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Contribution of Some Anthropometric Measurements and Pulmonary Volumes to the Numerical Achievement of 800-Meter Event Runners in Palestine

Loai Hanon[1], Hamed Salameh[2], Ali Qadoume[2], Motasem Aboalia[2], Khaled Qadoume[2], Riadh Khalifa[3]
[1]Ministry of education, Chinese secondary boys' school, Ramallah, Palestine.
[2]Faculty of Physical Education and Sport Sciences, Palestine Technical University- Kadoorie, Tulkarm State of Palestine.
[3] Higher Institute of Sport and Physical Education of Ksar Saïd, University of La Manouba, Tunis, Tunisia

Correspondence:
Ali Qadoume, Higher Institute of Sport and Physical Education of Ksar Saïd, University of La Manouba, Tunis, Tunisia
ali_qadoume2012@yahoo.com

Abstract: *The study aimed to identify the contribution of some anthropometric measurements and pulmonary volumes to the Numerical Achievement of runners in the 800-meter running event at Palestine. The study was conducted on a purposely designed sample of (17) runners in Palestine, aged between (18-22) years. The researchers used the descriptive analytical approach because it suits the nature of the study. Anthropometric measurements were performed related to (age, body mass, height, arm length, leg length, thigh length, lower leg length, instep length, chest circumference, chest circumference with inspiration, abdominal circumference, thigh circumference, Leg calf, upper arm circumference, and related Pulmonary volume measurements. Related Pulmonary volume measurements were performed (VC, FVC, FEV1, FWV1/ FVC%, MVV, TV, RV), and after the data was collected, it was processed statistically using SPSS. The results of the study showed that the anthropometric measurement that have the most contribution In the Numerical Achievement of 800 meters running event runners in Palestine was Height , which contributed to explaining (43.1 %) of the finishing time. The study also found that Pulmonary volume measurements contributed most to the Numerical Achievement For runners of the 800-meter running event in Palestine, was Vital Capacity (VC)which explained (39.1%) of the time Achievement.*
Researchers recommend that the predictive equations that have been developed should be used as predictors for the numerical achievement of the 800-meter running event.
Keywords: *Anthropometric measurements, Pulmonary volumes, Numerical achievement, runners, Vital capacity.*

INTRODUCTION

The 800-meter running competition is one of the middle-distance competitions that is closely linked to the endurance element, and that is why it is called (an endurance race), as the runner in this competition goes through four curved sections and four straights, so it is classified alongside the 400-meter running competition as one of the fiercest, most exciting and thrilling track competitions. This is indicated by the name given to them which "the killers of men or the graveyard of runners". The reason behind this name is the pain and fatigue that the runners of these competitions feel during the race resulting from the accumulation of large amounts of lactic acid because of the incomplete burning of glycogen, which is used as energy fuel in the race by the anaerobic system. Therefore, cyclic respiratory endurance, speed endurance , strength endurance, and performance endurance are considered the most important physical elements for success and achievement in this competition (Salama & Khalifa, 2018).

Achieving hi in this competition depends greatly on what the runners possess. From anthropometric and physiological specifications at the level of the heart muscle, Pulmonarys, nervous and muscular systems, in addition to height, leg length, and a muscular body free of fat (Salameh, 2018), as (Zar et al, 2008; Mande, 2016) to the importance these specifications are by saying that understanding the anthropometric, physical and physiological specifications for each sporting activity is an important and influential factor in sporting achievement, as each sporting activity has its own anthropometric, physical and physiological requirements that pave the way for the player who possesses these requirements to achieve achievement. He added (Gursavek & Mishra, 2012) that it is no less important than the technique used by an athlete in any game, and this requires attention to it by coaches and teachers when selecting players. Parseh & Hassan, 2015 also indicated that the medals obtained by Eastern European players In 1972, and in 1976, attention was paid to the anthropometric, physical, and physiological requirements when selecting talented athletes, according to the requirements of each game, and this was confirmed by many studies that dealt with study-

