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The Demographic and Clinical Characteristics in Association with Age at Onset of Menarche in a Sample of Iraqi Adolescent Girls: A Cross Sectional Study

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Abstract

Background: The onset of menstruation "Menarche" is one of the neglected indicators of girls' health in the community. In addition to its implication as a marker of transition from childhood to young adulthood, it plays an important role in identification of health including physical, nutritional and reproductive aspects. Menarche marks the initiation of reproductive activity and thus may put a girl at risk of negative reproductive and sexual outcomes including early pregnancy complications, birth outcomes and sexually transmitted infections.

Aim of the study:the aim of the current study was to figure out the association between demographic and clinical characteristics of girls and age at onset of menarche.

Subjects and methods: The current cross sectional study was carried out at Al-Diwaniyaha Maternity and Children Teaching Hospital and private clinic. The study has extended from January the 2nd 2019 through August the 15th 2020. The study included 207 adolescent girls from who were randomly selected from the pool of girls visiting the hospitaland private clinic during the period of study. A questionnaire form was prepared after reviewing articles dealing with onset of menarche and related outcomes in developed and underdeveloped countries and accordingly it included information about age, age of menarche, body mass index, length of menstrual cycle, the amount of menstruation and its duration, associated clinical features such as dysmenorrheal and hirsuitism, pelvic ultrasound findings, hormonal essays (luteinizing hormone (LH), follicular stimulating hormone (FSH), testosterone hormone) and treatment items.

Results: The mean age at onset of menarche was 12.43 ±1.69 years with a range of 8 -15.2 years. Girls with early menarche accounted for 85 (41.1 %), girls with medium menarche accounted for 108 (52.2 %) and girls with late menarche accounted for 14 (6.8 %). There was highly significant difference in mean BMI among girls according to onset of menarche ($p< 0.001$) and the proportion of obese and overweight girls was significantly higher in group with late menarche in comparison with both early and medium menarche groups. Polymenorrhea was significantly

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associated with early menarche, whereas, Oligomenorrhea was significantly associated with late menarche. There was no significant difference in mean serum LH ($p > 0.05$), but high serum FSH and testosterone were significantly associated with late onset ($p< 0.05$). Poly cystic ovary syndrome (PCOS) was more frequently seen in association with late and medium onset in a highly significant manner ($p< 0.001$).

Conclusion: Early menarche is common in our community. Obesity is associated with late menarche and disturbed FSH and testosterone in late onset menarche may explain the occurrence of PCOS in association with late onset menarche.

Key word:demographic, clinical, menarche, Iraqi

Introduction

By 2017, people categorized as adolescent accounted approximately 1.8 billion and this is by far the largest generation throughout history [(1)].Worldwide, this subset of population is at potential risk of having adverse reproductive outcomes such as unintended pregnancy, negative effects of early life pregnancy and sexually transmitted infections [(2-4)].Adolescent girls are the main target of such adverse reproductive outcomes [(5)].One of main draw backs is childbirth and its complications in our community which principally targets adolescent females and this observation is seen in other underdeveloped countries [(6)]. In developing countries, pregnancy and childbirth complications are among leading causes of death in adolescent girls [(7)].

The onset of menstruation "Menarche" is one of the neglected indicators of girls' health in the community. In addition to its implication as a marker of transition from childhood to young adulthood, it plays an important role in identification of health including physical, nutritional and reproductive aspects [(8)]. Menarche marks the initiation of reproductive activity and thus may put a girl at risk of negative reproductive and sexual outcomes including early pregnancy complications, birth outcomes and sexually transmitted infections [(9-15)].Adolescents who are pregnant are at increased risk because of life-threatening complications, because of their relatively immature reproductive organs, and these risks are in the form of obstructed labor and probable obstetric fistulae. The rate of eclampsiaand pre-eclampsia are also more frequent in adolescent pregnant females [(16-18)]. Females who are younger than 20 years of age are at approximately 2-5 times risk of mortality due to obstetric complications in comparison with women of ≥20 years of age [(19)].

The association between early menarche and reproductive and sexual outcome has been proposed to be similar in developed and underdeveloped countries; however, some data showed a number of variations based on cultural and social considerations. For instance in rural areas of our country and some other countries the menarche marks the readiness of a girl for marriage based one religious and cultural behavior which is not the cases in western and most developed countries [(20)]. Therefore, in our country, it is more likely to seen young adolescent girls with

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complications attributed to obstetric health that in other countries. This observation is also common in some underdeveloped counties [21].

