

Research Article

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## Strength and Speed Levels of The Upper and Lower Limbs of The Body and Their Relationship to Digital Achievement in Swimming Among Students

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### Abstract

**Background/purpose.** The study aimed to identify the importance of strength and speed levels of the upper and lower limbs of the body and their relationship to digital achievement in swimming.

**Methods.** The quasi-experimental approach was used. The study sample consisted of 28 students from the swimming course who were selected using the Intentional method. Upper and lower speed tests, maximum upper and lower strength tests, and strength endurance tests were used to achieve the objectives of the study.

**Results.** The results indicated that all study individuals had a high level of explosive strength in the lower and upper limbs. The results also showed that all study individuals had a low level of strength endurance variable. There is a correlation between strength and speed levels of the upper and lower limbs of the body and achievement. The researchers recommend focusing on the different stages of learning and developing the elements of physical fitness in the upper and lower limbs.

## 1. Introduction

Physical education is no longer the monopoly of some exercises and similar movements. Still, it has become a science like the rest of the life sciences, fields, and sub-sciences, the most important of which are the science of sports training, sports physiology, measurement and evaluation, sports biomechanics, sports psychology, sports injuries, and other sciences. Since its inception, the science of sports and exercise physiology has contributed to highlighting many physiological processes associated with the activity and movements of the body. This information helped in the development of the sports training process as well as appeared during the world competitions and championships in which many records for sports champions were broken during the twentieth century and the beginning of the twenty-first century at the Olympic Games in Sydney in 2000 and the subsequent continental and international championships (Ferreira et al., 2015; Sayed, 2003).

Many studies have agreed on the importance of physical fitness and its elements. The most important of these elements is the element of strength and speed, as they affect the rest of the other aspects. This is along with the fact that insufficient strength and speed negatively affect the level of mastery of upgrading skill performance and that strength and speed are essential elements that enter into the formation and formulation of the rest of the physical characteristics determining performance. Furthermore, the requirements of each exercise sports activity vary from muscular strength and speed to other activities, as they significantly affect the development of some other physical traits. Reaching high levels in any sport is linked to a set of procedures and steps based on scientific foundations for the athlete's selection, education, and training. For this reason, tests and measurements are necessary to continue scientific progress codified in the sports field to reach high levels and achieve achievement and ideal performance. (Allawi, 2015).

Abu Altaieb et al. (2017) and Bastawisi (1999) point out that each sports skill is associated with special physical abilities that positively affect their performance and confirm high correlations between physical abilities and physical measurements of performance levels in various sports activities. Therefore, coaches and supervisors must consider the selection of sports raw materials with physical and body specifications that characterize the skills of the specialized game. All this can be inferred by measuring and testing body, motor, and physical characteristics related to physical sports.

Reaching high sports levels in various games and breaking records for types of sports activities in general and swimming, in particular, are important topics that attract the attention of workers in this field. Thus, training and good planning in swimming have gained much attention in an attempt by scientists and specialists to benefit from the scientific method and the correct scientific foundations in the development process. This requires prior planning and the creation of all conditions to achieve achievement and a state of complete readiness and training with appropriate and effective plans as well. Strength training is one of the important physical qualities of swimming training, notwithstanding its role in essential exercises to strengthen muscle groups involved in performance.

The physical tests used in scientific research show the importance of objective measurement of physical characteristics that need to be measured, and the world has witnessed, during the past few years, a remarkable development of the scientific side, which includes almost all fields. This scientific development was reflected in aspects of life, including the sports side, and this scientific development studied did not come only from accurate and vigorous scientific studies to achieve records and higher levels in the effectiveness of freestyle in particular, as well as the continuous evaluation processes by the coach to reach the high achievements, records, and advanced positions in advanced swimmer's freestyle competitions.

Figueiredo et al (2013). Sayed (2003) indicates that functional strength training is one of the newly used training forms in the sports field, and the muscles of the lower limb are considered the

basic muscles necessary to achieve stability, constancy, and balance in the body. It is also one of the basic muscles that help the level of achievement in all sports in that it helps to get bigger and better weights than weight training and can ensure that the muscles of the lower limb are strong. This can form the difference between winning and losing from all sports activities, which are essential to reduce the chances of injury. This is particularly the case in the back area, which is becoming increasingly common, especially among women and athletes, as it provides the athlete with a solid or basic base. This is crucial in supporting a strong and permanent running step, and without strong basic muscles, the running step will be weak and will have no impact on endurance.

