Original Article

The Change Curve in Body Composition of Female Different Classes in Palestine School

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ABSTRACT

The purpose of this study was to investigate the change in body composition of female different classes in Palestinian school through determine (HT) height, weight (WT), fat, lean body weight LBW), the sample consist of all female different classes (180) students. We use anthropometric measurement to determine (Wt, kg), (Ht,m), muscle, fat, BMI=wt/(ht)2m. The researcher began to process the data through statistical packages for social sciences (SPSS) and achieved to the result through the research hypothesis.The result showed that the average of fat mass according to the places measurement (13.4, 15.7, 24.8,20.9, 14.9)mm,the average of weight, tall, weight of muscle and BMI in certain group (24.64,1.44,43,19.5) and this study showed there were appositive relative between the variables.

Keywords: Change curve, body composition, palestine school

INTRODUCTION

Anthropometric measurements have special position, especially in the field of sports, as where they provide knowledge of potential growth characteristics appearing in children in every stage of their age, with a note that there is a disparity in growth among children in the same stage, and so this contributes to the sport selection process. In all games, height and body mass play a key role in the performance of players, for example, arm length and height when the player has a decisive advantage and uncertain of success in some games (Thirumagal. A, 2013). In addition, (Haree, 1982) refers that the height is one of the basic requirements for success in a lot of sports and of basic

measurements at sport selection as identifying the body mass and height at different ages is one of the indicators that reflect the growth condition of individuals. Kahribt (1997) also refers to knowledge of stages of growth in children and physical changes help the coach to know the beginning of training for the open proposed activity.

Preservation of the child's body during early stages of growth is an important factor to protect him from obesity, due to the increase from birth until the age of 16 years old to be in the number of fat cells and their size, and then the increase becomes in the volume of fats. Moreover, (De Lorenzo, et al, 1999) refer that the increase is usually quick, especially in adolescence where fats percentage increases up to (15 – 20%). Bushirk, 1986) also refers to the importance of body composition to assist in classification of individuals and the study of individual differences between the sexes. He described growth, maturity, adulthood and old age in terms of being a natural or unnatural, as the necessary fat percentage for females is not less than 8% and the good one for sport performance is (12-22%), while the healthy accepted fat content is (18-30%), but

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the unacceptable increase is the one more than (30%), with people who are described as fat (Wilmore, 1986).

In terms of Body Mass Index (BMI), it is a well-known method to classify individuals. It is defined as body mass in kilograms (kg) divided by square height in meters (m) (Ravussin & Swinburn, 1992). Global rating, as indicated by (Anon, 1998) about classification of individuals is as follows: from 18.5 kg/m² is less than normal and weight is Ranked "Slim", from 18.5 to 24.9 kg/m² is Ranked "normal", 25 - 29.9 kg/m² is ranked "fact" and from 0.30 kg/m² or more longer is ranked "obese". It should be noted in this regard that these rating standards differ from one society to another due to nutrition, climate, nature of the work and genetics. In addition, knowledge of BMI is crucial from medical point of view in terms of the study of growth in children, the relationship of obesity with the activity exercised by the individual and the length of time for that activity (Maria, et al, 2006), besides its importance in guiding the child nutrition (Colic & Satalic, 2002).

Regarding percentage of fats and muscle mass, (Behnke) noted that there are two major components of body composition (body position) depending on the formation of the body: fats (Fat) and muscles (Lean body weight) (LBW) by (Wilmore & Costill, 1994). Moreover, (Brooks & Fahey, 1984) added that (LBW) refers to skeleton, water, muscles, connective tissues and organs. Since muscles are the main component, it is used to denote them. It is worth mentioning that the majority of studies used the term (FFM) (Fat Free Mass) instead of (LBW). The studies also rely in determining fat content on measurement of BD (Body Density) and then determine the percentage of fats in accordance with the (Siri) equation (Fox etal, 1989). In case of access to lipids ratio, fats body mass can be reached by multiplying the percentage by body mass and thus (LBW) can be obtained by body mass minus the fat mass (McArdle, Katch & Katch, 1981).

In relation to previous studies that has shown interest in knowing physical configuration, the study by Abdul Haq (2007) aimed to identify the contribution of some physical and anthropometric measurements in the level of performing the skill of jumping in extension and contraction for young gymnasts on a sample of 30 young athletes. Results of the study showed that anthropometric measurements play an important role in determining the level of performance skills to jump in extension and contraction, and a better relationship was for abdominal circumference.

