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Age at Menarche Among Adolescent Girls in Al-Ramadi/ Al-Anbar 2023

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ABSTRACT

Background: *The age at which a female reaches sexual maturity is critical in determining her future reproductive health and success.*

Objectives: *To determine the average age at menarche of adolescent Iraqi girls in Al-Ramadi city and its determinants.*

Patients and methods: *A cross-sectional study conducted at Al-Ramadi city during the period from first of March to the 30th of November 2023. The study included 380 female students who were selected from four intermediate and secondary schools in Al-Ramadi educational sector. Structured interview schedule was used to collect data. Analysis was done using statistical software; SPSS, and the statistical tests were applied accordingly at P. value ≤ 0.05 level of signifciance.*

Results: *The mean age at menarche was 12.4±1.2 years. A significant association was found between age at menarche and each of mother's employee and high educational level, larger body mass index (BMI), realistic type of movies, physical inactivity, and previous exposure to violence, (P. value <0.05).*

Conclusion: *The observed age at menarche was lower than age at menarche that reported in developed and many developing countries.*

Keywords: *Adolescence, Biological transformation, Menarche, Determinants*

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1. INTRODUCTION

Adolescence is a transitional period between childhood and adulthood (1). This is not only a phase of human development, in which biological transformation and manifestations occur, in addition to the typical psychosocial once. The adolescent life is a phase characterized by interrelationships between the various organic, psychoemotional and sociocultural dimensions, translated specifically by different societies and cultures (2). It is ranging from 10 to 19 years of age (3). At this stage of adolescence, the body undergoes profound and rapid transformations due to the hormonal changes that accelerate the physical growth and also the development of secondary sexual characteristics (2). The term menstruation refers to a normal physiological process that occurs during adolescence years and it is defined as periodic and cyclic shedding of progestational endometrium accompanied by loss of blood. It takes place at approximately 28 days interval during period from menarche and menopause (4). Menarche is defined as the onset of menses or the first time that females experience menstruation. Menarche is considered a very significant event in the life of the woman, characterized as the beginning of her reproductive life and involving major transformations of somatic, metabolic, neuromotor and psychosocial order (5). Puberty does not end with menarche, it takes at least two years and more for a child to be sexually mature and usually the female body still has a time to go from the time of menarche to the time she is sexually able to reproduce, the first sign of puberty is usually breast budding, followed by appearance of pubic or axillary hair, maximal growth or peak height velocity is usually the next stage. Menarche represents a concrete symbol of a shift from a girl to a woman (6). For most females, age at menarche (AAM) occurs between 10 to 16 years (7). Although, the precise determinants of menarcheal age remain to be understood, there are two major groups of interacting factors, which can influence age of menarche including genetic and non-genetic determinants. The contribution of genetic factors to age at menarche is estimated to be about 57-82% (8). The age of menarche varies in different parts of the world; many factors influence the age of menarche which includes, socioeconomic status, nutritional status of girls, area of residence, geographic region, racial, climatic and cultural background. A significant change in the way of living include changes in traditional and cultural practices like

food habits, free time activities, sleep and work patterns, lifestyle pattern, habits and adoption of modern lifestyle. This can be attributed to the drastic increase in the population, increased physiological stress, rapid urbanization and industrialization (9). Age of menarche has largely decreased in most developed countries in recent decades (5,9) and seems stabilized at 13±0.5 years (10-13). Good nutrition, good socioeconomic status and good health had declined the age of menarche among different population since two decades ago (14), in a cancer survey in Saudi Arabia, a difference of 0.4 year in the age at menarche was reported between women born 20 years ago and women born 45 years ago(15). Change in age of menarche occurs in Arabian countries with rapid change in socio-economic status and seems to be similar to that among high school students in most western countries such as Italy and US (16,17). Sickle cell anemia and certain systemic or chronic illness can delay onset of menarche (18-20). Early menarche is known to be a greater risk of psychosocial as well as physical health problems in women. Late menarche may be associated with an increased risk of Alzheimer's disease and stroke, as well as lower fertility (21-27). In Iraq, previous reports stated that the average age at menarche was 11.7-11.8 years and it was affected by some determinant factors (32-34). The importance of age at menarche came from its potential impact on early matured girls 'physical and psychological heath, which highlights the need to monitor the changes in age at menarche in Al-Anbar governorate, where life style, socioeconomic status, and dietary factors are rapidly changing, therefore, the present study aimed to fill part of the gap in the field and add to the scientifically sound growing literature about age at menarche in our country. Hence, our objective is to determine the average age at menarche of adolescent Iraqi girls in Al-Ramadi city and the factors that may play a role as determinants

2. METHODOLOGY

A cross sectional study that was carried out in four secondary and intermediate schools in Al-Ramadi / Al-Anbar during the period from March to the 30th of November 2023.

