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FACTORS AFFECTING MENARCHE AGE AMONG A SAMPLE OF SECONDARY SCHOOL FEMALES IN BAGHDAD

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ABSTRACT

The aim of study: was to determine the effect of obesity on the age of onset of menarche and the factors affecting it in AL-Dora sector' of, Baghdad Governorate. **Methodology:** This is a cross sectional study with multi-stage sampling was carried out during the period from the 3rd of December 2016 to the 12 th of March 2017. In the first stage, selection of schools was done. The schools were randomly selected from the list of schools provided by the directorate of education in Baghdad secondary Al- karkh in Iraq government. One class was selected randomly from each level of education ؛the number of selected schools was 14, 11 from urban area and 3 schools from rural area. The sample consists of 1760 students, the data was collected by a special questionnaire through a direct interview, weight with height were measured for each girl, and body mass index was calculated. **Results:** The study showed that the mean age at menarche for adolescent secondary school girls in Al-Dora wasl2.49±0.99 years, and the mean age at menarche of girls living in the urban area were 12.4±1.0 while 12.9±1.1 year for girls living in the rural area, with a statistically significant, so the girls from urban area had earlier menarche age than girls from rural area, and earlier age at menarche of those girls who had fewer number of siblings than those who had more siblings. Also the study discovered an earlier age at menarche in the girls whose parents' had a high educational level, occupation of mothers. **Conclusions:** The results reveals that the mean age at menarche of obese girls were 12.3±1.0 0 years, while the mean age at menarche of normal weight girls were 12.6±0.9years. This difference is statistically significant, a significant association is revealed between the age of menarche and mothers and sister's age of menarche, while there was no association between birth order, physical activity, occupation of father and the age at menarche. **A**

recommendation: to further elaborated study was suggested to estimate the age of menarche of Iraqi girls. As menarche age can vary by location, it may not be possible to generalize these results to other communities in the Iraq society.

INTRODUCTION

Menarche is being the onset of menstruation and one of the most significant milestones in a woman's life.[1] It is the most widely used indicator of sexual maturation in females as well as the most accurately recalled indicator of puberty among girls.[2] Because unlike other pubertal changes that are gradual, menarche is a distinct event with a sudden onset.[3]

The first scientific records on age at menarche was 158 years ago.[4] Over time, the age at menarche has been found to show a steady decline of about 2 to 3 months per decade in developed countries[5], and about 6 months per decade in developing countries.[6] Though there is some evidence in the literature to show that the trend toward earlier puberty is fast becoming a global phenomenon.[7,8]

Menarche can occur within a wide range of ages, and the timing is influenced by both genetic and environmental factors. The average age of menarche in the United States is about 12 years and 8 months.[9]

Over the centuries, menarche has occurred younger, just as people have grown taller, due to improved diet and health.[10]

Menarche is affected by many factors as food preference that lead them to obesity ‹therefore the obese girls irrespective of their ethnic origin have earlier age at menarche. This has been associated with increased levels of leptin in obese children and other studies reported that girls with early menarche tended to have higher BMI than girls with average or later menarche.[11, 12]

In addition to that distribution of body fat in the gluteofemoral part encourages early menarche than obesity in the upper part.[13] Other factors associated with early menarche are high conflict Life style (stressful environment).[14]

While increasing physical activity associated with delayed onset of menarche.[15] Genetic factors have been suggested to influence menarcheal age by Human Leukocyte Antigen (HLA) linked genes.[16] The age at which an individual attains menarche depends not only on

genetic potential, but also on health status, which is in turn influenced by environmental factors, such as general standards of living and nutrition. The report of some studies reveals that socio-economic status of the family as well as family size influence the menarcheal age of girls from other families.[17, 18] Being overweight or obese can have a serious impact on health. During childhood and puberty, obese girls grow faster and have earlier menarche.[19]

The event of menarche is an exceptional phenomenon, which occurs once in a lifetime. The knowledge of age at menarche is very important demographically as one can consider the distribution of the age at menarche as the potential starting point of reproduction. More recently, the average age at menarche has been used as a measure of reproductive risk for miscarriage and unsuccessful pregnancy outcomes and as a proposed basis for public health planning.[20, 21]

AIM OF THE STUDY

To assess the effect of obesity on age at menarche among secondary.

