Anthropometric Measurements and their Relation to Physical Fitness among Middle School Students Males (11-15) Years Old -A Field Study in Some Middle Schools of Constantine-

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Abstract:

Objectives: This study aims to identify the relationship between some anthropometric measurements and physical fitness, and to create a reference database for VO2max at the age of (11-15) years among male middle school students.

Methodology: The study included 249 students who were divided into 5 age groups (11-12-13-14-15) years. A set of anthropometric measurements were taken (weight, height, skin folds, body fat percentage, and fat-free weight). The students also completed a progressive and maximum test according to the "Leger 1982" method for indirect measurement of VO2max.

Results: The results of this study showed a positive significant relationship between age and each of (weight, height, body fat percentage), on the one hand, and an inverse significant relationship between age and fat-free weight (P<0.05) on the other hand.

The results: for maximum oxygen consumption also showed that the values of the latter were low compared to the results of scientific studies and references, with an inverse significant correlation between age and VO2max (P<0.01). The results also revealed an inverse significant correlation between VO2max and body fat percentage (P<0.01), and a direct correlation between VO2max and fat-free weight (P<0.01).

Keywords: anthropometric measurements, physiological measurements, physical fitness, VO2max, adolescence.

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1-The problematic introduction:

Anthropometric measurements are among the most important indicators that are used to predict the physical, health, functional, and psychological state of an individual. Specialists in the sports field attach great importance to anthropometric measurements when selecting beginner athletes. They are used to identify the general and specific training status of the athlete by conducting a set of motor tests. In addition to studying the functional capabilities of the various body systems, while determining the psychological, physical, skill and health capabilities, In addition to knowing the development in sports results and following them to reach the highest levels, it is also used in the process of selecting young people and directing them towards sports specialization. Physical measurements depend mainly on calculating the amounts of external body structures. (Belkacem, 2020, p. 32)

There are many studies that have shown the importance of physical measurements in the sports field. According to (Radwan 1998), the individual's physical composition is considered one of the most important indicators that reveal the health condition and physical fitness of the individual, and (Miloslav 2000) believes that there is a correlation between physical measurements And the effectiveness of physical and skill performance according to the type of sport (Najeh, 2014)

Matthews believes that anthropometric measurements are considered one of the basic components of the concept of physical fitness, as well as health and psychological fitness, physiological functions, or the body's efficiency to perform skills. Edward Hitchcock is considered the first to be interested in anthropometric measurements in physical education and pointed out their importance in predicting abilities and skills. Movement, as Moorhouse and Miller confirm, is that an individual's fitness for various sporting activities is determined by the suitability of his body composition to perform the required work.

Physical fitness is considered the individual's ability to acquire the ability to perform various physical activities, and this depends mainly on his cardiac and respiratory capabilities in the event of effort, which can be determined by measuring the amount of maximum oxygen consumption (VO2max) during sports practice (Dietz, 1996, p. 89), the latter. It is one of the most important indicators approved for measuring physical fitness, and it is one of the most widely used measurements in physical exertion physiology laboratories. Given the importance of this indicator in expressing the fitness of the body's systems: circulatory, respiratory and muscular in the recent widespread use of measurement technology, it is considered among the regular tests used to evaluate the general physiological fitness of people (Sayed, 2008, p. 217), and is translated as the best standard. To measure the functional limits of the cardiorespiratory system (Brocquet, 2002, p. 16), as both Rayan and Alman indicate that knowing VO2max can give an indication of the functional status of the circulatory and respiratory systems, and it not only clarifies the presence or absence of deficiency, but also shows its location and causes. It indicates the individual's suitability and ability to train (Thuraya, 2001, p. 28).

Both Matthews Sming and Warren agree that there is a definite relationship between body image and physical fitness.

Therefore, as part of our study, we pose the following questions:

- Is there a relationship between some anthropometric measurements and physical fitness in the age group (11-15) years among male middle school students?

- Is there a relationship between age and each of the physiological and anthropometric measurements under study?

- Does developing a database of reference values for VO2max help predict athletic performance capabilities and maintain the health of individuals?

2. Hypotheses: We put forward three hypotheses, which state:

- There is a relationship between some anthropometric measurements and VO2max in the age group (11-15) years, males.