### **1.1. Study Problem**

Through the work of researchers in teaching physical education, they noticed a difference in the level of strength and speed elements among students enrolled in the swimming education course, which affects their level of digital achievement and thus affects their level of evaluation. Also, the elements of physical fitness, precisely the characteristics of muscle strength and speed, in their various aspects, are among the most important physical characteristics that swimmers need in all different activities. The researchers agree with Al-Anzi et al (2012) and Bastawisi (1999) that exercises in the aspects of the elements of muscle strength and speed are of great importance in swimming, especially in learning basic skills in the swimming course, given the swimmer's need to use greater muscle strength and higher speed in order to move in the water, and that the strength and speed used differ from one activity to another according to the distance and time of achievement. The researchers believe that attention should be paid to exercises for swimmers outside the water, which they believe affect the strength and speed of the swimmer through his skillful performance inside the water.

### **1.2. The importance of the study**

The present study is one of the rare studies that deals with the strength and speed levels of the upper and lower limbs of the body and their relationship to the digital achievement of physical education students. The study investigates the strength and speed levels of the body's upper and lower limbs that contribute to students' digital achievement. This study helps trainers benefit from these measurements when preparing and implementing training programs. Through its theoretical framework and results, the present study will help researchers conduct further studies, a wider community, and other activities.

### **1.3. Objectives and study questions**

This study aimed to identify the levels of strength and speed of the upper and lower extremities of the body among students. Additionally, the study aimed to identify the strength and speed levels of the upper and lower extremities of the body and their relationship to digital achievement among students. To achieve these objectives, the study addresses the following research questions:

- What are the levels of force and speed of the upper and lower extremities of the body among students?
- Is there a correlation between the strength and velocity levels of the body's upper and lower extremities and students' digital achievement?

#### ***The study variables***

- The independent variables are power and speed levels.
- The dependent variable is digital achievement.

## 2. Methods

The experimental method was used due to its suitability for the nature and objectives of the current study. The study population consisted of students of the swimming course in the Department of Physical Education at Jadara University, which comprised 35 learners. The study sample consisted of students of the swimming course in the Department of Physical Education at Jadara University, numbering 28 learners, who were selected randomly, the researchers then conducted homogeneity tests on the participants of the current study. Table 1 indicates the homogeneity of the study sample members.

**Table 1.** The homogeneity of the study sample (n = 28).

Variable	Unit	Min. value	Max. value	M	SD	Skewness
Age	year	19	29	24.11	4.192	-0.107
Body mass	kg	61	78	68.43	4.849	0.528
Length	poison	162	177	169.46	4.192	0.025
Body mass index	kg/m <sup>2</sup>	20	27	23.86	1.881	-0.227

The ages of the study sample ranged between 19-29, where the arithmetic mean and standard deviation of the age variable was  $24.11 \pm 0.4.192$ , and the value of skewness was -0.107, a value that is limited between  $\pm 3$ , which indicates the moderation of the data in the study variables. The mass of the study sample ranged between 61-78 kg, where the arithmetic mean and standard deviation of the weight variable was  $68.43 \pm 4.849$ , and the value of skewness was 0.528, a value that is limited between  $\pm 3$ , which indicates the moderation of the data in the study variables. The lengths of the study sample ranged between 162-177 cm, where the arithmetic mean and standard deviation of the length variable was  $169.46 \pm 4.192$ . The skewness value was (0.025), a value that is limited between  $\pm 3$ , indicating the moderation of the data in the study variables. The BMI values of the study sample ranged between 20-27 cm, where the arithmetic mean and standard deviation of the BMI variable was  $23.86 \pm 1.881$ , and the value of skewness was -0.227, which is limited to  $\pm 3$ , which indicates the moderation of the data in the study variables.