Abdul Haq (2005) conducted a study, which aimed to identify some of the anthropometric characteristics (physical measurements in terms of lengths, circumference, symptoms and thickness of fat folds) for students at primary fourth and fifth grades in the schools of Nablus, in addition to knowledge of the differences in these measurements to the variable gender, class, the study sample consisted of 300 students from basic school students in the schools of Nablus. The study results showed that there is no statistically significant differences at level = (a = 0.05) between males and females (9-10) years in the variable of height and body mass, while the differences in favor of males in length and body mass, whereas differences were significant in favor of males in foot length, forearm and shoulder lengths, and differences were in favor of females in thigh and torso length. Results of the study also showed that there are significant differences in favor of females in the circumference of upper arm and thigh, while were not statistically differences among males and females in the vicinity of the forearm and symptoms of shoulders and thighs, wrist, ankle and elbow.

As for Mandur study (1997), which aimed to determine the anthropometric and physiological characteristics of primary school students (9-10 years) in Alexandria, the study was conducted on (3374) students from basic fourth and fifth grades. The researcher used the descriptive approach and results of the study showed distinction of boys over girls in the lengths of thigh, torso, upper arm, forearm and foot, while girls outperformed in the length of forearm and leg, as results showed superiority of girls over boys in the length of the overall height of the body, body mass at the level of the fourth grade, and the superiority of girls over boys in all measurements of the thickness of the fat and skin.

In Johnson's study, conveyed by (Melina & et al, 1991), which aimed to determine the anthropometric characteristics of Americans students at stage (9-10 years), where results of the study showed that the average leg of American girl is (26) cm and 27 cm for these stage, reached upper arm circumference (24.68 cm), (26.28 cm) for the same period and the average thickness of the folds of fat of the abdomen (11.69) mm.

In Lilia study (Lilia et al, 2001), which aimed to perform a set of anthropometric measurements on the basic school students in Mexico between ages (6-11) years, where he conducted (150) physical measurement on a sample of (4758) students. Results of the study were compared with American and Cuban students, and the results showed that there were no statistically significant differences between males and females in this age, but there are differences in some variables such as circumference (thigh) and some measurements of skin folds.

Problem of the Study

The concern for the individual and the study of manifestations of his growth characteristics at every stage is a positive indicator for the progress of any society and its development as different growth stages are connected to each other. They are the stages of formation where individual physical, mental, social and emotional growth is made, but at different rates and therefore profoundly affect future life of the individual. The current study is unique in the study of variables (body mass, height, the average thickness of fat, muscle, and body mass index), so that is a new study in Palestine with regard to the physical structure of each stage of education, the occurrence of developments and leaps of quality of these variables at any particular stage. Hence, problem of the study emerged for researchers in order to reach a real figures based on simple measurements and achieve a high degree of validity and reliability, which in turn will contribute to selection of sports and players choose the process to upgrade athletic levels to benefit from them in the future with the physical education teachers and coaches of different games and researchers as well.

Questions of the study

This study sought to answer the following questions:
1. What is the change curve in body composition for female students in educational grades (1 – 12) in Palestinian schools?
2. What is the relationship between height, weight, percentage of fat, muscle mass and body mass index for each stage of the educational grades (1-12) in the Palestinian schools?

Objectives of the Study

This study aimed to find out the change curve in body composition among female students in educational grades (1-12) in Palestinian schools, and to identify the relationship between heights, body mass, percentage of fat mass, muscle variables, body mass index for each stage of the educational grades mentioned.

METHODOLOGY & PROCEDURES

Methodology

The researcher used the descriptive method with one of correlation forms as appropriate to purposes of the study.

Population of the Study

Population of the study consists of about (7000) female students from various educational grades in governmental schools according to the census of Directorate of Education in Selvit governorate in the first term for the year 2016 – 2017.

Sample of the Study

The study was conducted on female students in governmental schools in Selvit governorate (180 students). The sample was selected randomly in (15) female students from various educational grades starting from the first primary year until the 12th grade (guidance). Table 1 shows a description of sample of the study according to the variables of height (m) and body mass (kg).

Tools of the Study and Practical Procedures of Measurement

In order to collect data, the following tools and procedures are used:

First, data collection form, which included the following information for members of the sample (name, age, and weight), and the balance was used in order to determine the weight of students without wearing shoes.