ing the relationship between anthropometric and physiological measurements with athletic achievement, such as the study (Salama & Khalifa, 2018), which It showed that abdominal circumference and instep length were the most contributing anthropometric measurements to the level of Numerical Achievement for the 800m running event, as they contributed to explaining (13.8%) of the completion time , and a study (Rathore, 2016 & Mishra) that found a significant relationship statistically between height, body mass, leg length, and thigh circumference with the 50-yard speed test, and a study (Singh & Malik, 2015) that showed a statistically significant relationship between height, leg length, shoulder circumference, hip circumference, shoulder diameter, and Elbow, thigh skin thickness, skin thickness of the biceps brachii muscle, 100-meter sprint completion, and a study (Singh & Malik, 2015) that showed a statistically significant relationship between height, leg length, shoulder circumference, hip circumference, shoulder diameter, and elbow diameter, The skin thickness of the thigh, the skin thickness of the biceps brachii muscle, the completion of a 400-meter run, and a study (Omelchenko et al, 2023), the results of which revealed a positive and direct relationship between height and body mass with measurements of pulmonary volumes related to (VT, FEV1, FVC, MV, ERV, IRV, VC, MVV) , and the study (Salameh et al, 2020) which showed that the Pulmonary volume measurements most capable of predicting physical efficiency were (FEV1 , FVC) , which respectively contributed to explaining (73.5, 78.3%) of the efficiency index. Physical fitness, a study (Mazic et al, 2014) showed that there was a statistically significant relationship between the (VC) measurement and players who played boxing and rugby. It also showed that there was a relationship between the (FVC) measurement and players who played Cycling, football, boating, as well as a relationship between measuring (FEV1) And boxing and water polo players, and a study (Yasuaki et al, 2006) which showed that high school football players in Yanazaki Prefecture in Japan are characterized by high levels of Pulmonary volume measurements related to (TLC, VC), and a study (Cheng et al, 2003) Which concluded that people who practice sports activities are characterized by high levels of pulmonary volume measurements (FVC, FEV1, FEV1/FVC%).

Given the importance of anthropometric measurements and pulmonary volumes among runners of the 800-meter running event , this study came as a practical scientific attempt by the researchers to determine the most contributing of these measurements to the Numerical Achievement of the 800-meter running, even in light of the unsatisfactory results achieved by a runner in competition at the national level from here it appears the study problem for the researchers.

METHODOLOGY

Researcher Wen The study was conducted on a purposive sample of (17) elite 800-meter runners in Palestine, and Table No. (1) shows the characteristics of the study sample.

Table 1. *Characteristics of the study sample (N = 17)*

Variables	Measuring unit	Minimum	Maximum	Mean	Standard deviation	Skewness coefficient
Age	Year	19.00	21.00	20.05	.820	-0.117
Body mass	Kg	60.00	74.00	66.20	4.68	.2030
Height	Cm	160.00	183.00	171.23	5.836	.3430

It is clear from the results of Table (1) that the values of the Skewness coefficient are between (± 3) and this indicates that the study sample is subject to the normal distribution.

Study procedures

- Anthropometric measurements were performed related to age, body mass, height, the lengths of (arm, leg, thigh, instep) and the circumferences of (chest, chest with inspiration, abdominal, thigh, calf, and upper arm) using a measuring tape.-Measurements of Pulmonary volumes (VC, FVC, FEV1, FWV1/FVC%, MVV, TV, RV, TLC) were performed using a spirometer.

- A Numerical Achievement measurement was conducted for the 800-meter running event on the track at Palestine Technical University- Kadoorie.

- The study was conducted in the time period 1-8/ 10-8-2023.

The following is an explanation of the study procedures:

***Anthropometric measurements**

First: height and body mass (body weight): To measure height, the researcher used a rectameter device, which is a stand installed vertically on a wooden edge, its length 250cm, the zero is at the level of the wooden base. There is also a stand installed horizontally on the stand so that it can be moved down and up.

The test subject stands on the wooden base with his back facing the stand so that it touches it at three points: the area between the two boards, the furthest point of the pelvis from the back, and the farthest point of the calves of the legs. Care must be taken to pull the body up and look forward, and the stand is lowered until it touches the upper edge of the skull so that the number facing the stand expresses the length. .

Second: The lengths of the limbs include:

•Arm Length: A measuring tape in centimeters is used to measure the arm from lateral edge of acromial process to the end of middle finger when it is straight.

•Leg length: The length of the lower limb is measured using a measuring tape from the greater trochanter of the upper head of the hip joint to the floor.

•Femoral length: Femoral length is measured using a tape measure from the greater trochanter of the superior head of the femur to the lateral edge of the middle of the knee.

•Leg Length: Leg length is measured using a measuring tape from the medial edge of the middle of the knee joint to the medial prominence of the heel.

•Instep length: The instep length is measured using a tape measure from the end of the heel bone to the tip of the big toe.