### 2.1. Tools used in the study

Sources and references, stopwatch, gymnastics mattresses, swimming pool, medical balls, stadiometer (to measure players' heights), electronic player mass measuring device, tape measuring (30) m, physical test results registration form, adhesive tape, multiple signs, and cones.

### 2.2. Physical tests

#### Physical tests

The physical tests used in the study were speed tests, upper and lower, which included rapid punching tests. This test involves hitting the target or device as quickly as possible using quick punches. The number of punches that can be directed over a specified period of time is measured to determine speed. The second test was the 30-meter running test. This test is similar to a 100-meter running test, but the time required for an individual to run a distance (30 meters) is measured at the highest possible speed.

#### Max power upper and lower

The max power upper and lower tests involve medicine ball throws and wide jump tests. Medicine ball throw requires throwing it hard from a long sitting position. The maximum power of

the upper part and the ability to generate explosive power are measured. The wide jump test measures the ability to jump wide using a tape measure. The person stands up and jumps with maximum explosive power to the furthest horizontal distance.

### **Bearing strength**

The bearing strength tests involve a 30-second pressure test (Push-ups) and a 30-second double jump test (Jump Squat). 30-second pressure test includes the ability to perform pressure with the arms repeatedly. The arms should be fully extended and then bent down until the body drops synchronously and then lifted again. 30-second double jump test is used to measure the strength of the legs and the ability of muscle explosion. In this test, the jump move is combined with the flexion movement of the knees (squats) to increase explosive power and muscular endurance.

### **2.3. Survey study**

In order to efficiently work in terms of saving time and effort and facilitating the communication process, the researchers selected an exploratory sample from the study population outside the study sample, which consisted of 3 participants. After applying it to the sample members, the researchers excluded it from the original study. The survey sample was applied to the swimming pool and facilities of the Department of Physical Education at Jadara University with the help of the work team.

The researchers wanted to identify the most critical obstacles and difficulties in this study and, in order to overcome them in the basic experience, prepare the experiment study tools and solidify their characteristics in terms of honesty, stability, and the ability to measure the variables of the study. Their suitability for the sample, the concepts adopted, the time it takes to undertake this study, and the best conditions for conducting the basic study are important. To ensure the validity of the instructions and data attached to the tests and the integrity of its language and ease of understanding by the sample members and on the level of efficiency of the members of the work team, which assisted in the implementation, management of measurements, tests and training them.

### **2.4. Scientific coefficients of the study**

For the purpose of verifying the truthfulness of the tests, the researchers used the truthfulness of the content. Then, the researcher distributed the tests to a group of arbitrators in the field of sports training and swimming, including their number (5) and asked them to express their opinions and observations on the suitability of the test content to the element to be measured. The researchers used the statistical program (SPSS) calculating arithmetic averages, standard deviations, percentages, and Pearson's correlation coefficient to reach the study results.

## **3. Results and Discussion**

To answer the first question, which state, "What are the levels of force and speed of the upper and lower extremities of the body among students?" the researcher used arithmetic averages and standard deviations.

**Table 2.** Arithmetic Averages and Standard Deviations of Study Sample Members (n = 28).

Variable	Test objective	Unit	Mini value	Max value	M	SD	Skewness	
Wide jump	Under tip	Maximum power	meter	1	3	1.86	.322	1.273
jump squat		Strong endurance	meter	18	32	25.64	4.288	-.288
Medical Throw Ball	Upper hem	Maximum power	meter	4	5	4.34	.486	.340
30s pressure		Strong endurance	reiteration	10	35	21.54	7.984	.472
Running 30 meters	Under tip	Top speed	second	3	6	4.74	.671	-.189
Running 200 meters		Bearing speed	second	26	39	33.06	3.440	-.231
Punching 8 seconds	Upper hem	Top speed	reiteration	28	38	33.50	2.742	-.070
Pass a basketball on the wall 30 seconds		Bearing speed	reiteration	28	52	41.79	6.076	-.193

The results of the second question are presented in Table 2. Arithmetic averages, standard deviations, skewness, and the maximum and minimum value in order for the variables of physical study among students of the swimming course at Jadara University as follows: Wide jump (1.86,  $\pm 0.322$ , 1.273, 3, 1), jump squat (25.64 $\pm$ 4.288, -0.288, 32, 18), medical ball throw (4.34, 0.486, 0.34, 5, 4), 30 seconds pressure (21.54,  $\pm 0.486$ , 0.472, 10, 35), 30 meters running (4.74,  $\pm 0.671$ , -0.189, 6, 3), 200m running (33.06, $\pm$ 3.44,-0.231,39,26), punching 8 seconds (33.5, 2.742, -0.07, 38, 28) basketball pass (41.79, $\pm$ 6.076,-0.193,52,28).