Length was also measured by meters by fixing the meter on the wall and the length of the student is measured, a piece of cardboard is fixed overhead with taking the measurement (by meter) without wearing shoes and looking forward with feet close to each other.

Second: (Skin fold): was used to take measurements of thickness of skin folds and to determine the average thickness of the fat has been used in several areas in mm including:

Table 1: Description of study sample due to height & weight

Grade/variable	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	Total
Weight	21.5	27.9	27.5	32.2	35.6	45.2	48.3	51.5	54	55.9	54.7	56.7	42.6
Length	1.13	1.24	1.27	1.35	1.39	1.48	1.53	1.55	1.61	1.60	1.59	1.60	1.44

- Skin bending thickness in triceps.
- Skin bending thickness in abdomen.
- Skin bending thickness in the thigh.
- Skin bending thickness in the chest.
- Skin bending thickness in the higher suprailiac area.

The right area of the body was adopted for all measurements related to skin thickness (fat thickness).

Third: Muscle Mass: as for (LBW) measurement, it was made through determining fat mass, multiplying fat percentage by body mass, fat percentage, body mass and then obtaining far mass in kg and then calculating (LBW) (kg through subtraction of fat mass from total mass according to the following equation:

Muscle Mass = Body Mass – Fat (Lipids) Mass (McArdle, Katch & Katch, 1981)

Fourth: BMI (kg/m^2). This was measured through multiplying the person's mass in kg by square length according to the following equation:

(BMI) kg/m^2 = Body mass in kg/height (m) (Ravussin & Swinburn, 1992).

All of these processes were implemented using computer on the Statistical Package for Social Sciences SPSS program.

Results of the Study

First results on the first question
What is the curve of change in body composition among female students in educational grades (1-12) in Palestinian schools?

In order to see the change curve in body composition among a sample of the study, the researcher used arithmetic mean and standard deviation for each grade of the classrooms for the variables under study (body mass, height, muscle mass, and Body Mass Index), and the results were as follows, as illustrated in Table 2. With regard to thickness of the fat, Table 3 shows arithmetic means and standard deviations depending on areas of measurement in the research.

Table 2 shows that arithmetic means of length, weight, muscle mass, and Body Mass Index for female students of various grades from (1 – 12) as follows: (19.5 kg/m^2, 36.12 kg, 1.44 kg, 42.64 kg).

Figure 1 shows length, weight, muscle mass, and Body Mass Index for female students of various grades from (1 – 12).

Table 3 shows that arithmetic means of fat thickness variables for female students of various grades from (1 – 12) are as follows according to measurement areas: (14.9/20.9/24.8/15.7/13.4) mm.

Second results of the second question
What is the relationship between height, weight, percentage of fat, muscle mass and body mass index for each stage of the educational grades (1-12) in the Palestinian schools?

To answer this question, the researchers used (Correlation Coefficient Person) and results of Table 4 as follows.

Table 4 shows that there is a positive statistically significant correlation between all variables (weight, height and fat thickness, muscle mass and Body Mass Index BMI), and there was a stronger relationship between height and Body Mass Index, reaching the value of Pearson's correlation coefficient to (0.973). To find out whether there were differences between the averages of the students in body composition curve, the researchers conducted an analysis of variance and Table 5 shows that.

Table 5 shows that the (F) calculated value consecutively according to variables under study (10.31/5.712/9.236/4.942/9.070). Since the tabulated (F) value is smaller, with statistically significant differences at significance level (0.05) in the curve of change in body composition for female students at various educational stages from 1 to 12. To determine differences in variables among grades, the test and Table 6 was used to show results of the test.

Table 2: Arithmetic means and standard deviations of weight, length, muscle mass and body mass index on a sample of female students in educational grades from (12-1) to (N=180)

Grade	Mean – SD	Weight (kg)	Length (m)	Muscle Mass (kg)	BMI
1st	Mean*	21.59	1.13	20.22	16.5
	SD**	2.84	5.48	1.87	1.5
2nd	Mean	27.96	1.24	25.12	17.76
	SD	7.99	7.46	5.27	3.49
3rd	Mean	27.56	1.27	25.01	16.97
	SD	4.96	5.15	3.27	3.23
4th	Mean	32.2	1.35	28.47	17.45
	SD	6.24	6.61	4.12	2.54
5th	Mean	35.61	1.39	31.65	18.20
	SD	7.54	6.87	4.98	2.69
6th	Mean	45.24	1.48	38.71	20.4
	SD	8.20	6.84	5.41	3.13
7th	Mean	48.35	1.53	39.90	20.41
	SD	12.2	8.36	8.10	3.37
8th	Mean	51.15	1.55	41.86	20.9
	SD	14	6.9	9.25	4.78
9th	Mean	54	1.61	44.57	21.03
	SD	9.0	6.94	5.99	3.82
10th	Mean	55.97	1.60	44.74	21.74
	SD	7.71	6.32	9.7	5.28
11th	Mean	54.7	1.59	45.29	21.4
	SD	7.71	4.23	5.09	2.5
Guiding	Mean	56.7	1.60	45.36	22.11
	SD	7.07	7.6	4.6	3.03
Total	Means	42.64	1.44	36.12	19.5
	SD	15.2	17	0.10	3.80