In our country, data about the demographic and clinical characteristics in association with onset of menarche are deficient because of little of the academic research work in this regard, thus, the aim of the current study was to figure out the association between demographic and clinical characteristics of girls and age at onset of menarche.

Subjects and methods

The current cross sectional study was carried out at Al-Diwaniyaha Maternity and Children Teaching Hospitaland private clinic. The study has extended from January the 2nd 2019 through August the 15th 2020. The study included 207 adolescent girls from who were randomly selected from the pool of girls visiting the hospitaland private clinic during the period of study. A questionnaire form was prepared after reviewing articles dealing with onset of menarche and related outcomes in developed and underdeveloped countries and accordingly it included information about age, age of menarche, body mass index, length of menstrual cycle, the amount of menstruation and its duration, associated clinical features such as dysmenorrhea and hirsuitism, pelvic ultrasound findings, hormonal essays (FSH, LH and testosterone) and treatment items.

Verbal consent was obtained from parents or care givers of all participants after full illustration of the procedure and goals of the current study./

Obtained data were transformed into SPSS (statistical package for social sciences) computer software (IBM, Chicago, USA, version 23.0) for purpose of statistical description and analysis. Quantitative data were expressed as mean, standard deviation and range, whereas, qualitative data were expressed as number and percentage. One way ANOVA was used to compare mean among groups of patients classified according to age of menarche and Chi-square test was used to study association among categorical variables. The level of significance was set at $p \leq 0.05$ and the level of high significance was set at $p \leq 0.01$.

Results

Results regarding age of adolescent girls and their menarche onset are shown in table 1. The study included 207 participants with a mean age of 14.61 ±1.86 years and an age range of 10 to 16 years. According to age, girls were categorized into 61 (29.5 %) early adolescents and 146 (70.5 %) late adolescents. The mean age at onset of menarche was 12.43 ±1.69 years with a range of 8 -15.2 years. Girls with early menarche accounted for 85 (41.1 %), girls with medium menarche accounted for 108 (52.2 %) and girls with late menarche accounted for 14 (6.8 %).

Data concerning body mass index (BMI) are shown in table 2. There was highly significant difference in mean BMI among girls according to onset of menarche ($p = 0.002$) in such a way that girls with late menarche had the highest BMI (22.68 ±4.43 kg/m^2), followed by

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those girls with early and medium menarche, 20.21 ±3.48 kg/m^2 and 21.76 ±3.26 kg/m2, respectively. The proportion of obese and overweight girls was significantly higher in group with late menarche in comparison with both early and medium menarche groups.

The characteristics of menstrual cycle and associated clinical features according to onset of menarche are shown in table 3. There was highly significant difference in the length of menstrual cycle according to onset of menarche ($p< 0.001$); girls with late menarche had the highest length followed by girls with medium menarche and lastly by girls with early menarche. Polymenorrhea was significantly associated with early menarche, whereas, Oligomenorrhea was significantly associated with late menarche. However, overall, normal menstruation was a rare finding in the current study. Hypomenorrhea was the dominant feature in all groups (early, medium and late menarche groups). Both hirsuitism and dysmenorrhea were significantly associated with medium and late menarche.

The hormonal levels of adolescent girls categorized according to onset of menarche are shown in table 4. There was no significant difference in mean serum LH but normal serum LH was significantly associated with early menarche. There was significant difference in mean serum FSH among girls according to onset of menarche ($p = 0.020$) in such a way that high serum FSH was more frequently seen in medium and late onset. There was highly significant difference in mean serum testosterone among girls according to onset of menarche ($p< 0.001$) in such a way that high serum level was more frequently seen in medium and late onset.

Ultrasound findings and treatment given to girls enrolled in this study according to onset of menarche are shown in table 5. Poly cystic ovary syndrome (PCOS) was more frequently seen in association with late and medium onset in a highly significant manner ($p< 0.001$). Most of participants were receiving Progyluton tab(hormonal treatment) and or metformin (Glucophage850 mg) for control of their symptoms.

