The Swedish Journal of Scientific Research

Original Article

# Contribution of some anthropometric, physical and physiological measurements in the level of digital achievement in a running for 400 meters for students in the field of physical education

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**SUMMARY**

The aim of this study was to identify the contribution of some anthropometric, physical and physiological measurements in the level of numerical achievement in a running of 400- meter among students in the field of physical education. To achieve this, the study was conducted on a sample of (100) students from the Department of Physical Education at the Technical University of Palestine "Khadoori" (PTUK), between the ages of (18-23) years. The two researchers used the descriptive method of its relevance to the nature of the study. Besides, Anthropometric measurements were made in terms of stature length, body mass, arm length, leg length, length of the instep, circumference of the shoulders, circumference of the chest, circumference of the abdomen, circumference of the thigh, circumference of the leg), and physical measurements in terms of (10 seconds, divide 5 steps (right-and-left), 200-meter sprint, Gri Cooper (12) minutes. To be added, physiological measurements In terms of heart rate, resting time and postoperative stress, systolic and diastolic pressure at the time of rest and after exertion (Cooper), and maximum oxygen consumption (Vo2max). The two researches used the SPSS program in data analysis. The results of the study showed that the abdominal circumference and the instep length were the most anthropometric measurements contributing to the level of digital achievement of track event (400 m), which contributed to the interpretation of (13.8%) of running time. Based on these results, the researchers recommend that trainers should take appropriate anthropometric, physical and physiological measurements for each of the athletics activities.

**Keywords:** Anthropometric, physical and physiological measurements, running for 400 meters, undergraduate.

## INTRODUCTION TO THE STUDY

Physical characteristics and anthropometric measurements are one of the most important means and the cornerstone of success and reach the highest levels of any sport game.(Zar, et al. 2008, p21- 22) and (Mande, 2016, p. 15) indicate that understanding the anthropometric and physical determinants of each Sports activity is an important and influential factor in athletic achievement. Each sport activity has its own anthropometric and physical requirements that pave the way for the player who has these requirements to achieve achievement. (Gursavek & Mishra 2012) added that it is as important as the athlete's technique in any game. This requires the care of trainers and teachers when selecting players. (Zar, et al., 2008, p21- 22) thinks that excellence and success in sporting activities depends on the player's physical abilities such as strength, speed, endurance, agility and other

Access this article online

Website: http://sjsr.se/

ISSN: 2001-9211

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physical abilities. In addition, (Parseh & Hassan 2015, p382), citing (Zapartdis et al., 2009), noted that the medals awarded to Eastern European players in 1972 and 1976 were due to attention to the anthropometric and physical requirements in selecting gifted athletes according to the requirements of each game. to be added, Physiological measurements are also considered to be the most important basic components of athletic achievement, as the trainers are trained in guiding and building training loads in terms of intensity, size and density, the most important of which are the maximum consumption of oxygen, heart rate and blood pressure. Furthermore, Abdel Fatah (p.172, 1997) indicated that "(Vo2max) is one of the most important physiological parameters of success in endurance sports, in which the player's physical level can be predicted. Physiologists such as (Fox, et al., 1989) (1984) (Lamb, 1985) (Astrand & Rodahl, 1986) found that Vo2max is the most accurate measurement of the fitness of the circulatory system, which represents the efficiency of the heart, lungs and blood in the transport of oxygen to the working muscles. Besides, (Wilmore & Costill 2004) noted that VO2max is strongly related to medium and long-term events, most notably the running. The idea of studying this variable stems from the fact that the 400-meter running is one of the short distances. The two researchers also believe that the player who does not have the anthropometric and physical measurements appropriate to the type of activity he practices, will be subjected to biomechanical problems leads to exert more effort and time than his colleague, who has the anthropometric and physical measurements that qualify him to the required achievement at the same time. Technical and training will not be able to prepare a hero from anybody, and hence the problem of the study, which can be summarized by answering the following question:

What are the most anthropometric, physical and physiological measurements, which contribute to the level of digital achievement of the 400 meter running of the students of physical education at the Technical University of Palestine "Khadouri"?

The two researchers also believe that the importance of the study is highlighted through the results that may help the training workers to raise the level of athletes and lead them to the highest levels, and save time, effort and money.

## METHOD AND PROCEDURES

### Study Approach

The researcher used the descriptive approach in his study of correlation due to its suitability for study purposes.

### Society and Sample of the Study

The study was conducted on a sample of (100) students from the Department of Physical Education at the Technical University of Palestine "Khadoori". They were randomly selected from the study population of 170 students. The study sample represented 58.82% Table 1 shows the characteristics of individuals in the study sample according to age, height, and body weight.

### Tools and Devices Used

In order to collect data, the following tools were used:

- Data collection form that included the following information:

(age, height, body mass, anthropometric measurements in terms of lengths and circumferences, physiological measurements, physical altars), an American-made mechanical balance of "Deteco" type, Measuring tape for lengths, and circumferences, siren, electronic stopwatch, exercise bench, start cubes, polar clock for pulse and postoperative systolic pressure measurement, medical stethoscope, sources and references.

