Original Research Article

Impact of habitual activities on age of menarche among Bengali adolescent school girls

ABSTRACT:

Background: Menarche, the first menstrual bleeding is the signal of initiation of reproductive age of girls. There was a secular decline in the average as at menarche. Age at menarche has significant impact on health in adulthood.

Objectives: The present study was an attempt to assess the mean age at menarche and to determine impact of habitual activities on age at onset of menarche.

Methods: A cross sectional questionnaire based study wasconducted among school girls having age limit 10-14 years who experienced menarche not more than previous three months. Subjects were divided into two group- experimental and control. Experimental group consisted of subjects those attained menarche below 11.5 years. Subjects of control group attained menarche above 11.5 years. Quantitative data were presented as percentage and/or mean ± standard deviation. t-test was done to determine significant of difference between physical characteristics of females early age at menarche and reference age at menarche. Chi square test and logistic regression analysis were done for analysis of our results.

Results: 23% of study population acquired menarche at age below 11.5 years. Anthropometric parameters differed significantly between experimental and reference group. Significant association was observed between age at menarche with habitual activities. Logistic regression analysis suggested that habitual activities might be considered as determinants of early menarche.

Conclusion: Risk of early menarche increases with increasing duration of screen time and decreasing duration of daily physical activities like walking, outdoor playing and bicycle riding. Adolescent girls should encourage for physical activities and minimize including screen time.

Key words: Early menarche, walking, playing, cycling, screen time

INTRODUCTION

Menarche, the first menstrual bleeding, is a signal that indicates that a girl is entering into a reproductive age. Onset of menarche has been found to vary across countries. The mean age at menarche among US girls was 12.34 years (1) and India 12.6 years (2).Literature survey indicates that the average age of menarche has beendecreased significantly in last 100 years. In the most develop countries like Europe and USA menarcheal age is decreased at a rate of 2-3 month per decade (3). Recently such a decline tendency has also been reported in developing countries (4).Studying the age at menarche is quite interesting due to the huge public health implication associated with the changes in age at menarche. Girls with early menarche tend to have depression (5) metabolic syndromes (6), glucose intolerance (7), breast cancer (8), and cardiovascular disease (9). Younger age at menarche is a well-known risk for unplanned pregnancy, unsafe abortion, endometrioses sexually transmitted diseases including AIDS (10, 11). Late menarche is associated with increased risk of osteoporosis (12).

From the early 1800s to the mid of 1950s menarche was occurredat increasingly younger ages (3). The declining trend is still continuing in many parts of the world (13, 14). The advancement of socioeconomic and health condition in the 20th century led to shift to earlier menarcheal age. This shift was noted worldwide and called secular trend (15, 16). Depending on studies early menarche is defined from 9 to 11.5 years (17).

Various factors like socioeconomic status, genetic, heredity, ethnicity, psychological stress and chronic illness have been postulated to affect the age at menarche (18, 19). Girls involved in physical activities had a lower chance for early menarche (20). Physical inactivity isnow considered as predisposing factors of early menarche (21). A recent study reported that physical inactivity and more sleeping hours induce early onset of menarche and physically inactive girls were overweight and mature at an early age (22).

During the past decades there have been remarkable change in way of living including food habit, free time activities, sleep and work patterns, lifestyle pattern and habits. With the advancement of technology and more scope of social media every section of society hasdeclined their habitual physical activity. People including adolescent prefer to remain sedentary (23). This study was aimed to investigate the influence of habitual activities of the individual over the menarcheal age.

MATERIALS AND METHODS

***Subject*:** A cross-sectional study was done in Hooghly district and adjoining areas. The population was unmarried Bengali female adolescent students who were randomly selected from Secondary schools in the age group between 10 to 14 years who experienced

menarche not more than previous three impact months to avoid significant change in physical features. It has been reported that there is no change in body weight greater than 5% in the previous three month (24). Students having age less than 10 years or more than 14 years, married, who have not started menstruating, Who has previous experienced of menarche more than three month, those who were taking regular drugs or hormonal therapy and suffering from chronic disorders including diabetes mellitus, clinically established hypertension, liver cirrhosis and kidney disease, suffering with secondary dysmenorrhea were excluded from the study.