*Mean, **Standard deviation

Table 3: Arithmetic means and standard deviations of fat thickness for female students in various educational grades from (12-1) to (N=180)

| Grade	Upper arm		Waist		Thigh		Pelvis		Chest	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1st	7.86	1.95	7.66	3.13	14.7	5.58	5.58	2.08	7.33	2.94
2nd	9.93	2.84	10.4	5.27	20.33	6.61	6.61	8.79	11.26	6.59
3rd	9.60	3.35	9.13	3.13	20.40	5.43	5.43	7.97	9.06	3.75
4th	10.60	4.37	13	5.04	22	5.22	5.22	6.80	12	4.58
5th	10.53	3.83	10.20	6.37	20.73	6.49	6.49	8.60	13.20	8.37
6th	12.53	4.25	15	7.52	24.80	7.58	7.58	8.51	15.33	5.87
7th	15	4.61	1906	9.01	29.6	6.23	6.23	6.12	1706	5.44
8th	15.73	5.95	21.4	8.20	26.2	7.17	7.17	10.2	20.2	8.85
9th	17.06	4.46	18.8	7.12	28.6	1.42	1.42	9.10	17.40	9.30
10th	18.20	6.25	22.13	9.59	32	11.38	11.38	6.55	20	7.85
11th	15.86	2.85	17.9	5.36	29.53	6.85	6.85	5.71	15.6	4.95
12th	18.26	4.55	23.80	8.91	28.8	6.96	6.96	4.50	20.4	9.66
Total	13.4	54	15.7	8.56	24.8	8.71	8.71	9	14.9	7.89
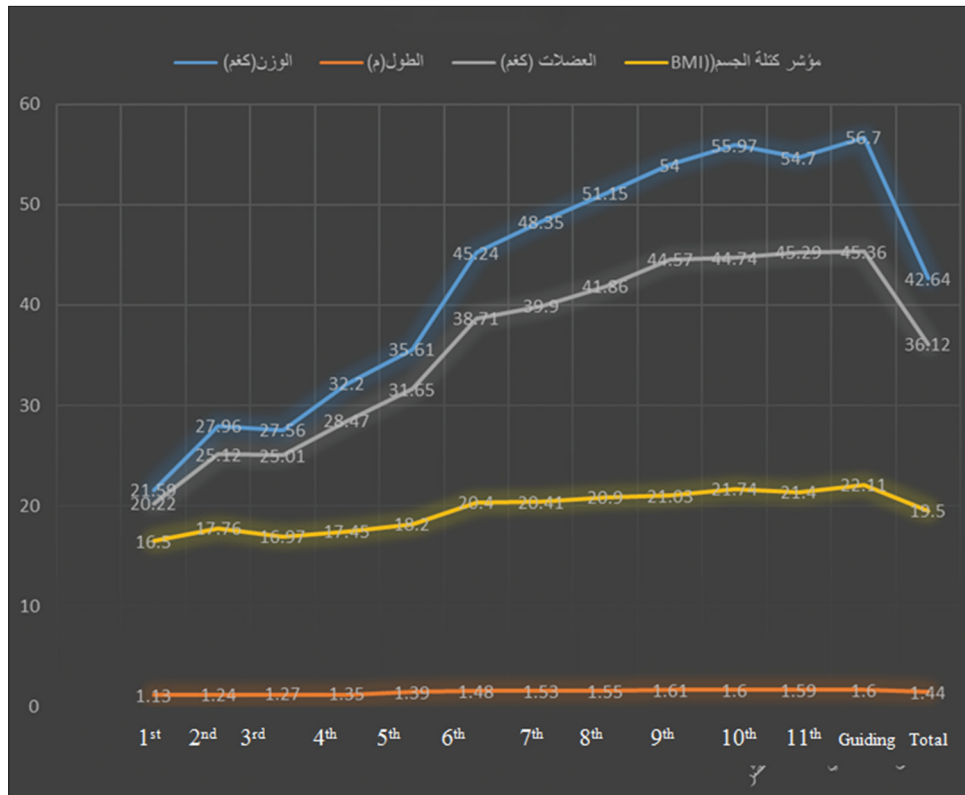
Figure 1: Shows length, weight, muscle mass, and Body Mass Index for female students of various grades from (1 – 12)