### Study Procedures

The researcher performed the anthropometric, physical and physiological measurements and measured the level of digital achievement of the 400-meter track event in the real time period between 2/10/2016 and 5/4/2017.

### Reliability and Consistency of Tests

To verify the accuracy of the physical measurements and the level of digital achievement of the 400- meter running, the discriminatory reliability was used on a sample of 30 students from the Department of Physical Education at the Technical University of Palestine, who were excluded from the original study sample and were divided into two equal groups distinctive and Non-distinctive. Then apply (T) test for the independent samples to indicate the differences between them, and the results of Table 2 show that.

It is clear from the results of Table 2 that there are statistically significant differences at the level of α (0.05) in all the physical tests and the time of accomplishing the 400- meter running between the two distinctive and non-distinctive groups and for the benefit of the distinct group. In addition, the result of the discriminatory reliability indicates measurement of the tests in what they were designed for.

To ensure that the tests were stable, the (Test-Retest) method was used on the same survey sample. The time interval between the first and second application was (8) days, Pearson correlation and self-honesty were used, and the results of Table 3 show that.

It is clear from the results of Table 3 that there is a statistically significant relationship at the level of significance ($\alpha \leq 0.05$) in all physical measurements and the level of numerical achievement of the run 400 m between the first and second applications. (0.87 – 0.90) Self-correctness values ranged from 0.932 to 0.948. The Pearson correlation coefficient for the measurements of the digital achievement level of the track event 400 meters (0.85) and Self-correctness reached (0.921). This is evidenced by the physical measurements and the digital achievement of the track event 400 meters with a good degree of stability that meets the purposes of the study.

As for anthropometric measurements, they are not necessarily reliable and consistent, because they have a high degree of reliability and consistency. They are adopted in most previous studies and are one of the most accurate measuring instruments because they are relatively measurable and have little error (Kirkendall et al., 1987).

As for the physiological measurements, the devices used to measure the physiological variables are true and consistent, they are highly accurate, and the possibility of error is very few, where the researcher to verify the safety before using them, and also make sure of the accuracy of the results before entering them to the computer for statistically processing which is adopted in most previous studies such as Sarma & Anantarup (2017), (Prioreschi, et al., 2017), Dhara & Chatterjee (2015).

**Table 1:** Distribution of the sample of the study according to the variables of age, height and mass of the body (n = 100)

| Changes | Measuring unit | Average | Deviation | Torsion coefficient |
|---|---|---|---|---|
| Age | Year | 19.0 | 1.20 | 0.53 |
| Height | Meter | 1.75 | 0.06 | –0.32 |
| Body mass | Kilogram | 70.33 | 8.07 | 0.05 |

**Table 2:** Test results for independent samples to indicate the differences between the two distinct and non-distinct groups in physical measurements and the level of digital achievement of 400- meters track event under study (n = 100).

| Group Physical and skill measurements | Measuring unit | Distinct group (N=15) | | Non-distinct group (N=15) | | Value (T) | Level of significance * |
|---|---|---|---|---|---|---|---|
| | | Average | Deviation | Average | Deviation | | |
| Wide jump of stability Test | Centimeter | 234.60 | 9.54 | 206.33 | 10.10 | 7.876 | 0.000* |
| Sitting out of recession 10 sec. Test | Number of times | 12.93 | 0.88 | 8.33 | 1.34 | 11.069 | 0.000* |
| 200 metre run Test | SEC | 28.27 | 0.93 | 31.59 | 1.17 | –8.590 | 0.000* |
| 5-Step hop (Right) Test | Meter | 12.07 | 1.19 | 10.01 | 0.837 | 5.492 | 0.000* |
| 5-step hop (left) Test | Meter | 11.87 | 0.85 | 10.13 | 0.78 | 5.884 | 0.000* |
| 400 metre run Test | Minute | 1.17 | 0.05 | 1.59 | 0.27 | –5.816 | 0.000* |

**Table 3:** Results of Pearson correlation coefficient for the relationship between the first and second applications of physical measurements and the level of numerical achievement of the track event of 400 meters under study (n = 100)

| Physical and skill measurements | Measuring unit | First application | | Second application | | Value (R) | Self-honesty |
|---|---|---|---|---|---|---|---|
| | | Arithmetic average | Standard deviation | Arithmetic average | Standard deviation | | |
| Wide jump of stability Test | cm | 220.46 | 17.31 | 223.26 | 15.56 | 0.90** | 0.948 |
| Sitting out of recession 10 sec. Test | once | 10.63 | 2.59 | 11.40 | 2.14 | 0.87** | 0.932 |
| 200 metre run Test | second | 29.94 | 1.98 | 29.80 | 1.89 | 0.87** | 0.932 |
| 5-Step hop (Right) Test | metre | 11.04 | 1.45 | 11.23 | 1.26 | 0.88** | 0.938 |
| 5-step hop (left) Test | metre | 10.99 | 1.19 | 11.10 | 1.15 | 0.87** | 0.932 |
| 400 metre run Test | minute | 1.38 | 0.29 | 1.34 | 0.32 | 0.85** | 0.921 |

*D statistically at ($\alpha \leq 0.05$ ), **statistically significant at ($\alpha \leq 0.01$ )

### Statistical Treatments

In order to answer the questions of the study, the Statistical Package for Social Sciences (SPSS) was used by making the following statistical treatments:

- Standard averages and standard deviations.
- Coefficient Pearson Correlation.
- Simple Linear Regression (T) and (Beta) to determine the regression line equation.