Sample size: This is cross sectional study using qualitative variable. Thus sample size was calculated using following equation: sample size = $(Z_{1\text{-alfa}/2})^2$ p (1-p)/d^2. Where $(Z_{1\text{-alfa}/2})$ = standard normal variate (at 5% type 1 error (confidence level 95%) where P<0.05 it is 1.96. As in majority of studies P values are considered significant below 0.05 hence 1.96 is used in formula. 'P' is expected proportion in population based on previous studies or pilot studies (according to previous studies girls with early age at menarche may not be more than 20%. 'd' is absolute error or precision (margin of error). It is considered as 5%. Thus sample size = 1.96^2 x 0.20 (1-0.20) / 0.05^2 = 245.86. Thus for this cross sectional study at least 246 subjects should be taken.However, to accommodate a nonresponsive participant and strongest statistical power and effect size (design effect and population correction factor) the sample size was projected to 400. 426 students were participated in this study. Out of which 26 subjects' data were discarded due to some incomplete information.

***Data collection*:** A self-administered questionnaire having questions related to their age, age when menarche appear and socioeconomic characteristics and life style. Age at menarche was obtained through recall, by calculating the time period between the day subjects menstruated first time and the date of birth.

Questionnaires for data Collection from participants

1. Name: 2. Address: 3. Locality: (Rural/urban/Semi urban) Under (Panchayet/Municipality/ Corporation) **4. Date of birth/Age** (in year and month) **5. Date of menarche/age at menarche (**in year and month) **6. Occupation:7. Participation in exercise/yoga:** (Yes/No); if Yes mention frequency/week: and duration /day **8. Participation in outdoor games:** (Yes/No); if Yes mention frequency/week: and duration /day **9. Involve in bicycle riding:** (Yes/No); if Yes mention frequency/week: and duration /day **10. Involve in walking:** (Yes/No) if Yes mention frequency/week: and duration /day **11. TV watching: (**Yes/No**)** if yes mention duration /day **12. Mobile phone use**: (Yes/No) if Yes mention duration /day and purpose of use.

***Anthropometric measurement*:** Body weight was measured in light clothing and bare feet using bathroom scale accurate to 0.5kg. The scale was kept on a flat surface and adjusted with '0' mark. Now the subject was requested to step on it in bare feet. Weight was recorded to the nearest 0.5kg. Height was measured using anthropometric rod without footwear on to the nearest 0.1 cm (20).BMI was calculated from the height and weight using following equation: BMI (kg/m^2) = weight (kg) / $height^2$ (m).WC was measured mid-way between iliac crest and lowermost margin of the ribs in quiet breathing using plastic tape (25). Hip circumference

(HC) was measured using plastic tape at horizontal level of greater trochanters with the leg close together.

***Assessment habitual activities*:** Information on the frequency and duration of outdoor playing, riding bicycle, free hand exercise, time spent in mobile phone for communication, whatsapp chatting, playing online games and listening songs and time spent in watching television (TV) program were retrieved from study questionnaire.

***Statistical analysis*:** Quantitative data were presented as percentage and/or mean ± standard deviation. t-test was done to determine significant of difference between physical characteristics of females early age at menarche and reference age at menarche. Chi square test was done for assessment of association between age at menarche and study parameters. Bivariate and multivariate logistic regression analysis was done to evaluate the impact of physical characteristics and habitual activities on early menarche. The significance level of the tests were considered at a significance level of 0.05.

RESULTS:

Age at menarche varies from 100 month to 172 month. Mean age at menarche was 150.11 ± 9.36 month. Study population were divided into two group; Reference and experimental. Reference group consists of school girls those attained menarche at 11.5 to 14.4 years of age (138 month to 173 month). Whereas experimental group is composed of girls those attained menarche at age below 11.5 years (<138 month). Basic characteristics of controland experimental group of girls was given in table-1. There was significant difference physical characteristics between experimental and control group of subjects.

Table-1: Comparison of Basic characteristics of control and experimental group of adolescent girls

Parameters	Controlgroup(age at menarche 11.5 to 14.5 year)	Experimental Group (age at menarche <11.5 year)	P value
Number of participants	308 (77%)	92 (23%)	-------
Height (cm)	152.71 ± 5.80	152.36 ± 6.63	> 0.05
Weight (kg)	46.77 ± 10.12	52.34 ± 12.77	< 0.001
Waist circumference (cm)	59.71 ± 7.03	64.39 ± 7.52	< 0.001
Hip circumference (cm)	64.99 ± 7.55	68.13 ± 7.47	< 0.01
BMI (kg/m^2)	20.00 ± 3.77	22.39 ± 4.31	< 0.001
Waist- hip ratio (WC: HC)	0.92 ± 0.04	0.94 ± 0.03	< 0.001
Waist height ratio (WC: Ht)	0.40 ± 0.05	0.43 ± 0.05	< 0.001

Distribution of subjects on the basis of age at menarche was given in a figure-1. 23% subjects acquired menarche at an early age.

