible to mark the wall with chalk (this is called the point of stability or height from standing).
3. The swimmer swings their arms downwards and backwards while bending their knees halfway (position Preparation), then it explodes upwards with maximum force to mark the highest point it reaches in the air with chalk.

Conditions

1. No foot movement or hopping before jumping.
2. Each swimmer is allowed three attempts, and the best attempt is taken.

Scoring method: The distance between the "standing mark" and the "highest mark during the jump" is calculated, and the result is the explosive power in centimeters.

Start Time Test 15 Meter Butterfly (Talha Hussein Hossam El-Din, 1994):1)

1. Test Name: Start and Arrival Time Test for the 15 Meter Mark
2. The purpose of the test: to measure the reaction speed and explosive power of the two men at the moment of leaving the platform, and their ability to maintain the momentum generated by the push during flight, entry, and underwater gliding.

Equipment Used

1. An Olympic-size swimming pool (50 meters) with clear markings (colored lane ropes at 15 meters)
2. A starting whistle connected to a timing system or an electronic stopwatch
3. A video camera (preferably with a high frame rate) placed at the 15-meter mark for accurate timing

Performance Specifications

The swimmer (from North Gas Club) stands on the starting platform in a fully ready position. - Upon hearing the starting whistle, the swimmer performs an explosive push from the platform, then launches himself into the water and executes the underwater "dolphin" strokes specific to the butterfly stroke.

The test ends as soon as the swimmer's head crosses the imaginary 15-meter line (marked by colored lines on the pool ropes).

Scoring Method

1. The time is calculated from the moment the whistle is heard (or the starting signal is seen) until the head crosses the 15-meter mark.
2. The swimmer is given two attempts, and the best (fastest) time, measured in seconds and fractions thereof, is used.

Turn Time Test (Mu'ayyad Abdullah Al-Badri, 2002): 2)

1. Test Name: Turn Time Test over a distance of (15) meters in butterfly stroke
2. Test Purpose: To measure the speed of the turn and the efficiency of the explosive force of the legs in generating thrust off the pool wall

Equipment used

1. A legal swimming pool with clear markings
2. A stopwatch with a constant accuracy of 0.01 seconds
3. A side-view camera to record the touch and crossing of the marker

Performance Specifications:

1. The swimmer starts swimming (butterfly) from the middle of the pool, approaching the wall at high speed.
2. The time is calculated as soon as the swimmer's hand touches the wall.
3. The swimmer performs a legal turn (touching both hands together), then propels themselves forcefully with their legs and glides underwater.
4. The test ends when the swimmer's head reaches the 10-meter mark after the wall

Scoring method

1. Time is recorded from the moment the swimmer touches the wall until they cross the 10-meter mark.
2. The swimmer is given two attempts, and their best result with the fastest time is recorded. 3. The total distance calculated for the turn is 10 meters from the wall.

Main Experiment

After completing all scientific procedures and ensuring the suitability of the equipment and auxiliary tools, the researcher conducted the main experiment on (9/7/2025) at (10:00) AM at the Al-Shaab Olympic Indoor Swimming Pool in the Governorate Baghdad, and the experiment included applying physical and skill tests to the research sample consisting of (10) swimmers from the North Gas Sports Club, according to the following steps:

Anthropometric measurements: The height and mass of each swimmer were measured before the start of the tests. Warm-up: The swimmers were given sufficient time for general and specific warm-up to ensure their physical readiness and avoid injuries. Implementation of physical tests: The (explosive power of the legs) test was started out of the water using the vertical jump from a standing position.

- Implementation of skill and achievement tests: - The starting time (15m) was measured from the moment of launch from the platform until crossing the 15-meter mark. The turning time (10m) was measured independently, where the swimmer swims towards the wall, performs the legal turning, and then propels himself for a distance of 10 meters. Since the test pool (50m) does not include a turning during the 50m race, the measurement was taken The butterfly swim (50m) was completed as a final test for crossing the length of the pool once. Documentation: The support team recorded the results in the data entry forms in preparation for statistical processing.

Statistical Methods

To process the data obtained, the researcher used the SPSS v26 statistical package.

The following statistical laws were relied upon:

1. Arithmetic Mean

2. Median

3. Standard Deviation

4. Skewness Coefficient

5. Pearson's Simple Correlation Coefficient

6. T-test

7. Percentage

Results

Table 3. Illustrates the statistical parameters of the research variables (n =10

Skewness	sd	x	Unit of Measurement	Variables
0.42	3.22	58.45	cm	Leg Explosive Power
0.21	0.28	6.42	second	Start Time
0.43	0.35	8.15	second	Turn Time
0.14	1.05	28.90	second	50 m Butterfly Swimming Performance

The results show that the values of the skewness coefficient were confined to (±3), which confirms that the data are normally distributed under the Gaussian curve, which indicates the homogeneity of the sample and its suitability for parametric statistical treatments.