## DISPLAYING AND DISCUSSING THE RESULTS OF THE STUDY

### First: Results Related to the First Question

What are the most anthropometric measurements that contribute to the level of digital achievement of 400 meter track event when students in the field of physical education?

To answer this question, Pearson Correlation Coefficient was used to determine the relationship between anthropometric measurements and the level of digital achievement of the 400 meter run as a first step. The linear stepwise regression was then applied to determine the contribution of statistically linked anthropometric measurements (Independent variable) at the digital level of 400 meter track event (continued variable) as a second step. The following is a presentation of the results of this question:

The results of Table 4 show a statistically significant relationship between the digital level of (400 m) track event and the anthropometric measurements (length of the instep and belly circumference), where Pearson correlation coefficient values were respectively (-0.28, 0.24) Where there is a statistically significant relationship between the digital level of the event of 400 m and other anthropometric measurements. The following is a presentation of the results of the multi-step linear regression of the contribution of anthropometric measurements to the digital achievement level of the 400 meter run under study:

The results of Table 5 show that the most anthropometric measurements that are able to contribute to the digital level of the 400 m event were the length of the instep and the belly circumference, where $R^2$ reached (0.138) The T-test, the beta factor, and the results of Table 6 were used.

The results of Table 6 show that the value of T was statistically significant at $\alpha$ (0.05). The anthropometric measurements (Belly circumference and length of sitting) were interpreted in 13.8% of run time (400 m) consequently the proposed equation would read as follows:

The digital level of track event (400 m) min. = 1.306 - () Length of instep (cm) × 0.014 (+) Belly circumference (cm) × 0.003).

As for the event of (400) meters, the results of the analysis of mono-variance in Table 5 showed that the belly and foot circumferences were the most anthropometric measurements capable of contributing to the digital level of this event. They contributed to the interpretation of 13.8% This result is consistent with the study of Abdul Haq (2007), where the results showed that the belly circumference contributed to the interpretation of (62.5%) of the skill of jump on the horse is open, as Othman, 2009 0.039), and the

**Table 4:** Pearson correlation coefficient results to determine the relationship between anthropometric measurements and the track event for 400 meter among students of physical education (N = 100)

| Anthropometric measurements | Measuring unit | Minimum value | Maximum value | Arithmetic average | Standard deviation | Value (R) |
|---|---|---|---|---|---|---|
| Age | Year | 18 | 23 | 19.70 | 1.20 | –0.06 |
| Body mass | Kg | 49 | 90 | 70.33 | 8.07 | –0.01 |
| Lengths | Metre | 1.62 | 1.86 | 1.75 | –0.11 | –0.11 |
| Tallness | Cm | 68 | 80 | 74.37 | –0.05 | –0.05 |
| Arm | Cm | 82 | 104 | 92.43 | –0.02 | –0.02 |
| Leg | Cm | 23 | 34 | 26.55 | –0.28** | –0.28** |
| Instep | | | | | | |
| Circumference | Cm | 77 | 99 | 86.64 | 0.01 | 0.01 |
| Chest normal | Cm | 21 | 33 | 26.25 | 0.15 | 0.15 |
| Humerus | Cm | 21 | 29 | 25.64 | –0.09 | –0.09 |
| Higher forearm | Cm | 58 | 93 | 76.21 | 0.24* | 0.24* |
| Belly | Cm | 41 | 63 | 52.52 | –0.07 | –0.07 |
| Thigh | Cm | 28 | 45 | 34.67 | –0.03 | –0.03 |
| Leg calf | | | | | | |

*D statistically at ($\alpha \leq 0.05$) , **statistically significant at ( $\alpha \leq 0.01$ )

**Table 5:** Results of the analysis of the mono-variance to identify the regression coefficient of the proposed predictive equation for track event of (400 m) among students in the field of physical education

| Anthropometric measurements | Source of Contrast | Total boxes of Regression | Freedom degrees | Average boxes | Value (F) | *Significance level | $R^2$ |
|---|---|---|---|---|---|---|---|
| Length of the instep | Regression | 0.057 | 1 | 0.057 | 8.722 | 0.004* | |
| | Error | 0.640 | 98 | 0.007 | | | 0.082 |
| | Total | 0.697 | 99 | | | | |
| Length of the instep + belly circumference | Regression | 0.096 | 2 | 0.048 | 7.777 | 0.001* | |
| | Error | 0.601 | 97 | 0.006 | | | 0.138 |
| | Total | 0.697 | 99 | | | | |

* Significance level ($\alpha \leq 0.05$)