Table 4: Results of correlation coefficient pearson for relation between length, weight, fat thickness, muscles, BMI for female students in various educational grades from (12-1) to (N=180)

BMI	Muscle mass	Fat thickness	Length	Weight	Variables
0.823**	0.961**	0.773**	0.856**		Weight
0.937**	0.889**	0.380**			Length
0.369**	0.712**				Fat thickness
0.886**					Muscle mass
					BMI

**Statistically significant at level (0.05), (α = à = 0.01)

Table 6 shows that differences were statistically significant at significance level ($0.05 = \alpha$) in the curve of change in body composition for variables under study with female students of different grades (1-12), and in favor of the higher grades.

DISCUSSION OF RESULTS

Regarding the length, arithmetic mean of age (6-18) reached (1.44 m). By comparing these results tables percentiles of the National Center of the American Health Statistics (NCHS) (Margret, et al, 1995), we find that the average height with the Palestinian females was higher than the average lengths of US and European females with stability in the medium height along after the age of 16 years, but after the age of 15, American and European females excelled in length over Palestinian females (James, et al, 1990). The qualitative leap lengthwise occurs specifically for students of fifth grade. These numbers agreed with the study conducted by (Mandur, 1997), and (Abdul Haq, 2005) on the fourth and fifth grade students, with an average length in this age of Palestinian female (1,365 m), while the female Americans and European females have an average height of (1.35 m) for this phase, while Japanese and Indian females were smaller (Koley, etal, 2009). The researchers attribute this difference to environmental, genetic factors and the nature of food intake.

Table 5: Analysis of variance with difference significance in body composition curve for female students according to grade

Variable	Total deviation squares	Freedom degrees	Average squares	F
Wright				
Inter-groups	12230.31	11	1111.481	10.03
Intra-group	18621.296	168	110.481	
Total	30851.611	179		
Length				
Inter-groups	4.503	11	0.409	0.712
Intra-group	12.028	168	0.071	
Total	16.531	179		
Fats				
Inter-groups	6870.231	11	624.566	9.236
Intra-group	11360.093	168	67.619	
Total	18230.323	179		
Muscle mass				
Inter-groups	610.218	11	55.474	4.942
Intra-group	1885.495	168	11.223	
Total	2495.713	179		
BMI				
Inter-groups	3960.747	11	269.159	9.070
Intra-group	4983.368	168	29.674	
Total	7946.125	179		

Statistically significant at level (à=0.05)

Table 6: Results of testing post-comparisons among arithmetic means

Grade	1	2	3	4	5	6	7	8	9	10	11	12
1st	-	−1.19	−1.98	−2.61	−3.28	14.96	19.27	16.89	11.62	9.54	3.06	0.22
2nd	-	-	−0.79	−1.42	−2.10	16.15	20.45	18.07	12.81	10.73	4.25	1.14
3rd	-	-	-	−0.64	−1.31	16.94	21.24	18.86	13.60	11.52	5.04	2.19
4th	-	-	-	-	−0.67	17.57	21.88	19.50	14.23	12.16	5.67	2.38
5th	-	-	-	-	-	18.25	22.55	20.17	14.90	12.83	6.35	3.50
6th	-	-	-	-	-	-	4.30	1.92	−3.34	−5.42	−11.90	−14.75
7th	-	-	-	-	-	-	-	−2.38	−7.65	−9.72	−16.22	−19.05
8th	-	-	-	-	-	-	-	-	−5.27	−7.34	−13.38	−16.67
9th	-	-	-	-	-	-	-	-	-	−2.08	−8.56	−11.40
10th	-	-	-	-	-	-	-	-	-	-	−6.48	−9.33
11th	-	-	-	-	-	-	-	-	-	-	-	−2.84
Guiding												

Statistically significant at level (à=0.05)