Third: The circumferences include:

•Chest circumference in the normal position: The chest circumference is taken at a level exactly above the nipple and the average circumference of the maximum inhalation and the minimum circumference during maximum exhalation are calculated.

•Chest circumference during inhalation: The chest circumference is taken as in the previous method, but after the tester takes the maximum breath (inhalation) and holds it until the chest circumference is read.

•Upper arm circumference during diastole: The largest circumference during contraction and relaxation.

•Abdominal circumference: the smallest circumference of the abdomen above the navel 2-3cm.

•Thigh circumference: The largest circumference of the thigh directly below the buttocks.

•Calf circumference: The largest circumference in the calf (Salama, 2018)

Pulmonary Function Measurements

The researchers used an electronic spirometer, type of Astra Touch, American made and manufactured by a company SDI Diagnostics. It is considered one of the modern and accurate devices that measures more than 40 measurements.

Measurement instructions and instructions:

- The measurements were carried out at 10-12 am, at a temperature of 27 degrees Celsius.
- Students who smoke and students who have respiratory diseases were excluded.
- Students were told to eat breakfast at least two hours before the test.
- The students were informed not to engage in any sporting activity before the measurement.

-Measurement Mechanism:

Measurements were performed according to the guidelines of the American Thoracic Society and the European Respiratory Society (ATS/ERS) according to the following steps:

was explained to all players before starting the measurement, with a sample performance for each test.

- Measurements were taken from a sitting position on a chair.

Close the nose with plastic forceps designated for this purpose.

- Players take tests with three attempts for each test, with the best one being recorded.
- (FVC, FEV1) were measured FEVI/FVC%) by the player taking the maximum inhalation and then following it with the maximum exhalation .
- VC was measured by the player breathing three times as a normal breath in the spirometer. On the fourth time,

the player took the maximum inhalation followed by the maximum exhalation, so we obtained measurements (ERV , IRV, SVC, TV) .

- (MVV) was measured by performing a breathing maneuver with the maximum possible inhalation and exhalation for (12) seconds (ATS, 2001) .

-The Numerical Achievement measurement for the 800-meter running event on the Olympic track was taken at Palestine Technical University –Kadoorie.

***Results**

Results related to the first study question, which states:

What are the most anthropometric measurements contribute to the Numerical Achievement of 800-meter event runners in Palestine?

To answer this question, firstly, the researchers found the values of the Pearson correlation coefficient between anthropometric measurements and the Numerical Achievement of 800-meter event runners in Palestine, and Table (2) shows that.

Table 2. *Pearson correlation coefficient between some anthropometric measurements the Numerical Achievement of 800-meter event runners in Palestine (N= 17)*

Anthropometric measurements	Measuring unit	mean	Standard deviation	R-value*
Age	Year	20.05	.820	0.195
Body Mass	Kg	66.20	4.68	-0.607
Height	Cm	171.23	5.836	*-0.657
Arm Length	Cm	73.53	3.18	-0.172
Leg Length	Cm	90.41	4.98	-0.383
Thigh Length	Cm	47.59	4.84	*-0.613
Lower Leg Length	Cm	42.88	2.47	0.373
Instep Length	Cm	26.65	1.58	0.126
Chest Circumference	Cm	84.41	4.43	-0.431
Chest Circumference With Inspiration	Cm	87.82	4.23	-0.352
Abdominal Circumference	Cm	74.24	4.18	0.066
Thigh Circumference	Cm	49.18	2.88	-0.294
Calf (Gastrocnemius) Muscle Circumference	Cm	34.71	2.64	-0.247
Upper Arm Circumference	Cm	28.47	2.62	0.215

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

From the results of Table (2), it is clear that there is no a statistically significant relationship at the level of significance ($\alpha \leq 0.05$) between some measurements of anthropometric related to measurements: (age, body mass, arm length, leg length, thigh length, lower leg length, instep length, abdominal circumference, upper arm circumference), and the Numerical Achievement of 800-meter event runners, while there is statistically significant relationship with height, thigh length. In order to determine the contribution of height, thigh length measurements, linear stepwise regression analysis was applied to identify the possibility of developing a predictive equation from some anthropometric measurements height, thigh length as an independent variables with the Numerical Achievement of 800-meter event runners as a dependent variable, and Table (3) shows this.