Table 1: Mean age and onset of menarche of girls enrolled in this study

Characteristic	Result
Number of cases	207
Age (years)	
Mean ±SD	14.61±1.86
Range	10 -16
Early adolescence, *n* (%)	61 (29.5 %)
Late adolescence, *n* (%)	146 (70.5 %)
Menarche (years)	
Mean ±SD	12.43±1.69

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Range	8 -15.2
Early, *n* (%)	85 (41.1 %)
Medium, *n* (%)	108 (52.2 %)
Late, *n* (%)	14 (6.8 %)

SD: standard deviation; ***n***: number of cases

Table 2: Body mass index of adolescent girls categorized according to onset of menarche

Characteristic	**Early** ***n* = 85**	**Medium** ***n* = 108**	**Late** ***n* = 14**	***p***
BMI (kg/m^2), Mean ±SD	20.21 ±3.48 B	21.76 ±3.26 B	22.68 ±4.43 A	0.002 O HS
Underweight, *n* (5)	26 (30.6 %)	22 (20.4 %)	3 (21.4 %)	
Normal, *n* (5)	54 (63.5 %)	75 (69.4 %)	8 (57.1 %)	
Overweight, *n* (5)	5 (5.9 %)	10 (9.3 %)	2 (14.3 %)	
Obese, *n* (5)	0 (0.0 %)	1 (0.9 %)	1 (7.1 %)	

BMI: body mass index;**SD**: standard deviation; n: number of cases; **O**: one way ANOVA; **HS**: highly significant at $p \leq 0.01$; capital letters (A and B) were used to indicate the level of significance after performance of post hoc Dunnetts' T3 multiple comparison test so that similar letters indicate no significance whereas different letters indicate significant difference

Table 3: Characteristics of menstrual cycle and associated clinical features according to onset of menarche

Characteristic	**Early** ***n* = 85**	**Medium** ***n* = 108**	**Late** ***n* = 14**	***p***
Length of menstrual cycle Mean ±SD	47.72±42.68 C	66.39±43.07 B	96.00±49.20 A	< 0.001 O HS
Polymenorrhea, *n* (%)	42 (49.4 %)	27 (25.0 %)	2 (14.3 %)	0.001 O HS
Normal, *n* (%)	7 (8.2 %)	7 (6.5 %)	0 (0.0 %)	
Oligomenorrhea, *n* (%)	36 (42.4 %)	74 (68.5 %)	12 (85.7 %)	
Duration of flow Mean ±SD	3.38±1.43 A	3.18±1.51 A	2.57±1.50 A	0.151 O NS

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	Hypo menorrhea, *n* (%)	53 (62.4 %)	76 (70.4 %)	12 (85.7 %)	0.133 O NS
	Normal, *n* (%)	31 (36.5 %)	29 (26.9 %)	1 (7.1 %)	
	Menorrhagia, *n* (%)	1 (1.2 %)	3 (2.8 %)	1 (7.1 %)	
Clinical features					
	Hirsuitism, *n* (%)	8 (9.4 %)	42 (38.9 %)	8 (57.1 %)	<0.001 O HS
	Dysmenorrhea,*n* (%)	34 (40.0 %)	83 (76.9 %)	12 (85.7 %)	<0.001 O HS

SD: standard deviation; n: number of cases; **O**: one way ANOVA; **HS**: highly significant at $p \leq 0.01$; **NS**: not significant at $p > 0.05$; capital letters (A and B) were used to indicate the level of significance after performance of post hoc Dunnetts' T3 multiple comparison test so that similar letters indicate no significance whereas different letters indicate significant difference

Table 4: Hormonal levels of adolescent girls categorized according to onset of menarche

Characteristic		**Early** ***n* = 85**	**Medium** ***n* = 108**	**Late** ***n* = 14**	***p***
LH		3.05 ±1.44	2.93 ±1.72	2.35 ±1.20	0.311 O NS
	Mean ±SD	A	A	A	
	Low, *n* (%)	22 (25.9 %)	44 (40.7 %)	7 (50.0 %)	0.049 C S
	Normal, *n* (%)	63 (74.1 %)	64 (59.3 %)	7 (50.0 %)	
FSH		5.09 ±1.84	5.86 ±2.53	6.50 ±2.40	0.020 O S
	Mean ±SD	B	A	A	
	Low, *n* (%)	9 (10.6 %)	12 (11.1 %)	2 (14.3 %)	0.200 C NS
	Normal, *n* (%)	65 (76.5 %)	68 (63.0 %)	8 (57.1 %)	
	High	11 (12.9 %)	28 (25.9 %)	4 (28.6 %)	
Testosterone		0.24 ±0.19	0.44 ± 0.31	0.49 ±0.36	< 0.001 O HS
	Mean ±SD	B	A	A	
	Normal, *n* (%)	81 (95.3 %)	68 (63.0 %)	7 (50.0 %)	< 0.001 O HS
	High, *n* (%)	4 (4.7 %)	40 (37.0 %)	7 (50.0 %)	