**Table 6:** The results of the T test and the beta coefficient of the regression line equation for the contribution of anthropometric measurements at the digital level of (400 m) track event among students in the field of physical education

| Component of equation of anthropometric measurements | Value | Standard error | Beta coefficient | Value (t) | * Significance level | Cumulative Contribution Ratio% |
|---|---|---|---|---|---|---|
| Consistent | 1.551 | 0.129 | | 12.012 | 0.000* | 8.2 |
| Length of instep | -0.014 | 0.005 | -0.286 | -2.953 | 0.004* | |
| Consistent | 1.306 | 0.159 | | 8.218 | 0.000* | |
| Length of instep + | -0.014 | 0.005 | -0.282 | -2.988 | 0.004* | 13.8 |
| Belly circumference | 0.003 | 0.001 | 0.238 | 2.251 | 0.013* | |

* Significance level ($\alpha \leq 0.05$)

researchers attributed the cause of the contribution of the circumference of the belly in the completion of run 400 meters to the importance of belly circumference is free of grease. In this increase in belly circumference is an indication of increased body mass and therefore increased resistance to the feet. This is confirmed by Al Hindi (2012) and Al-Lala (2000, p. 140), who say that weight gain is an impediment to muscle Of the speed and strength of activities requiring rapid movements, and the studies of Maldonado et al. (2002) and Arrese & Ostariz (2006) Anthropometric measurements such as height, weight, and body mass free of grease, while

researchers attribute the cause of the contribution of the foot in the digital achievement of the event of 400 meters run to increase the base of the pivot, which gives greater momentum and balance better during the run, specifically the run on the direction of the impact of strength repelling and central strength, and believes that the length of the step and speed of frequency in the run of 400 meters depends on two factors which are the muscle strength of the two legs in addition to the length of the instep, the longer the length of the Length of the instep the less resistance and the greater the strength produced and thus the length of the step and speed of frequency increase.

## Second: Results on the Second Question

What is the most physical measurements contribution to the digital level of the track event of 400 meters among the students of the specialization of physical education?

To answer this question, Pearson Correlation Coefficient was used to determine the relationship between physical and digital measurements of the 400 m track event as a first step, and then the Linear Stepwise Regression analysis was applied to determine the contribution of statistically linked physical measurements Independent variable) at the digital level of track event 400 meters (dependent variable) as a second step, the following is a presentation of the results of this question:

The results of Table 7 show a statistically significant relationship at $\alpha$ (0.05) between the digital level of 400 meters and all physical measurements. The following is a presentation of the results of the multi-step linear regression of the contribution of physical measurements at the digital level to the track event of 400 meters:

The results of Table 8 show that the most physical measurements capable of contributing to the digital level of (400 m) track event were (200 m and 5 left) and R2 to (0.275) The T-test, the beta coefficient, and the results of Table 9 were used.

The results of Table 9 show that the value of (T) was statistically significance at the ($\alpha \leq 0.05$)level. The physical measurements (200m run and 5 left step) in interpretation (27.5%) of the running time (400m) Thus, the proposed equation becomes as follows:

**Table 7:** Results of correlation coefficient Pearson to determine the relationship between physical measurements and the track event of 400 meter under study by students in the field of Physical Education (N = 100)

| Physical measurements | Measuring unit | Minimum value | Maximum value | Arithmetic average | Standard deviation | Value (R) |
|---|---|---|---|---|---|---|
| Wide jump from stability test | cm | 140 | 293 | 218.50 | 29.58 | –0.31** |
| Sitting from recession 10 sec. test | once | 8 | 15 | 10.89 | 1.75 | –0.30** |
| 200 metre run test | second | 26.60 | 37 | 29.99 | 2.19 | 0.45** |
| 5-step hop (right) test | metre | 6.70 | 15.20 | 11.19 | 2.07 | –0.38** |
| 5-step hop (left) test | metre | 6.85 | 15.80 | 11.59 | 2.29 | –0.39** |

*D statistically at ($\alpha \leq 0.05$) , **statistically significant at ($\alpha \leq 0.01$ )

**Table 8:** Results of the analysis of the mono-variance to identify the regression coefficient of the proposed predictive equation for (400 m) track event for students in the field of physical education.

| Physical measurements | Source of Contrast | Total boxes of Regression | Freedom degrees | Average boxes | Value (F) | Significance level * | $R^2$ |
|---|---|---|---|---|---|---|---|
| 200 m run | Regression | 0.142 | 1 | 0.142 | 25.155 | 0.000* | |
| | Error | 0.555 | 98 | 0.006 | | | 0.204 |
| | Total | 0.697 | 99 | | | | |
| 200 m run + 5 step left hop | Regression | 0.192 | 2 | 0.096 | 18.414 | 0.000* | |
| | Error | 0.505 | 97 | 0.005 | | | 0.275 |
| | Total | 0.697 | 99 | | | | |

*Significance level ($\alpha \leq 0.05$)

