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Factors Associated with Age at Menarche of Secondary School Girls in Rajshahi City, Bangladesh

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Abstract **Background:** Early onset of menarche is a risk factor for breast cancer on the other hand delayed menarche affects the reproductive function. The aim of the present study is to investigate the effects of anthropometric measures and parents' socio-demographic factors on age at menarche among secondary school girls in Rajshahi City, Bangladesh. **Methods:** The data was collected from 300 students from several secondary schools in Rajshahi City, Bangladesh. ANOVA and Student t-test were performed to find the relationship between the age at menarche and body measurements and different socio-demographic factors of the parents. **Results:** The results revealed that the mean and median ages at menarche of secondary school girls were 12.19±1.04 and 12.75 years, respectively. More than 68% school girls reached menarche in normal age (12-13 years), and only 5.70% got menarche at early age (9-10 years). Student t-test demonstrated that taller girls reached menarche significantly ($p<0.05$) earlier than their counterparts whereas underweight girls got menarche significantly ($p<0.05$) later than normal and overweight girls. Early menarche was especially found among the girls who came from high socio-economic status, having relatively high chest circumference and with both the parents working in government or non-government organizations. **Conclusion:** The results suggest that heavier girls and girls come from rich family are more likely to attain menarche earlier than their counterparts.

Keywords Age at menarche, School girls, Body mass index, Socio-economic factors, ANOVA

1. Introduction

Adolescence is a period of rapid transition from childhood to adulthood marked by biological changes including sexual maturation. Puberty is a period during adolescence characterized by transformation from a stage of reproductive immaturity to a stage of full reproductive competence. Age at menarche (the first menstruation) is the sign of puberty of a girl (Gluckman and Hanson, 2006). Menarche is an important event among the various pubertal changes in girls as it signifies the start of reproductive capacity (Karapanou and Papadimitriou, 2010). Early reproductive characteristics, including menarcheal age, may have significant effects on later health outcomes (Barsom et al., 2008). Menarche serves as an intermediate health outcome that affects the women's wellbeing at later stages of life (Al-Sahab et al., 2010). The age at onset of the menarche is a significant period in the life of a female adolescent. The age at which menarche occurs varies and is dependent on the interaction between genetic and environmental factors (Karapanou and Papadimitriou, 2010). Age at menarche is the reflection of cumulative pre-adolescent exposure of girls to either adverse environment such as food insecurity or affluent living conditions (Belachew et al., 2011). Age at menarche is an important indicator of future diseases; early onset of menarche is a well-established risk factor for breast cancer (Kelsey, 1993), pelvic inflammatory disease and spontaneous abortion (Helm et al., 1996) and ischemic heart disease (Cooper et al., 1999). On the other hand, delayed menarche may also affect the reproductive function resulting into a high risk factor towards irregular menstrual cycles and low peak bone mass (Anai et al., 2001). Early onset of menarche may be a marker for reproductive fitness or, at least, a marker for the onset of childbearing years (Riley et al., 1989).

A good number of research works have been done with age at menarche on a worldwide basis. Karapanou and Papadimitriou (2010) have reported a list of factors which are associated with age at menarche. Many researchers have reported gradual changes in age at menarche worldwide (Padez, 2003; Rokade and Mane, 2009; Basso et al., 2010).

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Wronka and Pawlinska-Chmara (2005) have suggested that socio-economic and demographic factors may be important factors for age at menarche. Numerous researchers have showed that age at menarche is associated with height, weight, body mass index (BMI) and menstruation disturbance (Bharati and Bharati, 1998; Ersoy et al., 2004; Hossain et al., 2010; Hossain et al., 2011). It has also been shown to be related to several determinant factors, viz. ethnic-racial differences, physical activity, housing and inheritance, and health status (Wong et al., 1999; Freedman *et al*., 2002; Lakshman et al., 2009). Studies on the relationship of age at menarche with nutritional status, post-menarcheal growth and marriage have been conducted using data from Bangladesh population (Chowdhury et al., 1977; Ogata, 1979; Haq, 1984; Riley et al., 1989; Chowdhury et al., 2000) and they have found that healthy girls get menarche earlier than thinner girls. More recently Hossain et al., (2010) have investigated age at menarche of university students in Bangladesh. They have collected data from female students residing in student halls at the University of Rajshahi, Bangladesh and have found that heavier students reach menarche earlier than thinner female. Also, they have found that early menarche has been associated with residence location at adolescence, religion and mother's education. Study about age at menarche of school girls in Bangladesh is poorly documented. Therefore, the main objectives of the study in this paper are to investigate the relationship between menarcheal age with body measurement and socio-demographic factors of secondary school girls in Rajshahi City, Bangladesh.