Duration of physical activities of reference and experimental group of girls was given in table-2. There was significant difference of duration of physical activities between experimental and reference group of subjects. Girls those spent more time in physical activity attend menarche in late age.

Table-2: Comparison of physical activity duration between control and experimental group

Parameter	Control group	Experimental group	p
Walking (hour/day)	0.988 ± 0.707	0.591 ± 0.538	< 0.001
Playing (hour/day)	1.144 ± 0.806	0.742 ± 0.567	< 0.01
Bicycle riding (hour/day)	0.967 ± 0.691	0.692 ± 0.536	< 0.02
Total activities (hour/day)	3.084 ± 1.472	2.069 ± 1.052	< 0.001

Duration of screen time (enjoy TV program and mobile phone)ofreference and experimental group of girls was given in table-3. There was significant difference in time spent in screen of TV and mobile phone between experimental and reference group of subjects. Girls with more screen time attend menarche in early age.

Table-3: Comparison of screen time between Control and experimental group of girls

Parameter	Control group	Experimental group	p
Television (hour/day)	1.187 ± 0.747	1.802 ± 0.867	< 0.001
Mobile phone (hour/day)	1.797 ± 0.975	2.091 ± 0.824	< 0.05
Television + mobile phone (hour/day)	2.967 ± 1.353	3.890 ± 1.232	< 0.001

Results of chi square test for association between habitual activities with age at onset of menarche (table-4) suggest that outdoor playing, walking, ridings of bicycle, time spent in mobile phone and time spent in TV watching significantly ($p<0.05$) associated with menarcheal age.

Table-4: Chi square test for association of habitual activities with age at menarche

Parameters		**Age at menarche**		**Chi square (df)**	**P value**
Name	**Subgroup**	**11.5 to 14.4 year**	**< 11.5 year**		
Walking (min/day)	0-30	80	38	8.326 (2)	< 0.02
	31-60	116	25		
	> 60	112	29		
Playing (min/day)	0-30	66	33	8.089 (2)	< 0.02
	31-60	128	33		
	> 60	114	26		
Bicycle riding (min/day)	0-30	98	43	6.968 (2)	< 0.05
	31-60	120	29		
	> 60	90	20		
Walking+ Playing+ Cycling	0-120	94	52	23.120(2)	< 0.001
	121-240	140	32		

(min/day)	≥ 241	74	8		
Mobile phone use (min/day)	0-60	114	15	22.621 (2)	< 0.001
	61-120	126	36		
	>120	68	41		
TV	0-60	174	28	35.385 (2)	< 0.001
	61-120	98	30		
	>120	36	34		
Mobile + TV	0 - 120	94	12	25.104 (2)	< 0.001
	121-240	154	40		
	> 240	60	40		

We calculated odd ratio and relative risk for parameters of behavioral activities for assessment of influence for early menarche. Results of logistic regression analysis for assessment of behavioral activity and risk of early menarche was given in table-5. Physical activities like walking, playing and bicycle riding delayed onset of menarche. Odd ratio and relative risk of early menarche decreased significantly in girls those involve in physical activities more than 30 min/day. Total duration of behavioral activities more than 2hour/day significantly decreases risk of early onset of menarche.

Table-5: Logistic regression analysis for physical activities and age at menarche

Parameter		Age at menarche		**OR**	**95% CI**	p
Name	Sub group	**11.5 to 14.4 year**	**< 11.5 year**			
Walking (min/day).	0-30	80	38	Ref	--	--
	31-60	116	25	0.454	0.254 – 0.810	0.0075
	> 60	112	29	0.545	0.311 – 0.956	0.0343
Playing (min/day)	0-30	66	33	Ref	----	---
	31-60	128	33	0.516	0.293 – 0.909	0.0219
	> 60	114	26	0.456	0.251 – 0.828	0.0099
Bicycle riding (min/day)	0-30	98	43	Ref	---	---
	31-60	120	29	0.551	0.321 –0.946	0.0308
	> 60	90	20	0.506	0.277 – 0.925	0.0270
Total physical activity	0-120	94	52	Ref	---	---
	121-240	144	32	0.413	0.247 to 0.689	0.0007
	≥ 241	74	8	0.195	0.087 to 0.437	0.0001