- There is a relationship between age and both physiological and anthropometric measurements in the age group (11-15) years.

The age stage (11-15) years is considered an important stage for establishing reference values for VO2max to guide middle school students.

3-Methodological procedures followed in the study:

3-1- Exploratory study:

(55) middle school students in the city of El-Kharroub underwent an exploratory study, the aim of which was to identify the method of work and the suitability of the devices used in the experiment, and also to identify the difficulties facing the researcher in his basic work.

3-2-Basic study:

3-2-1- Research methodology: We relied on the descriptive approach due to its suitability and the nature of our research.

3-2-2-Study population and sample: The research population consisted of (2499) male students whose ages ranged between (11-15) years, distributed among 12 middle schools in the city of Al-Kharroub for the 2016/2017 academic season. The study sample amounted to (249) students, then They were selected randomly from each academic level, and the following table shows this:

Table No. (01) Distribution of students in the research sample by age.

Age(years)	Native community	Sample size
11	520	52
12	542	54
13	554	55
14	412	41
15	471	47
the total	2499	249

3-2-3-Research areas:

3-2-3-1- Spatial field: We conducted a field study in the Carob Mediterranean area, which is located south of Constantine Province.

3-2-3-1 The human field: The members of the selected sample include male students (11-15) years old who are studying in Constantine middle schools.

3-2-3-2- Temporal scope: This study took us from the beginning of the 2016 academic season until March 2017.

3-2-4- Research methods and means:

3-2-4-1-Bibliographic analysis method: It consisted of collecting various data and information from various scientific references, publications and encyclopedias related to the subject of our study, so that it would be a support and support for us to analyze and discuss the results.

3-2-4-2-Anthropometric measurements: We used the method of measuring morphological characteristics in order to obtain:

- Height (cm) using the height scale listed in centimeters (cm)

- Weight (kg) medical scale, type HB.LO5.

- Skin folds to calculate fat-free weight (kg) and body fat percentage (%). We had to measure four skin folds using callipers to measure the skin folds (Type lange), which are: the biceps muscle (in front of the humerus), the triceps muscle (Behind the humerus), above the pelvis, and below the scapula, according to the method of "Dernen, 1974". The results obtained from the measurement process are added to the age and weight and transferred to the computer for processing according to the body density (DC) equations of "Demin", "Warsley", and "Lohman" to calculate the proportions of adipose tissue (Lohman, vol 1, 1989, p .30), Taking into account a set of principles, the thickness of the skin fold on the right side of the body is measured so that the ends of the device are placed 90° vertically to the longitudinal axis of the mark (the skin surface), and at a distance of 1 cm away from the two fingers (thumb and index finger) (Maton, 2008, p. 2)

3-2-4-3-Field tests used:

- Measuring maximum oxygen consumption (VO2max): Then measuring (VO2max) using the multi-stage shuttle running test, which was completed by Leger and his partners in 1982 AD, at the Department of Physical Education and Sports at the University of Montreal in Canada. This test has a degree of reliability, validity and objectivity (Gerbeaux, Lensel, Brandy, Dierkens, & Jacquet, 1991, pp. 19-26), with a correlation degree of t =0.84(Leger,

Mercier, Gadoury, & Lambert, 1988, p. 93), this correlation ranges between 0.7 (for 188 children) and 0.9 (for 77 adults), and has become valid for everyone (Cazorla, 2013).

* Description of the test: "20 m" multi-stage shuttle running test: It is a field test conducted in closed halls and flat fields, and is considered a good measure for estimating vo2max. Its procedures are summarized in running at a gradually increasing speed between two points, separated by a distance of 20 meters, and the rhythm of the running speed is adjusted through a recording tape that emits a short tone sound.

3-2-4-4- Statistical analysis method: Then use Microsoft Office Excel 2013 to calculate the arithmetic mean, standard deviation, least significant difference (LSD) test, and relationship test.

4- Display and analyze the results:

4-1-Finding the relationship between age and each of the anthropometric variables and Vo2max:

Table No. (02) The relationship between age, some anthropometric variables, and Vo2max.