**Table 9:** Results of T test and beta coefficient for regression equation for the contribution of physical measurements at the digital level of (400 m) track event among students in the field of physical education

| Components of equation for the physical measurements | Value | Standard error | Beta coefficient | Value (t) | * Significance level | Cumulative Contribution Ratio% |
|---|---|---|---|---|---|---|
| Consistent | 0.652 | 0.104 | 0.452 | 6.289 | 0.000* | 20.4 |
| 200 metre run | 0.017 | 0.003 | | 5.016 | 0.000* | |
| Consistent | 0.872 | 0.122 | | 7.123 | 0.000* | |
| 200 metre+ run | 0.014 | 0.003 | 0.364 | 4.004 | 0.000* | 27.5 |
| 5 step left hop | -0.010 | 0.003 | -0.280 | - 3.081 | 0.0.00* | |

*Significance level ($\alpha \leq 0.05$)

The digital level of track event (400 m) min. = 0.872 + run 200 m (s) run × 0.014 (-) 5 steps left step (cm) × 0.010).

As for the 400 meters run, the results of the single-variance analysis in Table 9 showed that a test of 5 steps hop left and 200 meters run were the most physical measurements contributing to the digital level of the track event of 400 meters (400) which contributed to an explanation in the interpretation of (27.5%) of time of the (400) meters run. This result is consistent with the study of Al-Enezi (2012), which showed the test of three hops contributed to the interpretation (56.2%) in the long and triple jump as Abu Altaieb et al. (2010) showed that there is a positive correlative relationship between the strength characterized by speed, explosive strength, moving strength and the digital level of triangular jumping event, where their percentage of performance interpretation reached 82%and researchers attribute the reason why the contribution of the strength characterized by speed in the test of the "5 steps" in the level of digital achievement in the 400 meters run to the track event of 400 meters classified among the events that depend on the anaerobic system in the production of energy, as Ahmed (1999, p. 149) referred to the association of muscle strength with speed, saying, "There is no speed without muscle strength." Al-Khuzaie (2010) noted that strength characterized by speed plays an important role in the acceleration phase during the 400 meters run, and the stage of decreasing speed requires the player to compensate it by increasing the length of the step frequency calculation in addition to the arms and likely increase its speed and this requires the player to a high level of strength characterized by speed in the legs and arms.

Where the two researchers attribute the reason why the 200-meter run test at the digital achievement level in the 400-meter run has contributed to the importance of speed bearing in this event as a common denominator between 200-400 meters and depends on the lactic energy system, Akira Ito et al. (2008) (Albek et al. 2009, p. 83) states that the track event of (200-400 m) is the most important based on the anaerobic system which requires a high level of speed bearing, where the speed of the player begins to decrease gradually due to high intensity and great effort, and the emergence of fatigue that is lactic acid, and Ahmed (1997, p. 36) thinks that the player loses 0.5 seconds during the third and fourth 100 meters of the race, as Zaher (2009, 124- 124) states that the player feels tired after the end of 300 meters, and intensifies during the last 40-90 meters of the race, and the player must maintain his speed as much as possible to rush in the end with all his strength to finish the race, and here shows the importance of speed bearing the player will achieve a better result than others, as the study of Singh and Malik (Singh & Malik, 2015) and Ahmed (2010) that the characteristic of speed bearing was the most important physical characteristics of the 400 m runners.

## Third: Results Related to the Third Question

What are the most physiological measurements that contribute to the digital level of track event of 400 meter among students in the field of physical education?

To answer this question, Pearson Correlation Coefficient was used to determine the relationship between physiological measurements and the digital level of track event of 400 m as a first step, and then the Linear Stepwise Regression analysis was applied to determine the contribution of statistically associated physiological measurements (independent variable) at the digital level of 400 m (dependent variable) as a second step. The following is a presentation of the results of this question:

It is clear from the results of Table 10 that there is a statistically significant inverse relation between at ($\alpha \leq 0.05$) between the numerical level of (400 m) track event and maximum oxygen consumption (VO2 max). The following is a presentation of the results of the multi-step linear regression of the contribution of physiological measurements at the digital level of the 400-meter track event:

The results of Table 11 show that the most physiological measurements able to contribute to the digital level of the (400 m) track event was (the maximum consumption of oxygen VO2 max), where the ($R^2$) value reached to (0.094). To identify the linear regression equation, the T- Test and the beta coefficient were used, and the results of Table 12 show that.

The results of Table 12 show that the T-value was statistically significant at the significance level ($\alpha \leq 0.05$), as the physiological measurement (the maximum oxygen consumption VO2 max) contributed to explain (9.4%) of the (400 m) running time, so the proposed equation becomes as follows:

The digital level of the (400 mpm) track event = 1.401 - (maximum oxygen consumption VO2 max (ml/kg/min) × 0.004).