OBJECTIVES

l-Determining the age of menarche at present time among secondary school students in Al-Dora sector of Baghdad Governorate.

2- Identify and study the factors affecting the onset of menarche.

3-Determining the BMI of study sample.

4-To determining the relationship between age at menarche and body mass index (BMI).

SUBJECTS AND METHODS

Across- sectional study wi.th a multi -stage random sample procedure was carried out during the period from the 3rd of December 2016 to the 12th of March 2017 and include 20% of intermediate and secondary schools for girls from Al- Dora sector in Baghdad Governorate.

In the first stage, selection of schools was done. The schools were randomly selected from the list of schools provided by the directorate of education in Baghdad secondary Al- karkh. One class was selected randomly from each level of education, the grades included was from the 1st educational to 6th educational grades.

Sample of the study was 1510 female students from urban area and 250 from rural area. The girls in schools of rural areas were few in numbers so we tried to choose many schools to coverage the numbers in urban areas. Arrangements were done to get approvals from the

directorate of education in Baghdad secondary Al karkh for the selected schools to conduct the study. All students included in the study of the intermediate and secondary schools were visited five days in the week by the researcher according to the time table arranged for this purpose. The teaching staff collaborative with researcher during the interview and the anthropometric measurements.

Inclusion of students in the study depends on the following criteria:

1. The age of the girls should be within the range (12-16) years old.
2. had no history of all type of chronic or acute diseases like heart diseases, asthma, diabetes. Tuberculosis and has no history of blood disease or acute or chronic blood loss.

Exclusion criteria

1. Married or divorced girls excluded from the study because they may be pregnant during the study.

Subjects and methods

The method consist of.

The Questionnaire form

The questionnaire form includes.

a-Socio-demographic data of the students

Including the age of the girl by year, class level, birth order, number of household, number of rooms, residency (urban/rural), education level of parents, occupation of parents, crowding index.

b-Family history of mothers and sisters menarcheal age. The questionnaire sent to the family to answer the questions, to know whether the girls had any chronic disease or not. Answers were collected in the next day.

C-Information related to health status of the girls.

D-Information related to physical activity.

Age of starting physical activity, type and duration of physical activity, and when she was started physical activity: is it before or after her menarche?

Each girl was asked about whether she had started menstruation or not, by year, separately by telling her to give the real time of the first flow of blood even if it was stopped after that time, and a special questionnaire was prepared for this purpose.

Anthropometry is a widely used, inexpensive and non-invasive measure of the general nutritional status of an individual or a population group. Anthropometry can be used for various purposes, depending on the anthropometric indicators selected.[22]

1- Weight: it was measured by using a well calibrated digital scale adapted by UNICEF (Kubota, Japan) to the nearest 1 00 kg. checked and the weight scale was standardized by one standard l kg weight before every day work and then adjusted with every 10 girls with a known weight.

The measuring technique for weight.
-Weight: the weight of the girls was measured with uniform clothes taking off outer clothes and without shoes.

2- Height: it was measured by using a measuring instrument to the nearest 0.1 cm using somatometer with a horizontal headboard that can be brought into contact with uppermost point on the head.

The measuring technique for height.
-Height: the height of girls was measured by letting the girl to stand bare- footed near the height measuring board, with both heals touching the board, her back straight to the board and the examiner checked the knee to be also at straight position touching the board. The head also straight looking forward with the head-part measuring board touching the head from above.

C-Body Mass Index (BMI)
Body mass index is a simple, inexpensive, and noninvasive surrogate measure of body fat. In contrast to other methods, BMI relies solely on height and weight and with access to the proper equipment, individuals can have their BMI routinely measured and calculated with reasonable accuracy.

BMI can also be calculated using this formula (BMI = (weight (kg) / ؛height $(m)^2$).

Table 1: BMI Categories according to WHO (2000).

The girls were divided into four groups according to their BMI as.