	Vo_{2max}	Fat-free weight	Body fat percentage	Under the shoulder blade	Above the iliac prominence	Triceps muscle	Biceps muscle	The weight	The length
age	0.283** -	* -0.177	*0.184	0.118	0.127	0.105	-0.008	**0.687	**0.822

** The correlation is significant at an error rate of 0.01 * The correlation is significant at an error rate of 0.05

It is clear to us from Table No. (04) regarding the relationship between anthropometric variables and age that the following correlation coefficients (0.184, - 0.177) for age with both (body fat percentage and fat-free weight) are significant correlations with an error rate of 0.05. As well as the correlation coefficient for age with height, weight, and adult, respectively (0.822, 0.687), there are significant correlations with an error rate of 0.01, and this indicates the presence of a direct significant correlation between both age and (height, weight, and body fat percentage), as well as the presence of An inverse significant correlation between age and fat-free body weight.

While the following age-specific correlations with (the skinfold of the biceps muscle, the triceps muscle, the skinfold above the iliac prominence and under the scapula), which are respectively: (-0.008, 0.105, 0.127, 0.118), are insignificant correlations.

It also appears to us that there is an inverse significant correlation with an error rate of 0.01 between age and Vo2max. As age increases, Vo2max decreases.

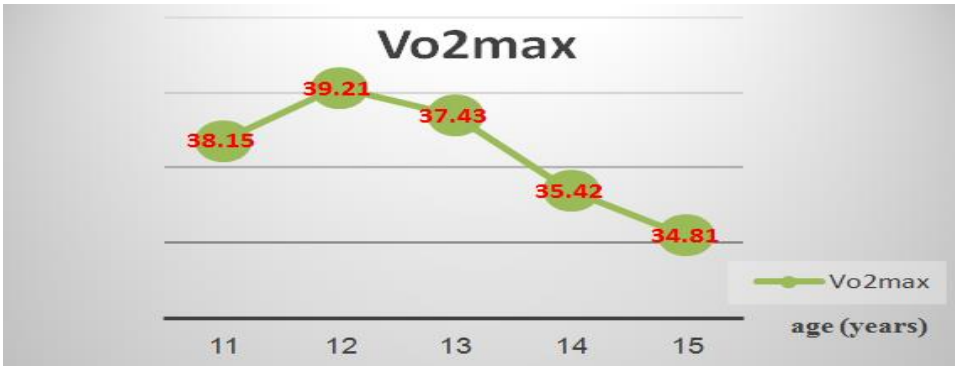

Figure No. (01): shows the development of Vo2max according to the age group (11-15) years

4-3- Finding the relationship between $VO2_{MAX}$ and each of the following (age, height, weight, body fat percentage, and fat-free weight)

Table No. (03): The relationship between $VO2_{MAX}$ and each of (age, height, weight, body fat percentage, and fat-free weight)

	Fat-free weight	Body fat percentage	The weight	The length
VO_{2MAX}	** 0.296	** -0.296	** -0.227	-0.098

** The correlation is significant at an error rate of 0.01 * The correlation is significant at an error rate of 0.05

It is clear to us from Table No. (05) that the following correlation coefficients (-0.227, -0.296, 0296) for VO_{2max} with each of (weight, body fat percentage, fat-free weight) are significant correlations with an error rate of 0.01. , which are inverse correlations between VO_{2max} and each of (weight, body fat percentage), while the correlation is directly significant between VO_{2max} and fat-free weight, while there is no significant correlation between VO_{2max} and height. Therefore, whenever VO_{2max} increases, age, weight, and body fat percentage decrease with it, and vice versa, while whenever VO_{2max} increases, fat-free weight increases with it.

5- Discussing the results:

The results of Table No. (02) regarding the relationship between anthropometric variables and age showed that there is a positive, significant correlation between age and (height, weight, and body fat percentage), where every increase in age corresponds to an increase in height, weight, and body fat percentage. This is due to the period of physical growth that corresponds to the stage of sexual puberty and the beginning of early adolescence, which is usually between (11-13) years for females, and (13-15) years for males (Vialle, 2013), where the speed of growth reaches its peak, with the beginning of puberty. The body is witnessing a rapid and significant surge in growth, as a surge in height occurs with an annual increase of up to 5.5 cm (Dimeglio & Bonnel, 2012), and an increase in weight of up to 9.5 kg annually (Weineck, 1998, p. 308).