Multistage random sampling technique was applied at Al-Ramadi educational sector, and Al-Ramadi center was selected conveniently. Four schools were selected. Adolescent girls were conveniently selected from the four schools

Inclusion and exclusion criteria:

Iraqi adolescent female students attended first- sixth level of education in four intermediate and secondary schools in Al-Ramadi city were included while the students who were absent at the day of interview, and those who refused to participate were excluded.

Sample size: Sample size was calculated according to the standard equation for cross sectional studies and the calculated sample size was 380 female students

Data collection:

Data were collected through direct interview between the researcher and the study participants to fill pre-structured questionnaires that prepared for the purpose of the study. Confidentiality and privacy of the participant girls and anonymity of the information were strictly assured.

In addition to the interview and filling the questionnaires, weight and height of the participants were measured using standard scales and the BMI was calculated using standard equation and classified into four categories as: underweight BMI <18.5 kg/m2, normal weight: BMI 18.5 – 24.9 kg/m2, overweight BMI 25- 29.9 kg/m2, and obese when BMI is ≥ 30 kg/m2.

Definition of variables was adopted from the widely used standard definitions of these terms for exposure to violence including verbal , Physical , Sexual or Psychological, Crowding index (CI) and Harassment.

Ethical consideration and official approval:

Administrative approvals were granted from the official authorities; The Council of Iraqi Board of Community and Family Medicine, Al-Ramadi second educational sector and administration of the selected schools. Additionally, verbal consent was obtained from each participant and her parents. All information kept confidentially in a password secured laptop and data were exclusively used for the purpose of the study.

Statistical Analysis

Analysis of data was carried out using the available the statistical packages for social sciences version 26(SPSS26). Data presented according to the type of variable as frequency, percentage, mean, standard deviation, and range. Scale variables were compared using student's t test and ANOVA accordingly. For qualitative variables, Pearson Chi-square test

used for comparison. Fisher Exact test used when Chi square was inapplicable. Statistical significance was considered when the P value≤ 0.05.

3. RESULTS

This study included 380 female adolescents with a mean age of 14.4±1.6 (Range: 12-19) years; 78.2% of female adolescents were in age group of 12-15 years. Mean body mass index was (19.7 Kg/m2); 42.1% of adolescents were underweight, 50.5% had normal BMI, 6.1% were overweight and 1.3% were obese, (**Table 1**). Distribution of other participants and their parents' characteristics including school grade, residence, crowding index, parents' occupation and education levels are demonstrated in (**Table 1 & 2**). The physical activity of studied adolescents was high in 11.1%, moderate in 35.7% and low in 53.2% of adolescents' girls. Chronic disease was positive in 3.4% participants, (**Table 3**). The history of menarche was positive in 273 (71.8%) participant girls. Mean age at menarche was (12.4 ± 1.2) years; 17.2% of female adolescents had earlier age at menarche of < 12 years. Mean adolescents maternal age at menarche was (13.5 ± 1.2) years; 2.4% of mothers had earlier age at menarche of <12 years. (**Table 4**). The regular internet use was reported by 64.2% of female adolescents and none of them use pornographic websites. Common movie type shown by studied adolescents was comedy (46.1%) followed by horror type (18.9%), more than one type (11.8%), realistic (12.6%), action (7.2%) and romantic (3.4%). (**Table 5**). Exposure to violence was present in 42.4% of female adolescents; commonly lingual (73.3%), followed by; psychological (10.6%), physical (9.3%) and harassment (6.8%). The perpetrator of violence was commonly from strangers (65.2%), followed by colleagues (11.8%), parents (9.9%), relatives (6.8%) and school (6.2%). (**Table 6**). Distribution of demographic characteristics according to age at menarche revealed a significant association between earlier age at menarche and each of younger age of female adolescents (p=0.002), larger body mass index (p<0.001), low school grade, (p<0.001) and urban residence of adolescent females, (p=0.01). No significant association was found between age at menarche and crowding index (P=0.30). (**Table 7**). No significant differences were observed between female adolescents with different ages at menarche regarding fathers' occupation and educational level, in both comparisons (P. value >0.05). A significant association was observed between each of governmental employment and university level of education of mothers of female