With respect of body weight, through results of the study, we see that there is a clear increase in weight among students of fifth and sixth grades, where average weights of the students of various educational classes are (42.64) kg. When compared to the results of other studies (Margret, et al, 1995), (Mandur, 1997), we find that the weight of Americans of African females in the age (6-16 years) are more than the weight of Palestinian females, while European females weight was less weight by 2 kg in the stages of (9-12) compared to Palestinian females of the same stage (James, et al, 1990), while the weight of the Japanese and Indian female was less than the weight of Palestinian females (Koley, etal, 2009), while most studies carried out in

different places of the world and which confirms that the child anthropometric characteristics at the age (8-10) consistent at the apparent increase in growth of height and weight as percentages with physical change at this stage (James, et al, 1990), and attributes the researchers differences in height and weight to environmental and genetic, economic and nutritional factors as agreed results with Mandur study (1997), and Abdul Haq (2005).

In terms of Body Mass Index (BMI), the mean reached (19.5) kg/m². By looking at the results and compare them to international standards set by the law (1998, Anon) where class individuals as follows: 18.5 kg/m² (less than normal weight) "slim", 18.5-24.9 kg/m² weight \ normal, 25-29.9 kg/m² "fat" 0.30 kg/m² or "more obese". We see that the elementary grades (first, second, third, fourth and fifth grades) are considered within the classification "slim", where results of body mass index have less than 18.5 kg/m², while the stages of the other grades were within normal healthy weight for the individual. In a study by (Koley, et al, 2009), they found that a higher Body Mass Index among Indian females was at the age of 15 years, reaching 20.16 kg/m² and is filed under normal weight. This reason is due to the nature of food in addition to environmental and economic factors, and the study by (Rcachera, et al, 1991) traced the stages of growth among French children in terms of Body Mass Index found that the average Body Mass Index among students was less than 18.5 kg/m², which is located within the classification "slim" (less than normal weight), and this stage of the first primary until the seventh grade, but the rest of the stages of the ranks of education were within normal and healthy stages and good weight for exercise. This reason may be attributed to the attention of the French nutrition programs and regular exercise in addition to the difference in time and the number of sport shares given in schools among students. British children have the Body Mass Index slightly higher, (Cole, et al, 1991). It is worth mentioning that the Body Mass Index increases as children's progress in life because of its direct association with weight and height, but it varies according to heredity and environment (2007 Daijh, et al,) and is associated with the increase or decrease in body mass index of activity practiced and followed by the student (Maria, et al, 2006).

Regarding muscle weight (LBW), the mean was (36.12) kg. By looking at the results, we found that the increase in muscle mass was constant for the students of educational classes except for the sudden increase in muscle mass among fifth-grade students.

With regard of fat thickness (the average thickness of fat for the posterior surface of the upper arm was of 13.4, average thickness of fats to the abdominal area of 15.7, average thickness of fats to the thigh area and thickness of 24.8 fats, 14.9 for the chest area and the average thickness of pelvis is 20.9) millimeters. The researchers believe that the fat content for Palestinian females came more than French, Canadians and Indian females, (Rcachera, et al, 1991), (James, et al, 1990). The reason is due to the difference in the nature of nutrition as well as the lack of sports activities, a lack of interest and encouragement by the community and parents as well as the nature of sports education classes, which are not sufficient in terms of quantity and quality of female Arab sport to practice and the lack of venues and facilities, and this was confirmed by the study of each of (Khanfar, 2001), (Emad, 2005). As for the Americans, fat content to them was higher compared with Palestinians, which were increasing in every stage of life, and the researchers attribute this to the nature of food compared with females in the Palestinian environment, with an average thickness of fat in the waist area for American females at the age of 9-10 years to become (11.69 mm) while (10.20) mm for Palestinian females. These results also agreed with each study of Cynthia, et al, 1990 and) Flegal, et al, 2010).

CONCLUSIONS

In light of the results of the study and their discussion, the researchers concluded the following:
1. The growth factor is clear from grade to another, where variables showed increase in some rows and stability in other classes. This shows the difference in physical composition of each age category in addition to the occurrence of quantum leaps of those variables.
2. The apparent increase in the weight and height is at the age (8-10). These results agreed with most of the studies carried out in different places of the world.
3. The level of Body Mass Index among female students was normal, reaching average to 19.5 kg/m².
4. The proportion of fat was slightly higher than normal for Palestinian females compared to other studies, with the exception of the proportion of fat for African-American female.

5. There is a positive correlation between the variables under study for various educational grades.

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