BMI Categories	BMI
Finder weight	**<18.5**
Normal Weight	**18.5-24.9**
Overweight	**25.0-29.9**
Class I	**30.0-34.9**
Class II	**35.0-39.9**
Class III	**>40**

WHO (2000) Obesity[23]

A pilot study was conducted on a random sample of 10 girls. Full data were collected from these girls during the time of the interview, at Al-Batol secondary school in Baghdad/Al-Dora. The questionnaire form sent to the family to answer the questions about the age of menarche of the mother and that of students sisters girls and the type of chronic disease which may the girls had it**.**

Statistical analysis

Analysis of data was carried out using the available statistical package of SPSS-20 (Statistical Packages for Social Sciences- version 20). The data were presented in simple measures of frequency, percentage, mean, standard deviation, and range (minimum-maximum values).

The significance of the difference of the different means (quantitative data) were tested using Student-t-test for two independent means 01' ANOVA test for difference among more than two independent means. The significance of difference of different percentages (qualitative data) were tested using chi-square test (x-test) with application of Yate's connection or Fisher Exact test whenever applicable.

Pearson correlation was calculated for the correlation between two quantitative variables with its t-test for testing the significance of correlation. The correlation coefficient value (r) either positive (direct correlation) or negative (inverse correlation) with value <0.3 represent no correlation, 0.3-<0.5 represent weak correlation, 0.5-<0.7 moderate strength, >0.7 strong correlation. In addition to correlation the r^2 was calculated (The coefficient of determination), i.e. when value of r=0.58, then r^2=0.34, this means that 34% of the variation in the values of may be accounted for by knowing values of x or vice versa. Statistical significance was considered whenever the p value was equal or less than 0.05.The sensitivity, specificity, positive predictive value, negative predictive value and accuracy rate were calculated.

RESULTS

The total number of the female students who participated in the current 1760, of these 1543 had attained menarche, with mean age at of the study sample was 12.49±0.99 with standard error of |90.99 and age range between (8-17) years,in table 4-1 most girls who had not attain menarche were in the 13 years and at class, level 1, while the higher percentage of girls.menarche were in the age of 16 years and class level 4, which.statistically significant. And according to residence the study failed to significant association.

Table 4-1: Distribution of the study sample according to their age (years), and residency.

		Menarche		No		P value
		No =1543	%	No=217	%	
Age(years)	12	44	2.9	65	30.0	0.0001*
	13	233	15.1	117	53.9	
	14	234	15.2	34	15.7	
	15	236	15.3	-	-	
	16	346	22.4	-	-	
	17	230	14.9	1	0.5	
	18	217	14.1	-	-	
	19	3	0.2	-	-	
	Mean±SD (Range)	15.4±1. (12-19)		12.9±0.7 (12-17)		
Class	1	266	17.2	161	74.2	0.0001*
	2	261	16.9	53	24.4	
	3	194	12.6	2	0.9	
	4	328	21.3	1	0.5	
	5	304	19.7	-	-	
	6	190	12.3	-	-	
Residence	Urban	1324	85.8	183	84.3	0.562
	Rural	219	14.2	34	15.7	

*Significant association between proportions using Pearson Chi-square test at 0.05 level