The results also showed an increase in the percentage of fat as the members of our study sample advanced in age, in contrast to fat-free weight, which decreases as age increases. It is known that the percentage of body fat in males, unlike females, begins to decrease, similar to fat-free weight,

which witnesses An increase starting from puberty, and this is due to the appearance of the sex hormones estrogen in females and testosterone in males. The latter stops being secreted at birth and is secreted again starting at puberty, and is a reason for an increase in muscle mass in the body and a decrease in fat percentage (Goussard, 1998, p. 12)

It is also clear to us from Figure No. (01) that the Vo2max values for the age group (11-15) years reached, respectively: (38.15, 39.21, 37.43, 35.42, 34.81) mm/kg.d., with the largest value occurring at the age of 12 years and after. The rate of VO2max witnessed a decrease until it reached 34.81 mm/kg.d. The results of Table No. (02) showed that there is an inverse significant correlation between both age and Vo2max. As age increases, Vo2max decreases, and this is consistent with the study of “Bailey, 1973.” "Anderson, 1974" and "Lavelle and Shepherd, 1977", where the results of these studies showed a slight decrease in (Vo2max) starting from the age of 9 years, and this decrease is more concentrated between the ages of (12) and (15) years (Falgairette G. (2013, pp. 12-16).

The values for the results of Vo2max in our study according to the classification of “McArdle-Katsen, 2000” are considered weak (Muhammad, Part 2, 2002, pp. 35-69), and the relative decrease in VO2max may be related to the increase in body fat, which was offset by a decrease in fat-free weight, and this is what Shown in Table No. (03), which showed the existence of an inverse correlation between VO2max and the percentage of fat in the body, as well as the existence of a direct correlation between VO2max and fat-free weight. As the percentage of fat increases, VO2max decreases, and as fat-free weight increases, VO2max increases, and this is consistent with Study by “Ahmed Nasr El-Din Sayed et al., 1996”, where the researchers concluded that there is a negative correlation between body fat weight and aerobic capacity as estimated by relative Vo2max (Tantawi, 2005, p. 44). Lack of physical activity leads to an increase in the percentage of body fat (Halimi, 2005, p. 12), This was confirmed by a study (Al-Rukban, 2005), which concluded that the lack of regular motor activity led to a high rate of weight and obesity among students (Abdel Fattah and Hassanein, , 1997, pages 325), in addition to a study (Al-Sayed, 2001), Which aimed to know the effect of continuous physical training on muscle weight in the body, through which the researcher came to know that there is a positive, positive relationship between continuous physical training and burning fat in the body, and thus a decrease in fat weight is offset by an increase in muscle weight (Azab, , 2009, page 235). Also among the factors that may lead to an increase in the percentage of body fat is children’s addiction to playing computers and sitting for hours in front of television screens.

Most research indicates that computer games and watching television are among the most common causes of lack of physical activity among children, which leads to increased body fat and obesity (Ibrahim, Physical Fitness... Health Methods and Sports Championships, 1st edition, 2004, p. 279).

6- Conclusions: Through the results of anthropometric and physiological measurements, we reached:

- There is a significant relationship between age and body length, weight, and body fat percentage.

- There is an inverse relationship between age and VO2max.

- There is an inversely significant relationship between age and fat-free weight.

- There is an inverse relationship between VO2max and height, weight, and body fat percentage.

- There is a positive correlation between VO2max and fat-free weight.

The maximum relative oxygen consumption is affected by fat mass. The higher the percentage of fat, the lower the VO2max.

7- Conclusion:

The results allowed us to identify the relationship between some anthropometric measurements and physical fitness, as the researcher concluded that weight gain leads to a decrease in VO2max and thus a decrease in the individual's physical fitness, as the greater the percentage of body fat, the lower the level of performance. The results also allowed us to create a reference database. For the VO2max of our study, which was as follows: (11 years old – 38.15 mm/kg.d), (12 years old – 39.21 mm/kg.d), (13 years old – 37.43 mm/kg.d), (14 years old – 35.42 mm /kg.d), (15 years - 34.81 mm/kg.d), with an average of 37 mm/kg.d. These results were much lower than the values mentioned in previous references and studies, which ranged between 40 and 65 mm/kg.d. . (Falgairette G., 2016, pp. 12-16)

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