As for the 400 meter track event, the results of the one-way analysis of variance in Table 9 showed that the maximum oxygen consumption (Vo2 max) was the most physiological measure, contributing to the digital level of the 400 meter track event, as it contributed to explain (9.4%) of running time. This result is consistent with Abbas' study (2008), which showed that the Vo2 max contributed to explain (82.85%) of the skilled performance level of ground tennis, and it is also consistent with (Sarma & Anantarup, 2017),

**Table 10:** Results of Pearson correlation coefficient to determine the relationship between physiological measurements and the track event of 400 meter under study by students in the field of Physical Education (N = 100).

| Physiological measurements | Measuring unit | Minimum value | Maximum value | Arithmetic average | Standard deviation | Value (R) |
|---|---|---|---|---|---|---|
| Pulse during resting time | Pulse/minute | 52 | 88 | 65.78 | 6.18 | 0.18 |
| Pulse during effort | Pulse/minute | 120 | 184 | 149.21 | 13.31 | 0.16 |
| Systolic pressure resting time | Mm / hg | 99 | 130 | 115.13 | 6.47 | -0.10 |
| Systolic pressure time effort | Mm / hg | 120 | 189 | 150.50 | 12.74 | -0.13 |
| Diastolic pressure resting time | Mm / hg | 43 | 80 | 65.48 | 8.04 | -0.09 |
| Diastolic pressure time effort | Mm / hg | 48 | 110 | 73.78 | 8.86 | -0.03 |
| Maximum oxygen consumption (VO2 max). | Mm/ kg / minute | 35.75 | 67.04 | 53.94 | 6.03 | -0.30** |

*D statistically at ($\alpha \leq 0.05$) , **statistically significant at ($\alpha \leq 0.01$)

**Table 11:** Results of the one-way analysis of variance to identify the regression coefficient of the proposed predictive equation for the (400 m) track event among physical education students

| Physiological measurements | Source of contrast | The sum of squared deviations | Degrees of freedom | The average of squares | F Value | Significance level* | $R^2$ |
|---|---|---|---|---|---|---|---|
| Maximum oxygen consumption VO2 max | Regression | 0.065 | 1 | 0.063 | 10.158 | 0.002* | 0.094 |
| | Error | 0.631 | 98 | 0.006 | | | |
| | Total | 0.697 | 99 | | | | |

*Significance level ($\alpha \leq 0.05$).

**Table 12:** Results of T- test and beta coefficient of the linear regression equation for the contribution of physiological measurements in the digital level of the (400 m) track event among physical education students

| Equation components for physiological measurements | Value | Standard error | Beta coefficient | T- value | Significance level * | Cumulative Contribution Ratio % |
|---|---|---|---|---|---|---|
| Constant | 1.401 | 0.073 | | 19.286 | *0.000 | 9.4 |
| Maximum oxygen consumption VO2 max | -0.004 | 0.001 | -0.306 | -3.187 | *0.002 | |

*Significance level ($\alpha \leq 0.05$).

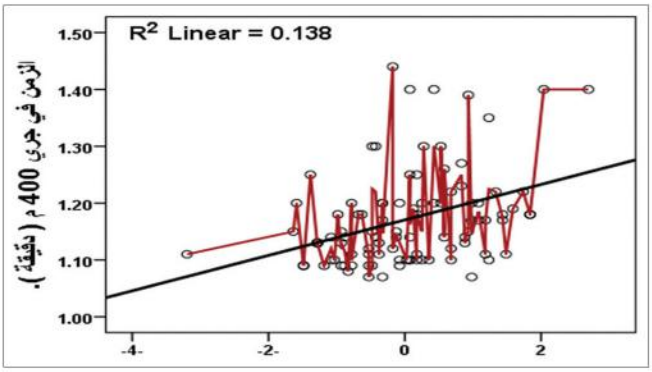


**Figure 1:** Regression line for the contribution of anthropometric measurements in the digital level of the track event of 400 meters (minute)

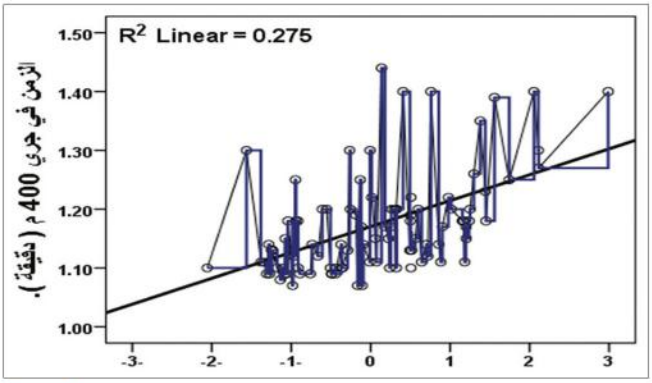


**Figure 2:** Regression line for the contribution of physical measurements at the digital level of the track event of 400 meters (minutes)