To answer the second question, which states: "Is there a correlation between the strength and velocity levels of the upper and lower extremities of the body and the digital achievement of students?". Pearson's correlation coefficient was used, and the results are displayed in Table (3).

**Table 3.** Pearson Correlation of Study Sample Members (n = 28).

Variable	Test objective	Unit	Pearson correlation	Sig.
Wide jump	Under tip	Maximum power meter	-.404(*)	.033
jump squat		Strong endurance meter	-.242	.215
Medical Throw Ball	Upper hem	Maximum power meter	-.125	.525
30s pressure		Strong endurance reiteration	-.349	.069
Running 30 meters	Under tip	Top speed second	-.182	.354
Running 200 meters		Bearing speed second	-.285	.142
Punching 8 seconds	Upper hem	Top speed reiteration	.285	.142
Pass a basketball on the wall 30 seconds		Bearing speed reiteration	.126	.521

Table 3 shows the existence of a correlation at the level of significance alpha less than 0.05 with the variable of broad jump and the value of significance was (0.033). As for the value of the correlation was (-0.404), and there is no statistical significance for the rest of the variables. As for the existence of a direct relationship, we take the negative value from the correlation coefficient because the lower time is considered more favorable, and they are the following variables (wide jump, throwing the medical ball pressure 30 seconds, running 200 meters).

In light of the responses of the study sample on the maximum strength variable, it should be noted that all study members have a high level of explosive power in the lower and upper limbs because they focus in the learning stages on exercises related to the large muscles in the lower part of the body. This has an impact on the record time as the explosive strength variable is one of the important variables and one of the important elements of physical fitness that all students of the Faculty of Physical Education must enjoy; this agrees with Al-Zoubi (2016) and Ay et al. (2013).

Considering the responses of the study sample to the strength endurance variable, it should be noted that all study members have a medium strength endurance level. This indicates that the strength endurance variable is one of the basic elements, especially among short-distance swimmers, due to its great impact on the completion time, which was previously mentioned by Al-Zghoul & Al Dababseh (2023). In light of the responses of the study sample on the speed tolerance variable, it should be noted that all members of the study have a low level in this variable. The researchers agree with Al-Qaddoumi & Nador (2021); Al-Zoubi (2021). this result to the time of the muscular work, which was at a rate of 24 s, which is considered a long time for absorption and what this element requires to enjoy high capabilities to continue to perform.

These results agreed with the study of Morais et al (2016) and Al-Qaddoumi & Taher (2010), and this study differed with the study of Jamhour (2016). The researcher attributes these results to the fact that most students were registered for practical courses such as physical preparation, football, basketball, and handball, in which the training they received targeted large muscle groups. Therefore, the explosive power characteristic was statistically significant. The participants of the study who have greater explosive power had a better completion time due to their reliance in the early stages of education on exercises targeting the muscles of the legs. The learning stages targeting the arms were yet to be completed.

#### 4. Conclusion

The conclusions of this study were as follows: The participants of the study who had explosive power in the lower limb had a greater time of completion in swimming. Additionally, the variables that affected the achievement time in swimming on the positive side were the explosive power of the two legs, the explosive power of the arms, the strength endurance of the arms, the strength endurance of the legs, the speed of the legs, and the endurance speed of the legs. Therefore, the researchers recommended the following points: conducting more studies such as this type but with different physical tests, researching more physical variables related to performance, focusing on the various stages of learning, and developing fitness elements in the upper and lower parts.

#### 5. Limitations

The findings of the present study are limited to the validity of the instrument and methodology used. Besides, the study participants were male and female students from the swimming course. Hence, it is highly recommended for future research to consider involving students from other courses.

#### Declarations

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