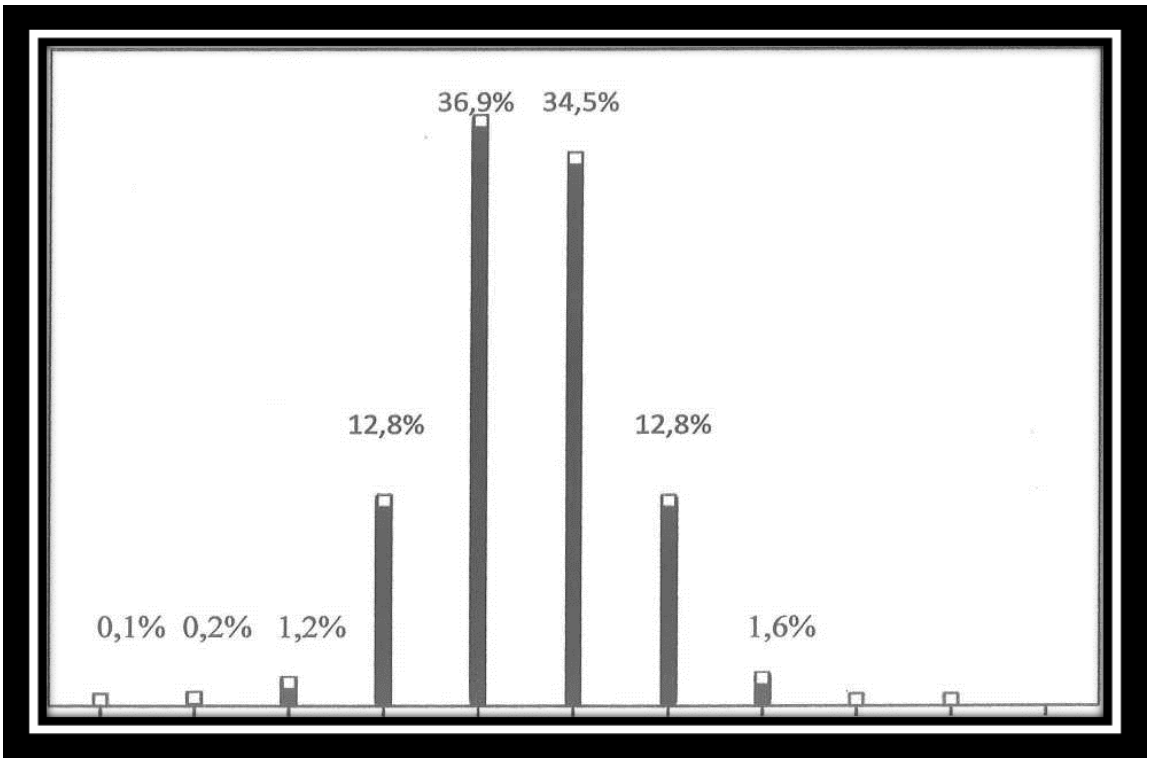

Figure l: represents distribution of age at menarche of study sample, the highest percentage was in ages 12(36.9%) and 13(34.5%) and one girls experienced menarche at age eight.

In table 4-2 results showed the mean age at menarche of girls at age 12 was 11.7±0.6, while at age 16 was 12.6±0.9, with a significant difference, and the mean age at menarche of girls at class level 1 was l2.2±1.0 year, while at class level 4 wasl 2.6±0.9 year, with significant difference, thus an earlier age at menarche in those girls at age 12 years old and in class level 1 while late menarche at age 16 years old and in class level 4.

In addition the mean age at menarche in girls living in the urban area was l2.4±1.0, while 12.9±1.1 year for girl's living in the rural area, although there was a slight difference in age at menarche it was statistically significant, so the girls from urban area with earlier menarche than girls from rural area. The present study shows that an earlier age at menarche in those girls who had fewer numbers of siblings than those who had more siblings.

Table 4- 2: The mean age at menarche of the study sample according to age (years), class, residency and crowding index.

		Age at menarche	
		No=1543	Mean±SD
Age (years)	12	44	11.7±0.6
	13	233	12.4±0.7
	14	234	12.4±1.1
	15	236	12.4±1.0
	16	346	12.6±0.9
	17	230	12.7±1.0
	18	217	12.6±1.1
	19	3	13.3±1.5
	P value		0.0001*
Class	1	266	12.2±1.0
	2	261	12.4±0.8
	3	194	12.5±1.0
	4	328	12.6±0.9
	5	304	12.7±1.0
	6	190	12.6±1.1
	P value		0.0001*
Residence	Urban	1324	12.4±1.0
	Rural	219	12.9±1.1
	P value		0.0001*
Crowding Index	<3	1180	12.5±1.0
	3--5	353	12.4±1.0
	>5	10	12.6±0.8
	P value		0.0001*

*Significant difference using Students-t-test for difference between two independent means or ANOVA test for difference among three independent means or more at 0.05 level

Table 4-3 the study discovered an earlier age at menarche in those girls whose parents' had a high educational level and menarche age affected by the occupation of mothers but not affected by the occupation of father.

Table 4.3: The mean age at menarche of the study sample according to the parent's education level and occupation.