Presentation and Analysis of Correlation Relationships Between the Variables Under Study:

Table 4. Correlation Coefficient Matrix Between Independent and Dependent Variables (n =10)

Type of Significance	Level of Significance	Calculated t-value	Correlation Coefficient	Related Variables
Significant	0.002	4.75	0.86-	Explosive Power ↔ Performance Time
Significant	0.004	4.05	0.82-	Explosive Power ↔ Start Time
Significant	0.006	3.68	0.79-	Explosive Power ↔ Turn Time
Significant	0.001	5.51	0.89+	Start Time ↔ Performance Time
Significant	0.006	3.92	0.81+	Turn Time ↔ Performance Time

Discussion

Discussion of the Relationship Between Explosive Power and Start, Turn, and Completion

The results showed a strong, significant correlation between the explosive power of the two legs and all the research variables, both skill-based and time-related. The researcher attributes this to the fact that the legs are the primary drivers in butterfly swimming.

In the vertical jump test, the swimmer's ability to recruit a large number of fast-twitch muscle fibers is demonstrated. This translates into the force of propulsion from the platform (start) and the force of rebound from the wall (turn). This aligns with what Talha Hossam El-Din (1994) stated, that explosive power contributes to overcoming the body's inertia at the moment of launch, which explains the correlation. The high score in the first 15 meters (Talha Hussein Hossam El-Din, 1994)

Discussion of the relationship between start time (15m) and turn time (10m) with performance

The start skill achieved the highest correlation coefficient (0.89), followed by the turn (0.81). The researcher believes that the 50m butterfly is a purely anaerobic race, where the non-actual distances (start, turn, and flow) constitute approximately 50% of the total race distance. (15m start + 10m turn). A swimmer with a short start time has effectively utilized the mechanical propulsion from the platform and executed underwater dolphin strokes with high efficiency, thus reducing surface water resistance. (Mu'ayyad Abdullah, 2002) indicated that a swimmer's success in sprint distances depends on maintaining the speed gained from the start or turn for the longest possible time. What the results statistically proved in this study.

Third: The correlation and integration between variables

From the tables, it is clear that there is an integration between physical strength (explosive power) and skill application. The swimmer with strong legs is the same swimmer who achieved the fastest turn and start time, which necessarily led to an overall completion time. Superior, and this was confirmed by (Mohammed Hassan Alawi, 2001) that the alignment between physical demands and the motor pathways of the skill is what makes the numerical difference in elite-level sports.

Conclusions

1. A strong, statistically significant correlation exists between the two swimmers' explosive power and their time in the 50m butterfly, confirming that explosive power is the primary driver for achieving qualifying times.
2. The results demonstrated that the time of the first 15m (start and flow) has the highest correlation with overall performance, indicating that excellence in butterfly swimming begins from the starting platform, not from the beginning. Only inside the water.
3. There is a significant direct relationship between rotation efficiency and total time, as swimmers who possessed high explosive power in their legs were faster in rebounding from the wall and shortened the (10m) rotation time.
4. The research showed that the skill variables (start and turn) are not separate skills, but rather a direct reflection of the swimmer's level of explosive physical ability, which means there is integration between the physical and skill aspects.
5. The results proved that the youth category (15-18 years old) in the North Gas Club has a high response to training that focuses on speed-strength, which was clearly evident in the consistency of their statistical results.

Recommendations

Coaches should include structured lower-limb explosive power training in youth swimming programs. Start and turn drills should also be trained as specific technical components rather than only as parts of general swimming practice. The vertical jump test may be used periodically to monitor explosive leg power development. Future studies are recommended to involve larger samples, other swimming strokes, different age groups, and biomechanical analysis to provide deeper insight into start and turn performance.

1. Swimming coaches (especially at the North Gas Club) must develop training programs that focus intensively on developing the explosive power of the legs both out of the water and in the water, due to its direct link to performance.
2. Focus on "start" and "turn" drills as independent skills and allocate training units to improve the time of the first 15 meters, due to their crucial impact in short-distance races.
3. The researcher recommends the periodic use of imaging and kinematic analysis techniques to track start and turn times, identify technical errors, and correct them immediately.
4. The vertical jump test should be adopted as a physical fitness test, as it provides an accurate indicator of the development of explosive leg power.
5. The researcher recommends conducting similar studies on other swimming strokes (breaststroke, backstroke, freestyle) and on different age groups (juniors, advanced) to broaden the scientific

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