Risk of early menarche was more in girls those spent more time in mobile serving and TV watching. In respect to reference group (those spent 0-60 min/day in mobile) odd ratio was 2.17 and 5.7 times

for girls those spent 61-120 min and more than 120 min in mobile use respectively. Like mobile phone use, similar pattern was noted for TV watching. Total screen time more than 2 hour/day significantly increases risk of early onset of menarche (table-6).

Table-6: Logistic regression analysis for screen time and age at menarche

Parameter		Age at menarche		**OR**	**95% CI**	p
Name	Sub group	**11.5 to 14.4 year**	**< 11.5 year**			
Use of Mobile (min/day)	0-60	114	15	Ref	---	---
	61-120	126	36	2.171	1.130 – 4.174	0.0200
	>120	68	51	4.582	2.361 – 8.895	0.0001
TV	0-60	174	28	Ref	---	---
	61-120	98	30	1.902	1.074 to 3.369	0.0274
	>120	36	34	5.634	3.171 to 10.862	0.0001
Mobile + TV	0 - 120	94	12	Ref	---	---
	121-240	154	40	2.035	1.016 to 4.074	0.0449
	> 240	60	40	5.222	2.537 to 10.749	0.0001

DISCUSSION

The finding of this study revealed that there was significant difference in the habitual pattern between reference group and experimental group of girls. It was also found in this study that behavioral activities whether active or sedentary plays significant role on age of onset of menarche. Physically active life style is a type of lifestyle involving more physical activities like outdoor playing, walking, bicycle riding etc. Sedentary lifestyle is a type of lifestyle involving little or no physical activity and spent time in lying down or sitting state and engaged in activities like socializing, watching TV, playing video games or using mobile phone. It is seen that girls those attend menarche at an early age are sedentary in compare with control group of girls. It is evident from the previous studies that lack of physical activity is associated with earlier onset of menarche (26).

Low physical activity and high sedentary time increases the risk of overweight and obesity particularly among adolescent girls (27). It is also reported that obesity is associated with physical inactivity and sedentary behavior (28). Screen time is positively associated with obesity (29). In our study girls those attained menarche at an early age are physically inactive and involve more in sedentary time like screen time hence more chance of overweight and obese (high BMI). Results of our study reported that BMI and other anthropometric obesity indices significantly higher in girls those attained early menarche than control group. Body weight, BMI of a subject influence the age at menarche (30, 31). In our previous study we reported that increase in BMI is associated with decrease in menarcheal age (32). The inverse relationship between BMI and age at menarche was supported by many other studies (33, 34). It has been proposed that effect of physical

activity on menarche time is mediated by volume of adipose tissue (35). The adipocyte secretes hormone leptin which increases with the amount of body fat. Leptin stimulate hypothalamus to secrete gonadotropin releasing hormone which in turn stimulate pituitary-ovarian axis and reproductive maturation in women (36).

Physical activity reduces endogenous estrogen by increasing metabolism and excretion whereas sedentary lifestyle reduces metabolism and excretion of estrogen (37). Thus endogenous estrogen levels become high in girls those are physically less active and spent more sedentary time. It is well established that estrogen plays a major role in onset of menarche as first menstruation is anovulatory (estrogen break through bleeding). Thus endogenous high estrogen level due to less physical activity and more screen time may be one of the cause of early onset of menarche.

CONCLUSION

The present study reveals that behavioral activities significantly influence the age at menarche. The girls who had a sedentary lifestyle pattern attained menarche earlier compare to those who had active lifestyle pattern. Physical inactivity is one of the risk factor of early onset of menarche. Risk of early menarche increases with increasing duration of screen time and decreasing duration of daily physical activities like walking, outdoor playing and bicycle riding. Adolescent girls should encourage for physical activities along with their study scheduled and minimize sedentary lifestyle including screen time.

CONSENT AND ETHICAL APPROVAL

The study was non-invasive. The prior written permission of the Institutional authority was taken. The written informed consent was obtained from the study participants and their parents after the purpose of the study was explained. Participants were informed that the data obtained from them would be kept confidential.

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