		Age at menarche		
		No=1543	%	Mean±SD
Education level of mother	Illiterate	14	.9	12.4±1.0
	Read&Write	48	3.1	12.7±1.2
	Primary	179	11.7	12.4±1.1
	Intermediate	464	30.3	12.5±0.9
	Secondary	382	24.9	12.4±1.0
	Institute&College	446	29.1	12.5±1.0
	P value			0.0001*
Occupation of mother	Dead	10	0.6	12.5±0.5
	High professional and managerial	98	6.4	12.5±0.9
	Lower professional, skilled and semiskilled workers	240	15.6	12.5±1.1
	Unskilled workers, unemployed and retired.	1195	77.4	12.5±1.0
	P value			0.0001*
Education level of father	Illiterate	15	1.0	12.5±1.3
	Read&Write	15	1.0	13.1±1.2
	Primary	101	7.1	12.5±1.1
	Intermediate	203	14.2	12.3±1.0
	Secondary	239	16.7	12.5±1.0
	Institute&College	856	59.9	12.5±1.0
	P value			0.010*
Occupation of father	Dead	114	7.4	12.6±0.9
	High professional and managerial	279	18.1	12.5±1.0
	Lower professional, skilled and semiskilled workers	490	31.8	12.5±1.0
	Unskilled workers, unemployed and retired.	660	42.8	12.5±1.0
	P value			0.770

*Significant difference using Students-t-test for difference between two independent means or ANOVA test for difference among three independent

Table 4-4: The study found no significant association between birth order and mean age at menarche. Also it finds out that mean age at menarche of girls was positively associated with age at menarche of their mother's and sisters.

Table 4-4: The mean age at menarche of the study sample according to birth order, sisters age at menarche and mothers age at menarche.

		Age at menarche	
		No=1543	Mean±SD
Birth order	1	408	12.5±1.0
	2	471	12.5±1.0
	3	300	12.4±1.0
	4	175	12.5±0.9
	5	99	12.5±1.1
	6	44	12.4±1.0
	7	28	12.5±1.3
	8	11	12.3±1.1
	9	4	12.5±0.6
	10	2	12.5±0.7
	11	1	13.0±
	P value		0.971
Does the student have sisters	Yes	1114	12.5±1.0
	No	429	12.4±1.0
	P value		0.182
Age at menarche of big sister	10	3	13.3±0.6
	11	25	11.6±1.1
	12	498	12.3±1.0
	13	469	12.7±0.9
	14	105	12.8±1.0
	15	14	13.6±0.9
	P value		0.0001*
Age at menarche of mother	10	2	12.5±0.7
	11	85	11.2±0.7
	12	689	12.2±0.9
	13	570	12.8±0.8
	14	180	13.2±1.1
	15	17	13.3±0.9
	P value		0.0001*

*Significant difference using Students-t-test for difference between two independent means or ANOVA test for difference among three independent means or more at 0.05 level

Table 4-5: the high percent of the girls who attain menarche were with normal weight (BMI 18.5-24.9) and the lowest percentage of girls were with morbid obesity (BMI=>35).

Table 4-5: Distribution of the study sample according to their BMI and family history of obesity.

		menarche		No		P value
		No=1543	%	No=217	%	
BMI (Kg/m2)	Undernourished (<18.5)	77	5.0	70	32.3	0.0001*
	Normal (18.5-24.9)	752	48.7	104	47.9	
	Overweight (25-29.9)	269	17.4	26	12.0	
	Obesity (30-34.9)	385	25.0	15	6.9	
	Morbid Obesity (=>35)	60	3.9	2	0.9	
	Mean±SD(Range)	25.6±5.2 (13.28-44.12)		21.3±4.6 (14.29-35.56)		
Current medication	Yes	-	-	-	-	
	No	1543	100	217	100	
Family history of obesity	Yes	453	29.4	35	16.1	0.0001*
	No	1090	70.6	182	83.9	

*Significant difference between proportions using Pearson Chi-square test at 0.05 level

Table 4-6 the results showed the mean age at menarche of obese girls was 12.3±1.0 0 years, while the mean age at menarche of normal weight girls was 12.6±0.9 years. This difference is statistically significant, thus the study comes out with the fact that the menarche age of girls with higher BMI was lower than those with normal or lower BMI.

Table 4-6: The mean age at menarche of the study sample according to BMI, and family history of obesity.