adolescents and earlier age at menarche, (P. value <0.05), (**Table 8**). A significant association was found between each of high physical activity of participant adolescents and earlier age at menarche (p=0.01). Nether having chronic diseases nor maternal age at menarche showed significant association with earlier age at menarche of female adolescents , in both comparisons, (P. value>0.05), (**Table 9**). A highly significant association between realistic movie type and earlier age at menarche (p<0.001). No significant differences were observed between female adolescents age at menarche regarding internet usage regularly (p=0.30). (**Table 10**). No significant association was observed between female adolescents age at menarche and violence exposure (p=0.60). A significant association was observed between each of harassment and strangers' violence and earlier age at menarche (p<0.05), (**Table 11**).

Table 1. Demographic characteristics of female adolescents (N=380)*

Variable	Category	No.	%
Age (year)	12-15	297	78.2
	16-19	83	21.8
	mean (SD): 14.4 (1.6)	-	-
BMI	Underweight	160	42.1
	Normal	192	50.5
	Overweight	23	6.1
	Obese	5	1.3
	mean (SD): 19.7 (3.8) kg/m²	-	-
School grade	First	154	40.5
	Second	100	26.3
	Third	102	26.8
	Fourth	3	0.8
	Sixth	21	5.5
Residence	Rural	152	40
	Urban	228	60
Crowding index	≤2	166	43.7
	>2	214	56.3
	mean (SD): 2.6 (1.2)	-	-

*All participants were Unmarried, SD: standard deviation, BMI: body mass index

Table 2. Parental and maternal characteristics of female adolescents (N=380)

Variable	Category	No.	%
Father occupation	Governmental employee	261	68.7
	Self-employee	119	31.3
Parental education	Uneducated	21	5.5
	Primary level	65	17.1
	Secondary level	160	42.1
	University level	134	35.3
Mother's occupation	Governmental employee	101	26.6
	Self-employee	7	1.8
	Unemployed	272	71.6
Mother's education	Uneducated	39	10.3
	Primary level	151	39.7
	Secondary level	88	23.2
	University	102	26.8

Table 3. Physical activity and chronic disease of female adolescents

Variable		No.	%
Physical activity	High	42	11.1
	Moderate	136	35.7
	Low	202	53.2
Chronic disease	Yes	13	3.4
	No	367	96.6

Table 4. Menarche history of female adolescents

Variable		No.	%
Attain menarche	Yes	273	71.8
	No	107	28.2
Age of menarche	<12 years	47	17.2
	12-15 years	226	82.8
	mean (SD): 12.4 (1.2)	-	-
Maternal age at menarche	<12 years	9	2.4
	12-18 years	371	97.6
	mean (SD): 13.5 (1.2)	-	-

Table 5. Internet usage of female adolescents

Variable		No.	%
Internet regularly	Yes	244	64.2
	No	136	35.8
Movie type	Comedy	175	46.1
	Realistic	48	12.6
	Romantic	13	3.4
	Action	27	7.2
	Horror	72	18.9
	More than one type	45	11.8

Table 6. Violence history of female adolescents

Variable		No.	%
Violence exposure	Yes	161	42.4
	No	219	57.6
Type of violence	Lingual	118	73.3
	Physical	15	9.3
	Psychological	17	10.6
	Harassment	11	6.8
Violence perpetrator	Parents	16	9.9
	School	10	6.2
	Colleagues	19	11.8
	Relatives	11	6.8
	Strangers	105	65.2

Table 7. Distribution of demographic characteristics according to age at menarche

Variable		Age at menarche				P. value
		<12 years		12-15 years		
		No.	%	No.	%	
Age (year)	12-15	42	21.8	151	78.2	0.002
	16-19	5	6.3	75	93.8	
BMI	Underweight	11	12.2	79	87.8	<0.001
	Normal	25	15.8	133	84.2	
	Overweight	6	30	14	70.0	
	Obese	5	100	0	0.0	
School grade	First	28	34.6	53	65.4	<0.001
	Second	11	15.9	58	84.1	
	Third	8	8.1	91	91.9	
	Fourth	0	0.0	3	100.0	
	Sixth	0	0.0	21	100.0	
Residence	Rural	10	9.9	91	90.1	0.010
	Urban	37	21.5	135	78.5	
Crowding index	≤2	24	19.8	97	80.2	0.300
	>2	23	15.1	129	84.9	