Table 3. *Results of a one-way analysis of variance to identify the regression coefficient for the predictive equation for Numerical Achievement for 800-meter event runners in Palestine (N=17)*

Model	Source of variance	Sum of Squares	df	Mean Square	F	Sig.	R^2
Height	Regression	0.066	1	0.066	11.383	*0.004	0.431
	Residual	0.087	15	0.006			
	Total	0.153	16				

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

It is clear from the results of Table (3) that anthropometric measurements contribute most In the numerical achievement for the 800 meter event runners , it was height where the value of (r^2) reached it has (0.431), and to identify the equation of the regression line, the t-test and the beta coefficient were used, and the results of table (4) show this.

Table 4. *Results of the t-test and the beta coefficient of the regression line equation for the contribution of some anthropometric measurements to the numerical achievement of 800-meter event runners (N=17).*

Model	Value	Standard Error	Beta	T	Sig.	R^2
Constant	4.149	0.560	-0.657	7.413	0.000*	0.431
Height	-0.011	0.003		-3.374	0.004*	

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

It is clear from the results of Table No. (4) that the value of (t) was statistically significant at the significance level ($\alpha \leq 0.0\ 5$), where the measurement contributed Height In interpreting (43.1)% of the numerical achievement of the 800-meter event runners , the proposed equation becomes as follows:

Numerical Achievement for running 800 meters = 4.149 - ((Height (cm) × 0.011))

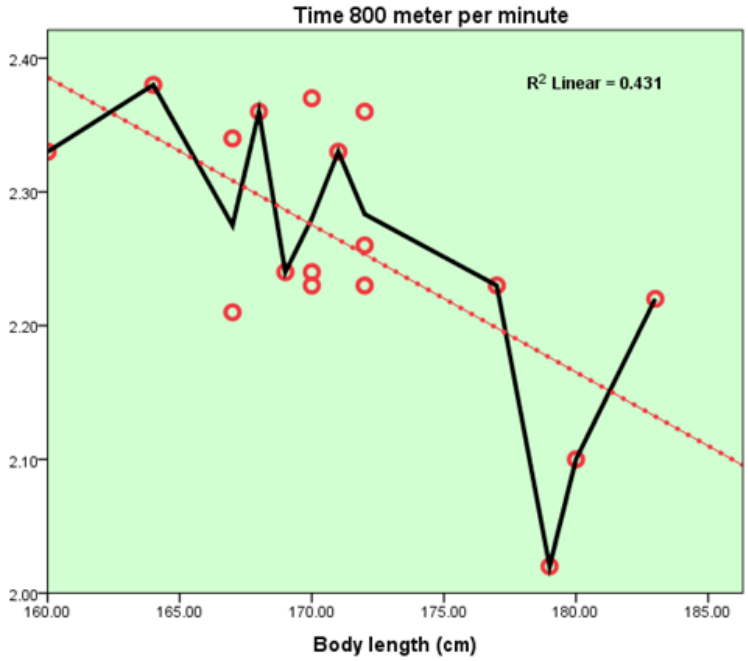

Figure 1. *Height measurement as a predictive in the numerical achievement for the 800 meter event runners*

***Results related to the second study question, which states:**

What are the most Pulmonary volume measurements contribute to the numerical achievement of 800-meter event runners in Palestine?

To answer this question, firstly, the researchers found the values of the Pearson correlation coefficient between pulmonary volume measurements and the numerical achievement of 800-meter event runners in Palestine, and Table (5) shows that.

Table 5. *Pearson correlation coefficient between pulmonary volume measurements and the numerical achievement of 800-meter event runners (N= 17)*

Pulmonary volumes measurements	Measuring unit	Mean	Standard deviation	R-value*
VC	L / min	4.36	0.48	*-0.625
FVC	L / sec	4.22	0.46	*-0.555
FEV1	L / min	4.06	0.46	*0.288
FEV1/FVC%	%	95.52	4.70	0.429
MVV	L / min	164.38	18.92	0.168
TV	L / min	1.45	0.59	0.007
IRV	L / min	1.50	0.46	-0.276
ERV	L / min	1.49	0.65	-0.299
IC	L / min	3.20	0.62	-0.245
RV	L / min	1.06	.110	*-0.496

** Significance level (α ≤ 0.05)*

From the results of Table (5), it is clear that there is no a statistically significant relationship at the level of significance (α ≤ 0.05) between measurements of pulmonary volumes related to measurements: (FWV1/FVC%, MVV, TV, IRV, IC, ERV) and the numerical achievement of 800-meter event runners, while there is statistically significant relationship with (VC, FVC, FEV1, RV) and the numerical achievement of 800-meter event runners. In order to determine the contribution of (VC, FVC, FEV1, RV) measurements, linear stepwise regression analysis was applied to identify the possibility of developing a predictive equation from some Pulmonary volumes measurements (VC, FVC, FEV1, RV) as an independent variables with the numerical achievement of 800-meter event runners as a dependent variable, and Table (6) shows this.