		Age at menarche		
		No=154 Mean± S 3 D		
BMI(Kg/m^2)	Undernourished (<18.5)	**77**	**5.0**	**12.5±1.0**
	Normal(18.5-24.9)	**752**	**48.7**	**12.6±0.9**
	Overweight(25-29.9)	**269**	**17.4**	**12.4±0.9**
	Obesity (30-34.9)	**385**	**25.0**	**12.3±1.0**
	Morbid Obesity (=>35)	**60**	**3.9**	**12.1±1.0**
	P Value			**0.0001***
***Significant difference using students t-test for difference between two independent means or ANOVA test for difference among three independent means or more at 0.05 level				

Table 4.7 the study reveals no significant association between physical activity and mean age at menarche ‘the study finds out a significant association between age of menarcheal onset and years of physical activity performance before menarche.

Table 4-7: The mean age at menarche of the study sample according to type, duration of physical activity.

		Age at menarche	
		No=1543	Mean±SD
Do you practice physical activity	Yes	378	12.5±1.0
	No	1165	12.5±1.0
	P value		0.408
Type of physical activity	Football	136	12.6±1.1
	Swimming	31	12.3±0.7
	Others	211	12.5±1.0
	P value		0.494
The number of minutes in which the physical activity in one day	<15	335	12.5±1.0
	15--30	37	12.4±0.9
	>30 minutes	6	12.7±0.5
	P value		0.798
How many days a week you practice physical activity	1 day	79	12.7±0.8
	2--3	204	12.5±1.1
	4--5	42	12.4±1.0
	6--7 days	53	12.6±0.8
	P value		0.480
Was this a case before menarche	Yes	156	12.7±1.1
	No	222	12.4±1.0
	P value		0.004*

*Significant difference using Students-t-test for difference between two independent means or ANOVA test for difference among three independent means or more at 0.05 level

DISCUSSION

The total number of the students who participated in the current study were 1760, 1543 had attained menarche and 217 did not.

Most of the girl's who do not attained menarche are in age I3years old and in class level 1, while the highest percentage of girls who attained menarche are in ages 16 years and in class level 4, which was statistically significant.

The results showed that the mean age at menarche of the study sample wasl2.49+0.99 years, ranging between (8-17) years, the lowest age of menarche were 8 years and highest were 15

years, an earlier age at menarche in those girls who are at age 12 years and at class level 1, while the girls with late age at menarche at age 16 years and at class level 4, This difference statistically significant, the study agreed with the results reported by Richmond 2010 in Medina ؛Accra.[24] who suggesting that the younger girls attain menarche at an earlier age than older girls. Results showed the mean age at menarche of the study sample werel2.49+0.99 years old, were slightly less than that reported by Al-Jassar 2002 in Baghdad.[25] who found that the mean age at menarche was 12.61 t 1.74 years this difference due to improvement of nutritional status. The study's mean age at menarche is slightly higher than the age reported in the US in 1999-2002, the national age at menarche in the US was estimated to be 12.34 years (95./. Cl = 12.24 tol2.45 years).[26] The study coincide with the results reported by Yener 2007 in Turkey[27], Tabassum. et al 2011 in Lucknow[28], Al-Awadhi. et al 2013 in Kuwait[29] They found that the mean age at menarche was 12.43 ±1.49, 12.42 (±1.04) years, 12.41 years respectively.

The mean age of menarche of the study were lower than that reported by Whincup. et al 2000 in British[30], Babay. et al 2004 Saudia[31], Kabir. et al 2007 in Iran[32], Ouj. et al 2008 in Nigeria[33], Ali. et al 2011 in Sudan[34], Parvin. et al 2012 in Iran[35], They all found that the mean age at menarche was 13.0 years, 13.05 years0.06±13.18؛ years, 15.0 years, 13.211.33-years, 13.07±1.0 years, respectively. This decrease in the mean age at menarche might be attributed to the increasing prevalence of overweight and obesity among adolescent girls. Many reasons have been postulated: improved living conditions,.-sanitations and improved nutrition are primary contributors.