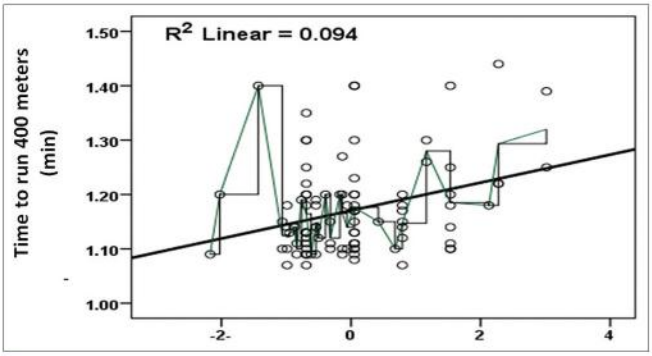


**Figure 3:** Regression line of Maximum oxygen consumption at the digital level of the (400 m) track event (min.).

(Prioreschi, et al, 2017) study, and (Dhara & Chatterjee, 2015) study, whose results showed a contribution rate and a great connection to sports achievement. The researcher attributed the reason of VO2 max contribution in the digital level of the 400 meter track event to the development of heart and lungs' of the study sample individuals on the understanding that they are student athletes, and therefore have advantage of the heart cavity size and this leads to the absorption of a larger amount of blood, so athletes receive more oxygen for the purpose of producing energy with fewer heartbeats.

In addition to increasing the heartbeat size caused by the heart size increasing as an adaptation of what the students learn from different programs and loads of training during the practical lectures. Furthermore, Sayed (2003, p. 211) stated that the lungs elasticity and their ability to stretch and shrink for the performance of strong and deep breathing movements increases, the breathing rate decreases,its depth increases, the athlete's efficiency increases in oxygen utilizing and consuming to produce energy, the strength and efficiency of breathing muscles improves, and the pulmonary sizes of the endurance athlete increases in general. As well, the researcher attributed this to the increased cardiac output during running due to the muscles need to consume oxygen, to increase the heart drive during the enemy resulting from the need for muscles to consume oxygen. Khalil (2008, p. 155) stated that the pulse amplitude increases during physical exertion, leading to an increase in cardiac output. This is confirmed by Abdel Fattah (2000) by saying that cardiac output can increase by increasing the heart rate or pulse size, so this increase in cardiac output is offset by an increase in the maximum rate of oxygen consumption (Vo2 max) among students.

## CONCLUSIONS

By presenting and discussing the study results, the two researchers found that the best anthropometric measurements that have the ability to determine the level of digital achievement of 400 meters running were (the abdominal circumference and the length of the instep), while the tests (running 200 meters, and hopping 5 steps on the left foot) were the most physical measurements able to determine the level of digital achievement of the 400 meters track event, while (Vo2 max) was the most physiological measurements able to determine the level of digital achievement of the 400 meters track event.

## REFERENCES

1. Ahmed, Bastois. (1997). Track and Field Competitions (Education, Technic, Training), Cairo, the Publisher, Dar Al-Fikr Al-Arabi
2. Ahmed, Bastois. (1999). Foundations and Theories of Sports Training, the Publisher, Dar Al-Fikr Al-Arabi, Cairo.
3. Ahmed, Faiza Abdel Jabbar. (2010). "Use of special exercises for extreme jogging rhythm centered in the race time and its impact on speed endurance and the completion of (400) meters running" Journal of Sport Sciences, University of Diyala, vol. 2 (2): 199-220.