Table 6. *Results of one-way analysis of variance to identify the regression coefficient for the predictive equation for Numerical Achievement for 800-meter event runners in*

Model	Source of variance	Sum of Squares	df	Mean Square	F	Sig.	R^2
VC	Regression	0.060	1	0.060	9.632	*0.007	0.391
	Residual	0.093	15	0.006			
	Total	0.153	16				

**Significance level (α ≤ 0.05)*

It is clear from the results of Table (6) that Pulmonary volume measurements contribute most In the Numerical Achievement of runners in the 800-meter running event in Palestine She was VC The value of (R^2) reached (0.391), and to identify the equation of the regression line, the t-test and the beta coefficient were used, and the results of table (7) show this.

Table 7. *Results of the t-test and the beta coefficient of the regression line equation for the contribution of some Pulmonary volume measurements to the Numerical Achievement of 800-meter event runners (n=17)*

Model	Value	Standard Error	Beta	T	Sig.	R^2
Constant	2.819	0.181	-0.625	15.615	0.000*	0.391
VC	-0.128	0.041		-3.10	0.007*	

**Significance level (α ≤ 0.05)*

It is clear from the results of Table No. (5) that the value of (t) was statistically significant at the significance level (α ≤ 0.05), where the measurement contributed VC explains (39.1)% of the Numerical Achievement of runners in the 800-meter running event , and therefore the proposed equation becomes as follows:

Numerical Achievement for running 800 meters = 2.819 - ((VC (unit of measurement) × 0.12))

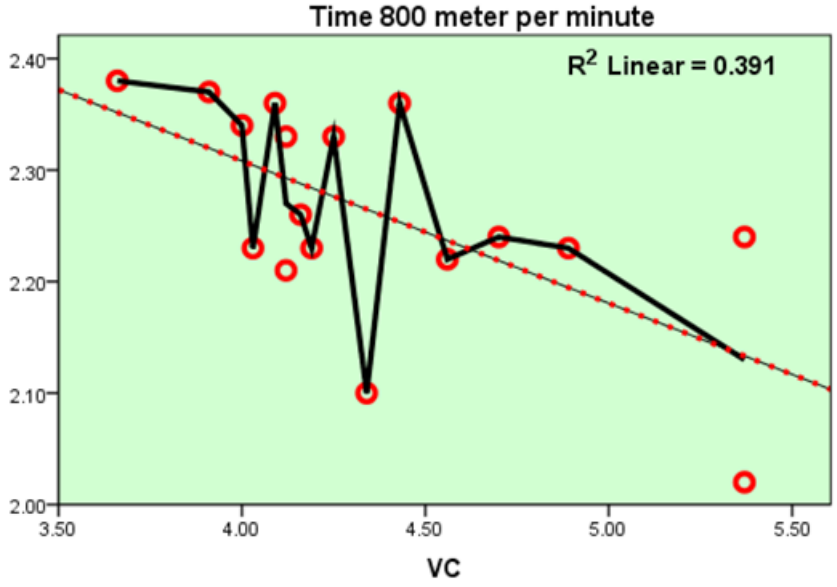

Figure 2. *VC measurement as a predictive in the Numerical Achievement of running 800 meters*

DISCUSSION OF THE RESULTS

Discussing the results related to the first question:

It is clear from the results of Tables (2-4) that anthropometric measurements have the most contribution The Numerical Achievement for the 800-meter running competition among elite runners in Palestine was Height It contributed to explaining (43.1%) of the numerical achievement of runners in the 800-meter running event in Palestine. This result is consistent with the study (Sekarbabu et al, 2021), which showed that height contributed to explaining (31%) of the completion time of the 800-meter competition, and a study (Salameh, 2017), which found that height contributed to explaining (46.3%) of the performance distance in javelin throwing, and the study (Ali and Nasser, 2016), which proved that height contributed to explaining (35%) of the numerical achievement of my test. The broad and vertical jump from stability, among basketball players, and the study of Hanoun (2016) which proved that height was one of the most important anthropometric measurements for predicting the Numerical Achievement of some athletics events, as it contributed to explaining (49%) of the high jump completion distance, (49.2%) of the distance for completing the long jump, and (18.9%) the time for completing the 100-meter sprint, and the study (Rathore, 2016 & Mishra) which showed that height is one of the most important anthropometric measurements related to speed, as well as the study of Singh & Malik (2015) which proved the existence of a positive relationship between height and Numerical Achievement in the effectiveness of the 100-meter sprint, and the researchers attribute this to the distinction of the tall athlete. Step length during fast running, as step length is one of kinematic variables that