5-2 Place of residence

In the current study the mean age at menarche of girls who living in the urban area were 12.4±1.0 while 12.9±1.1 years for girls who live in rural areas, although there was a slight difference in the mean age at menarche which is statistically significant (p = 0.000). The study agreed with the results reported by Kamal 2000 in Baghdad[36], DS. etal 2004 in India[39], Yup Kiu. et al (2005)[38], Mokha. et al 2006 in Punjabi[39], Yener 2007 in Turkey[27], Delavar. et al 2008 in Iran[40], Karapanou. et al 2010[41], Subha. et al 2010 in India[42], Tabassum. et al 2011 in Lucknow[28], Ali. et al 2011 in Sudan[31], Fang. et al 2014 in BeiJing[43], Their study discovered that the mean age at menarche of urban girls is significantly less than rural girls and the age at menarche is affected by place of residence.

The study disagree with Padez. et al 2003in Coimbra[44], Tunau. et al 2012 in Sokoto[45], they found out that the mean age at menarche was not affected by place of residence.

The researcher point is difference in the mean age at menarche between urban and rural areas due to difference in physical activity, behavior and lifestyle, the result agree with Delavar. et al 2008 in Iran.[40]

The present work showed that the earlier age at menarche of the girls who had fewer number of siblings than those who had more siblings, it was supported by the results which were obtained by Al-Jassar 2002 in Baghdad[25], L Sunuwar 2010 in Nepalese[46], Elshiekh 2011 in Sudan[47], they all conclude that the mean age at menarche is delayed due to the increase in number of family members and more siblings. But these results are differed from Dosoky. et al Saudial 997[48], Padez.et al 2003[45], who find out that the size of the family did not have any significant effect on the mean age at menarche. Also the study discovered no significant association between birth order and mean age at menarche. The study agreed with the results reported by Kamal 2000 in Baghdad.[36]

Al-Jassar 2002 in Baghdad[25], Joseph. et al 2014in Punjabi.[49] But these results different from Elshiekh. et al 2011in Sudan[47], who found that the effect of birth order on menarcheal age is positive. The study further discovered an earlier age at menarche in the girls whose Parents' had a high educational level and occupation of mothers. This result coincides with the report by Al-Jassar 2002 in Baghdad[25], Elshiekh 2011 in Sudan[47], Alphonsus 2013inNigerian.[50]

The study disagree with Padez. et al 2003[45], Y.raji. et al 2006[51], Delavai. .et al 2008 in Iran[40], these studies discovered that the age at menarche not affected by parents' education level. Also the study discovered no significant association between age at menarche and occupation of father, the study agreed with that reported by Delavar. et al 2008 in Iran.[40] The researcher further discovered no significant association between the number of sisters and the age at menarche. The study disagrees with the results reported by Matchock. et al 2006[52], who found a significant association between number of sisters and the age at menarche.

The study comes out with the result found that the mother's age at menarche is positively associated with the age at menarche of their daughters ؛the study agreed with the results reported by Kamal 2000 in Baghdad[36], Ersoy. et al 2005[53], Bradford. et al 2005[54], Tehrani.

et al 2010.[55] The significant relation in the present study is found between the age of menarche of girls with their sister's menarcheal age and this agreed with Yup Ku. et al 2006.[56] The maternal age of menarche is closely related to her daughter's age of menarche.[57]

Nutrition was an important bearing on the age at menarche. Adolescents gain 50% of adult weight and more than 20% of their adult height during this period. Menarche is attained earlier by well nourished adolescents.[58] A minimal amount of body fat is essential for initiation of menarche. Body mass index was the most sensitive indicator for both the nutritional status as well as the occurrence of menstruation. BMI was a contributing factor in determining the age of onset of puberty.[59, 60 & 61]

In the current study the girls who do not attain menarche are Undernourished (BMI<18.5)and normal (18.5-24.9), while the menstruating girls are obese (30-34.9), So the BMI of menstruating girls are significantly higher than BMI of non-menstruated girls'. The study agrees with the results reported by Khakbazan. et al 2005[62], Kim. et al 2010 in Korean[63], Goon. et al 2010 in Benue State[64], Cho. et al 2010[65], Rigon.ٔ. et al 2010 in Italy[66], Daniel. et al 2010 in Nigeria.[67]