Table 8. Distribution of parental and maternal characteristics according to age at menarche

Variable		Age at menarche				P. value
		<12 years		12-15 years		
		No.	%	No.	%	
Father's occupation	Governmental employee	25	14.7	145	85.3	0.15
	Self-employee	22	21.4	81	78.6	
Father's education	Illiterate	6	33.3	12	66.7	0.14
	Primary level	8	16.7	40	83.3	
	Secondary level	20	19.6	82	80.4	
	University	13	12.4	92	87.6	
Mother's occupation	Governmental employee	22	27.8	57	72.2	0.008
	Self-employee	0	-	7	100	
	Unemployed	25	13.4	162	86.6	
Mother's education	Illiterate	0	-	36	100	0.001
	Primary level	24	24	76	76	
	Secondary level	4	7	53	93	
	University	19	23.8	61	76.3	

Table 9. Distribution of physical activity, chronic disease and maternal age at menarche according to age at menarche

Variable		Age at menarche				P. value
		<12 years		12-15 years		
		No.	%	No.	%	
Physical activity	High	9	33.3	18	66.7	0.010
	Moderate	21	20.2	83	79.8	
	Low	17	12	125	88	
Chronic disease	Yes	4	30.8	9	69.2	0.180
	No	43	16.5	217	83.5	
Maternal age at menarche	<12 years	3	33.3	6	66.7	0.190
	12-18 years	44	16.7	220	83.3	

Table 10. Distribution of internet usage according to age at menarche

Variable		Age at menarche				P. value
		<12 years		12-15 years		
		No.	%	No.	%	
Internet regularly	Yes	26	15.5	142	84.5	0.300
	No	21	20	84	80	
Movies type	Comedy	19	16.8	94	83.2	<0.001
	Realistic	16	33.3	32	66.7	
	Romantic	0	-	10	100	
	Action	4	19	17	81	
	Horror	0	-	49	100	
	More than one type	8	25	24	75	

Table 11. Distribution of violence history according to age at menarche

Variable	Category	Age at menarche				P. value
		<12 years		12-15 years		
		No.	%	No.	%	
Violence exposure	Yes	17	15.7	91	84.3	0.600
	No	30	18.2	135	81.8	
Type of violence	Lingual	4	5.6	68	94.4	<0.001
	Physical	6	40	9	60	
	Psychological	0	-	10	100	
	Harassment	7	63.6	4	36.4	
Violence perpetrator	Parents	0	-	12	100	0.008
	School	0	-	10	100	
	Colleagues	0	-	15	100	
	Relatives	0	-	7	100	
	Strangers	17	26.6	47	73.4	

4. DISCUSSION

The menstrual cycle has a various patterns. Assessing adolescents' age at menarche and risk factors for earlier or late menarche is essential to relieve anxious adolescents, co-morbidities management and acquiring better life quality. Knowing age at menarche is predictable for community nutrition state, geographical variances, environment effects and socioeconomic level (35). In the current study, the female adolescents that attained menarche contributed for 71.8%. This proportion is higher than results of a recent Indian study where 55.9% of female adolescents aged 9-16 years attained menarche (36). This difference might be attributed to discrepancies in cultural and socioeconomic factors. In present study the mean age at menarche was (12.4 years) which is lower than the mean age of (13.1 years) for female adolescents in Al-Ramadi city (37). An Iraqi study in Baghdad city found a mean age at menarche of (11.8 years) (34). In Nigeria, a mean age at menarche was (16.2 years) (35), while in Saudi Arabia, it was (12.46 years) (38). These differences may be related to differences in socioeconomic status, obesity prevalence and environmental factors. In our