plays an important role in running speed and thus finishing the race distance in a small number of steps compared to short stature. Also, the muscular strength of the legs increases as their length increases, thus increasing the length and breadth of the step, and this is what was confirmed. It contains the results of a study (Pourrahim et al, 2021), which found that there is a significant and positive relationship between leg length with the time of running 400 meters, 800 meters, 1500 meters, and a test of the muscular strength of the legs.

Results related to the second study question, which states:

It is clear from the results of Tables (5-7) that Pulmonary volume measurements that contribute most in the Numerical Achievement of the runners of the 800-meter running event in Palestine was Vital Capacity (VC) , which contributed to the interpretation of (39.1%) of the Numerical Achievement of runners in the 800-meter running event in Palestine. The researcher attributes this to the importance of the Vital Capacity (VC)for 800-meter runners because it reflects the true adaptation that has occurred in Pulmonary efficiency and volume as a result of regular training, and improving this measurement means improving the rest of the Pulmonary volume measurements associated with it, which are (ERV, IRV, SVC, TV, ERV, IRV, TV, ERV, IRV, TV, FEV1, FVC, FEVI/FVC) which is obtained by the player breathing three times normally in a spirometer , and on the fourth time taking the maximum inhalation followed by the maximum exhalation. Vital Capacity (VC) measurement is one of the measurements that is very closely related to training. Endurance, and in view of the importance of this physical element for 800 meter event runners, this contribution appeared, as he pointed out as (Salama, 2018) pointed out that the nature of the physical requirements for the 800 meter running event are closely related to the endurance element, and that is why they are called (endurance races), and cyclic respiratory endurance is considered, Endurance and speed, and speed is the most important of these elements for players, so this type of activity depends on the aerobic and anaerobic energy production system, and with a slightly greater percentage on the anaerobic system (lactic acid system), as (Mohamed , 2015) indicated that the approximate percentage of the contribution of energy sources The aerobic and anaerobic components in the 800 meter running event are approximately (60 %) anaerobic, and approximately (4.0 %) aerobic, and this develops the strength and efficiency of the breathing muscles (the diaphragm muscle, the intercostal muscles, the external intercostal muscle, the sternocleidomastoid muscle, and the spinal cord). Which increases the flexibility and expansion of the rib cage during the breathing process, and this allows for better performance of respiratory processes in runners during physical exertion. The density of the surrounding blood capillaries in the alveoli of the lungs also increases as a result of the opening of a number of closed or dormant capillaries or the generation of new capillaries under the influence of Continuous repetitions of performing physical effort, and this leads to an increase in the surface area over which gases are exchanged between the capillaries and pulmonary alveoli, not to mention an increase in the elasticity of the lungs and their ability to expand and contract to perform strong and deep breathing movements, and thus the efficiency of Pulmonary volumes, both static and dynamic, is improved, the most important of which is measuring vital capacity (VC). Which is considered one of the most important functional indicators of lungs and thus an increase in the volume of inspiratory reserve over expiratory reserve in runners because of speed endurance training. In general, the results of the current study were consistent with the studies of (Ja'afar et al, 2023 ; Nehe et al, 2023; Megahed et al, 2023; Abu Seman et al, 2022; Drobnicc et al, 2021; Salameh et al, 2020; Kocahan et al, 2017; Akhade & Muniyappanavar, 2017; Akhade, V., Bhatt et al, 2015; & Muniyappanavar, 2014) which proved three basic and established facts, which are that Pulmonary volume measurements are positively affected by Height and mass, age, and practicing sports activities and competitions that require an element of respiratory cyclic endurance, speed endurance, force endurance, and performance endurance, such as middle- and long-distance running, and football. Basketball, handball, rowing, swimming, boxing, and snowboarding.

Conclusion

It is clear from the results of the study that anthropometric measurements, as well as pulmonary volume, can be used to predict measurements of achievement in the 800-meter running competition.

Conflict Of Interest

No potential conflict of interest relevant to this article was re reported.

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