Also the results show that the mean age at menarche of obese girls are l2.3±1.0 0 years, while the mean age at menarche of normal weight girls were 12.6±0.9 years. This difference is statistically significant, so the study finds out that the menarche age of girls with higher BMf are lower than those with normal or lower BMI, This is supported by the results which were obtained by Einy. et al 2006 in Iran[68], Abdulla. et al 2010 in Tikrit city[69], Yeong Kim. et al 2010 in Korea[70], Akbar. et al 2013[71], the study disagree with Asgharnia.et al 2008 in Iran[72], Moelyo. et al 2012[73], They found no association between BMI and menarche age. Pierce. et al 2005[74], Mohammad et al. et al 2013 in Iran[75], Al-wadhi. et al 2013in Kuwah.[29] Their studies showed that the BMI had an important role in determining the menarche. This finding is related to the improvement of nutritional status. The girls with a higher percentage of body fat were more likely to reach menarche at a younger age than thinner girls.

Exercise training is known to have the potential to modify body composition and induced a preferential loss of body fat.[76]

In the current study high percent of non-menstruating girls practiced physical activity, while high percent of menstruating girls do not practice physical activity, with a statistical significance, so the age of menarche of physically active girls were significantly delayed as compared to their inactive counterparts. The study agrees with the results reported by Cavadini. et al 2000 in Switzerland[77], Shu-Hui. et al 2000[78], Herman. et al 2007[79], Late menarche that is related to athletic training is mainly caused by changes in hypothalamus then decrease in estrogen level, which can cause serious damage to the bones, briefly hypothalamus affected by a critical level of body fat and the effect of stress.[77]

The study didn't find a significant association between the type and duration of physical activity with the age at menarche. This finding agrees with that reported by Kamal 2000 in Baghdad[36], Al-Jassar 2002 in Baghdad[25], These studies disagree with Abdulla. et al 2010 in Tikrit city.[69] Who found a significant association between the age of menarche and sporting.

Similarly, the study discovered a significant association between the age of menarcheal onset and years of physical activity performance before menarche. This finding agrees with that reported by Klentrou p. et al 2003[80], who found out that female athletes who begin physical activity early in life, had delays in menarche.

CONCLUSIONS

1- The mean age at menarche in adolescent girls at intermediate and secondary school in Al-Dora isl2.49+0.99 years and ranging between 8- 17 years.
2- A significant correlation between age at menarche with age and class level in school, suggesting that the younger girls attain menarche at an earlier age than older girls.
3- The epidemiological factors which affect the onset of age at menarche

are

A-Body mass index is significantly related to the age at menarche.

Higher the body mass index lowers the age at menarche.

B-Mothers and sisters age at menarche is significantly associated with adolescent's girl's age at menarche, so the genetic factor plays an important role in age at menarche.

C- The significant association is found between the age at menarche and Parents' education level and mother's occupation. So an earlier age at menarche in the girls whose parents' had a high educational level.

D- Adolescent girls from large families had delayed menarche.

E- The mean age at menarche of urban girls is significantly less than rural girls and the age at menarche is affected by the place of residence.

F- Furthermore the study reveals a significant association between the age of menarcheal onset and the period of sport by year's performance before menarche. Thus, the age of menarche of physically active girls is significantly delayed as compared to their inactive counterparts.

G-All other variables such as order birth, exercise and occupation of father have not any association.

- Recommendations

According to the findings of the present study the following Recommendations were formulated.

1- Development of a monitoring program using the appropriate anthropometric indicators to follow up the change in the nutritional status during the period of accelerated growth.
2- Nutritional education of adolescent girls and their families through enhance the knowledge of the adolescent girls on their habits of nutrition.
3- Collaborative work can be issued between the Ministry of health and the Ministry of education to provide educational services for this segment of population by the establishment of educational courses for schools around the menarche age and important of physical activity.
4- Based on the results of this study, educational programs should be begun earlier for residents of urban areas and for crowded families, because they are expected to have earlier menarcheal onset by encourage girls to play physical activity constantly.
5- Further elaborated study is required to estimate the of menarche age of Iraqi girls, because menarche age can vary by location, it may not be possible to generalize these results to other communities in the Iraq.
6- Further studies are necessary to identify the inherent in the Iraq population, which relate to and influence the age of menarche.

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