4. Akira Ito, Koji Fukuda, and Kota Kejima. (2008). " Mid-phase sprinting movements of Tyson Gay and Asafa Powell in the 100 m race during the 2007 IAAF", IAAF Journal, vol. 23, (2): 31-40.
5. Al-Baik, Ali Fahmi, Abu Zeid, Emad Eddin Abbas, Khalil, and Mohammed Ahmed Abdo (2009). Metabolism and Anaerobic and Pneumatic Energy Systems, Series of Recent Trends in Sports Training "Theories – Applications", Knowledge Foundation, Alexandria.
6. Khuzaie, Entisar Mezher. (2010). "The Relation between Acceleration Types and Some Physical Abilities and Achievement of Running 400 m freestyle", Modern Sport journal, Baghdad University, vol. 11 (16): 20-40.
7. Khalil, Samia. (2008). Principles of Sports Physiology. Edition 1, Nas Printing Company, Iraq.
8. Zaher, Abdel Rahman, Abdel Hamid. (2009). Mechanism of Training and Teaching Athletics Competitions, edition 1, Markaz al-Kitab li al-Nashr, Cairo.
9. Sayed, Ahmed Nasr El Din (2003). Sports Physiology "Theories and Applications", edition 1, Dar Al-Fikr Al-Arabi, Cairo.
10. Abdelhak, Emad (2007). "The Contribution of Some Anthropometric Physical Measurements in the Performance Level of the Skill of Open Jumping and Annexation Jumping Among Gymnastic Emerging Players." The Second International Scientific Conference - Scientific Developments in Physical and Sport Education, Faculty of Physical Education, University of Ermuk, Jordan.
11. Abdel Fattah, Abou El Ela Ahmed. (2000). Biology of Sports and Athlete Health, Dar Al Fikr Al Arabi, Cairo.
12. Abdel Fattah, Abou El Ela. (1997), Sports Training - Physiological Basis, Cairo: Dar Al Fikr Al Arabi, Egypt.
13. Othman, Mohammed Jassim. (2009). "Some Physical Measurements in the Event of Shot Put Using the Rotational Technique and Its Relation to Achievement for Beginner Students," Journal of Physical Education, University of Baghdad, vol. 21 (2): 344-362.
14. Anzi, Ahmed Muayad Hussein, the student Ali Zia Majid, and Dabbagh, Elsayed Mohammed Khaled Ahmed. (2012), "Percentage Of The Contribution Of Some Elements Of Fitness In The Achievement Level In Long Jump And Triple Jump Competitions Among The Students Of The Department Of Physical Education," Journal of Kirkuk University for Humanitarian Studies, Volume 7 (3): 1582- 1598.
15. Allala, Osama Kamel. (2000). "Relation Of The Fat Percentage And Its Variation On Some Physiological Variables Related To Physical Exertion Among Children", (unpublished PhD thesis), Faculty of Physical Education, University of Baghdad.
16. Al-hendi, Fayez Yahya Hussein. (2012). "Some physical measurements and their relation to some physical characteristics of handball players, Faculty of Physical Education," University of Sana'a, (44): 363-374.
17. Abu-Altaieb, M, Al-Sbabha, M, & Hatamleh, M. (2010). The Relationship among Types of Strength and Their Contribution in the Triple Jump among Students of Physical Education Faculty at the Hashemite University. Journal of Abhath-Al-Yarmouk (Humanities), 24(4), 859-872.
18. Arrese, A.L., & Ostariz, E.S. (2006). Skinfold thicknesses associated with distance running performance in highly trained runners. *Journal of Sports Sciences, 24*(1), 69-76.
19. Astrand, P. O. & Rodahl, K.(1986). Textbook Of Work Physiology, Mcgraw Hill, New York. Australia [J Sci Med Sport] Date of Electronic Publication, 9 (3): pp.249-55.8p.
20. Dhara, Santu & Chatterjee, Kallol.(2015). A Study of VO2 max in Relation with Body Mass Index (BMI) of Physical Education Students. Research Journal of Physical Education Sciences, 3(6): p9-12.
21. Fox, E. Bowers, R. & Foss, M. (1989). The Physiological Basis of Physical Education and Athletics. Champaign, Illinois: Human Kinetics Publishers.
22. Gursavek, S, Mishra, P.K.(2012). Relationship of Selected Anthropometric Measurements and Physical Variables to Performance in Triple Jump. Indian Journal of Movement Education and Exercises Sciences, 2 (2): p2249-6246.
23. Lamb, D. (1985). Physioloy Of Exercise: Responses an Adaptations, Macmillan, Publishers.
24. Maldonado, S., Mujika, I., & Padilla, S. (2002). Influence of body mass and height on the energy cost of running in highly trained middle- and long-distance runners. *International Journal of Sports Medicine, 23*(4), 268-272.
25. Mande, Sudhakara Babu. (2016). Comparative study on selected anthropometric variables among university men sprinters, throwers, jumpers and long distance runners, International Journal of Multidisciplinary Education and Research,Vol. 1, No (1): p15-19.
26. Parseh, Abed & Solhjoo, Mohammad. (2015). Studying the Relationship Between Body Mass Index With Speed, Agility And Balange In Male Students Of 15- 13 Years Old, *Indian Journal of Fundamental and Applied Life Sciences ISSN: Vol. 5 (S2), pp. 382-387.*
27. Prioreschi, A, Brage, S, Westgate, K, Norris, A & Micklesfield, K. (2017). Cardio respiratory fitness levels and associations with physical activity and body composition in young South African adults from Soweto. BMC Public Health, 17 (1): p2-8.
28. Sarma, Anantarup Sen.(2017). A comparative study of selected physiological variables between active and sedentary college students. International Journal of Physical Education, Sports and Health, 4 (2): p100- 102.
29. Singh, Lakha & Malik, Ashok Kumar.(2015). Selected anthropometric and physical fitness measures as predictors of performance in 400 meters track event. International Journal of Physical Education, Sports and Health, 1 (4): p70-72.
30. Wilmore. J, & Costill. D.(2004). Physiology Of Sport And Exercise. IL: Human Kinetics, Champaign, 3rd ed.
31. Zapartdis I, Vareltizis I, Gouvali M and Kororos P (2009). Physical fitness and anthropometric characteristics in different levels of young team handball players. *The Open Sport Sciences Journal* 2: 22- 28.
32. Zar, Abdossaleh, Gilani, Azadeh, Ebrahim1, Kh, Gorbani, M.h. (2008). A surey of the physical fitness of the male taekwondo athletes of the Iranian national team, Series: Physical Education and Sport Vol. 6, No 1, 2008, pp. 21 – 29.
33. Kirkendall B, Gruber J, Johnson R, (1987). Measurement and evaluation in physical education. 2nd Ed, Human kinetics publishers, Champaign, Illinois.
34. Abbas, Warda Ali. (2008). Predictive value of the kinetic capabilities in terms of some of the physical measurements on the junior tennis ground. (Unpublished MA Thesis), the University of Baghdad, Faculty of Physical Education for Girls.