SD: standard deviation; n: number of cases; **O**: one way ANOVA; **HS**: highly significant at $p \leq 0.01$; **NS**: not significant at $p > 0.05$; S: significant at $p \leq 0.05$; capital letters (A and B) were used to indicate the level of significance after performance of post hoc Dunnetts' T3 multiple

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comparison test so that similar letters indicate no significance whereas different letters indicate significant difference

Table 5: Ultrasound findings and treatment given to girls enrolled in this study according to onset of menarche

Characteristic	**Early** ***n*** **= 85**	**Medium** ***n*** **= 108**	**Late** ***n*** **= 14**	***p***
US				
Negative, *n* (%)	71 (83.5 %)	53 (49.1 %)	6 (42.9 %)	
PCOS, *n* (%)	7 (8.2 %)	43 (39.8 %)	7 (50.0 %)	< 0.001 C HS
Ovarian cyst, *n* (%)	7 (8.2 %)	12 (11.1 %)	1 (7.1 %)	
Follow up				
Nothing, *n* (%)	2 (2.4 %)	1 (0.9 %)	0 (0.0 %)	
Progyluton, *n* (%)	70 (82.4 %)	67 (62.0 %)	8 (57.1 %)	----
Progyluton+Metformin, *n* (%)	9 (10.6 %)	38 (35.2 %)	6 (42.9 %)	

n: number of cases; C: Chi-square test; HS: highly significant at $p \leq 0.01$; Chi-square was not calculated in cases of follow up because more 20 % of cells had expected count of < 5

Discussion

In the current study, early menarche was a common finding accounting for 85 (41.1 %), which is a relatively a high figure. In one study, which was performed in Bangladesh the prevalence of early menarche was estimated to be approximately 48 %[(22)], which is higher but in consistence with high prevalence of early menarche in Asian population, therefore is supports our findings. Similarly, in Pakistan, about 46 % of girls reach menarche at an early age [(23)], in accordance with our observation. In the current study, the mean age at time of menarche was 12.43 ±1.69 years which is in line with previous studies [(22)]. There is in general a decline in mean age at menarche globally according to several previous reports [**(24-27)**].

In the present study, obesity and hormonal disturbances were seen in association with late onset menarche; in addition, PCOS changes were common and more frequently associated with late onset menarche. The association between body fat content and obesity has been previously discussed.

It has been shown that onset of menarche is associated with critical body weight gain [(23)]. In contrast to our study, obesity and higher subcutaneous fat had been shown to be associated

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with early menarche [28,29]. However, in a recent, meta-analysis, it has been shown that the association between obesity and age of menarche is inconsistent [30]. Two previous studies have denied any significant association between menarche onset and BMI [31,32].

In this study, high serum FSH was more frequently seen in medium and late onset and high serum testosterone level was more frequently seen in medium and late onset menarche. These findings, combined with Oligomenorrhea and cystic changes in most participant girls can lead to suggestion that anovulation is the main cause behind high FSH and high testosterone levels. In our study, polymenorrhea was significantly associated with early menarche, whereas, Oligomenorrhea was significantly associated with late menarche. However, overall, normal menstruation was a rare finding in the current study. Hypo menorrhea was the dominant feature in all groups (early, medium and late menarche groups). Both hirsuitism and dysmenorrhea were significantly associated with medium and late menarche. According to ultrasound results, in this study, poly cystic ovary syndrome (PCOS) was more frequently seen in association with late and medium onset.

It has been shown in previous reports that high testosterone was seen in adolescent girls with Oligomenorrhea[33]. High FSH correlates with hormonal abnormalities in association with anovulation and Oligomenorrhea in adolescent girls. Abnormal pattern of hypothalamic-pituitary-ovarian axis has been suggested in the pathogenesis of ovarian cystic disease. A change in the secretion pattern of the "gonadotropin-releasing hormone (GnRH)"leads to the relative rise in FSH release [34]**.** Actually, the relationship among hormonal profile and pattern of menstruation is so complicated and out of scope of current study.

Conclusion

Early menarche is common in our community. Obesity is associated with late menarche and disturbed FSH and testosterone in late onset menarche may explain the occurrence of PCOS in association with late onset menarche.

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