study, 17.2% of female adolescents had earlier age at menarche. This prevalence of early menarche is lower than prevalence of (42.4%) in Karbala city (Southern Iraq) (39). Our study prevalence of early age at menarche is higher than results of previous study in France which reported that only (5.3%) of female adolescents had early menarche (40). The current study found that mean adolescents maternal age at menarche was (13.5 years); 2.4% of mothers had earlier age at menarche (below 12 years). This finding is similar to results of prevvious literatures (41,42), where a gap in age at menarche between mothers and daughters leading to a downward secular trend and an obvious decline adolescents' age at menarche. However, age at menarche is also affected by geographical location and environmental factors in same community in addition to effect of socioeconomic status of families (43). Recent population-based study in South Korea stated that early menarche history is a significant predictor of poor health status for women especially during future pregnancy (44). In the present study, violence exposure was present in 42.4% of female adolescents. This prevalence is lower than prevalence of (54.1%) for violence exposure among female adolescents reported by recent study in United States of America (45). In Iraq, a study reported a significant relationship between violence exposure of adolescents and poor academic achievement (46). The present study found a significant association between younger age of female adolescents and earlier age at menarche; this finding coincides with results of previous study in United States of America which found lower mean age of adolescents with early age at menarche (47). In our study, a highly significant association was observed between increased body mass index of female adolescents and earlier age at menarche ($p<0.001$). Similarly, a cross sectional study conducted in Indonesia found that overweight/obesity of female adolescents was regarded as a risk factor for early age at menarche (48). The current study found a highly significant association between low school grade of female adolescents and earlier age at menarche ($p<0.001$). This finding is consistent with results of recent cross sectional study carried out in Indonesia which revealed that earlier age at menarche was accompanied by low school grade of female adolescents (49). Our study showed a significant association between urban residence of female adolescents and earlier age at menarche ($p=0.01$). This finding is parallel to results of Iraqi study which reported that mean age at menarche for adolescents living in urban areas was (12.4 years),

while in rural areas was (12.9 years) with a significant difference (50). In present study, a significant association was observed between governmental employment of female adolescents mothers and earlier age at menarche (p=0.008). Consistently, previous Iraqi study revealed a significant association between mothers' employment and earlier age at menarche among female adolescents (51). Our study showed a significant association between university level of female adolescents mothers and earlier age at menarche (p=0.001). This finding is similar to results of previous cross sectional study in Iraq which reported that female adolescents with highly educated mothers had significantly earlier age at menarche (52). In current study, there was a significant association between high physical activity of female adolescents and earlier age at menarche (p=0.01). This finding is inconsistent with our study findings regarding obesity. However, this contradictory regarding relation between physical activity and early age at menarche among adolescents coincides with results of systematic review study conducted in United Kingdom which stated that the relationship between physical activity and early age at menarche among adolescents is affected by many factors like lifestyle and behavior of adolescents in addition to type and definition of the physical activity (53). The present study found a highly significant association between realistic movie type and earlier age at menarche (p<0.001). This finding is inconsistent with results of recent study in Taiwan which found that exposure of female adolescents to sexual movies is related to early age at menarche (54). This inconsistency might be related to differences in cultural and regional aspects between different societies. In our study, a highly significant association was observed between harassment of female adolescents and earlier age at menarche (p<0.001). This finding coincides with results of Turkish study which stated that harassment of female adolescents leads to earlier age at menarche (55). On other hand, a study carried out in Ghana found that earlier age at menarche of female adolescents made them more vulnerable for sexual harassment (56). Our study showed a significant association between strangers violence of female adolescents and earlier age at menarche (p=0.008). Consistently, a study carried out in United States of America found that early age at menarche was significantly related to strangers' violence (57). The main limitations of present study were the inability to assess temporal relationship (cross sectional study) and it was a single center study.

5. CONCLUSIONS

The age at menarche among Iraqi female adolescents in Al-Ramadi city/Al-Anbar was declining. There is a gap in age at menarche between mothers and daughters. The prevalence of violence exposure among female students is high. The risk factors for early age at menarche among female adolescents are younger age, increased body mass index, urban residence, mothers' employee and high educational level, realistic movie type and harassment by strangers. We recommend education programs regarding adolescence health and especially regarding violence exposure and harassment, also we highly suggest conducting further studies on a national level for more precise conclusions.

Ethical Approval:

All ethical issues were approved by the author. Data collection and patients' enrollment were in accordance with Declaration of Helsinki of World Medical Association, 2013 for the ethical principles of researches involving human. Signed informed consent was obtained from each participant and data were kept confidentially.

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