2. Materials and Methods

The study sample was comprised of 300 adolescent girls of purposively selected from secondary schools in Rajshahi City, Bangladesh. The sampled schools were drawn purposively, but it was tried to make the samples as diverge as possible.

Rajshahi is a divisional city in the western border of Bangladesh separated from India by a branch of Ganges River (Padma branch). To the northwest of Rajshahi lies the elevated and undulating barind region; to the south is the high, well-drained Padma Valley; and a swampy depression drains the land in the immediate vicinity of the city (Encyclopedia Britannica, 2009). Rajshahi with several public and private universities, colleges and schools is called the educational city in Bangladesh. In addition there are some garment and other factories in Rajshahi. People come from the different parts of country especially for education and after completing education they settle at Rajshahi city for different purposes.

The data were collected during 1-31 October, 2012, using purposive sampling technique. A total of 300 selected students were canvassed by a single research student of the Department of Population Science and Human Resource Development, University of Rajshahi; Bangladesh. The research student applied direct interview method and uses structured questionnaires. The questionnaire was designed considering demographic characteristics and socio-economic characteristics in addition to anthropometric measures of respondents and all of the participants have participated in giving answerer with the help of parents and teachers (100% response rate). Age at menarche of school girls was collected by recall method. The data were then prepared for entry and analyzed with Statistical Package for Social Sciences (SPSS version 16.00). Body height in centimeter (cm) was measured as the distance from the highest point of the top of the head in the mid-sagittal plane to the floor by anthropometer and body weight in kilogram (kg) is taken with thin clothing using a weighting scale. Chest circumference in cm was also measured by loose tape. The BMI defined as the ratio of weight in kilogram to height squared in meter, was calculated (i.e., BMI = weight (kg) / [height (m)] ^{2}) for further analysis.

3. Methods

The sample was subdivided according to socio-economic class and body size. Kolmogorov-Smirnov test was used for normality test of age at menarche data. Frequency distribution of age at menarche was done. Mean and standard deviation in age at menarche were calculated for each socio-economic groups and different body size groups. Student t-test was performed for comparing in age at menarche between two groups. For comparing age at menarche among more than two groups, analysis of variance (ANOVA) was utilized in this study. The normality and homogeneity of cohort variances were checked by using Kolmogorov–Smirnov nonparametric non-parametric test and Levene test, respectively, for the validity of our data in ANOVA (Chatterjee & Hadi, 2006). A p-value <0.05 was considered to be statistically significant.

4. Results

Table 1. Distribution of age at menarche with descriptive statistics

Age at Menarche	Frequency	Percentage	Mean	SD	Median
9	3	1.00			
10	14	4.70			
11	53	17.60			
12	107	35.70	12.19	1.04	12.75
13	98	32.70			
14	25	8.30			
Total	300	100.00			

The age at menarche of 300 secondary school girls was interviewed and examined in this study. Kolmogorov - Smirnov non-parametric test demonstrated that our data were normally distributed. The range of age at menarche of Bangladeshi school girls was 9 to 14 years, with mean menarcheal age of 12.19±1.04 (95% CI for mean:

12.08-12.31 years) and a median 12.75 years. More than 5% school girls reached menarche at 9-10 years old. Most of the school girls (86%) in Bangladesh got menarche between 11 to 13 years old. Only 8.30% girls reached menarche at 14 years old (Table 1).

Table 2 shows the percentage distribution of body measurements and socio-demographic factors with mean and SD of age at menarche by groups. The sample used in this study was classified into different groups according to their parents' socio-economic status and subjects' body size; parents' education level ((i) illiterate (no education), (ii) primary education and (iii) secondary and higher education), parents' occupation ((i) self-employed for father, house wife, (ii) service), family income ((i) low, (ii) middle and (iii) high), size of chest circumference (CC) ((i) CC<75cm, (ii) 75≤CC≤83 cm and (iii) CC>83CC), body mass index (BMI) ((i) underweight (BMI≤18.5 kg/m^2), normal weight (18.5 kg/m^2 <BMI<25.0 kg/m^2) and overweight and obese (BMI≥25.0 kg/m^2), height (short ((i) height≤151 cm and (ii) taller (height>151 cm), family size ((i) small family (number of member <4 (ii) middle and large (number of family member ≥4) and subject' birth order ((i) birth position 1 and (ii) birth position 1 and above). ANOVA and student t-test was carried out in this study for comparing the age at menarche groups and between the pair of groups, respectively.

The majority (53.0%) of the school girls' fathers' educational qualification (FEQ) was found to be primary whereas 63.0% of the respondents' mothers' educational qualification (MEQ) were found to be primary. ANOVA showed that there was no significant association between girls' age at menarche with parents' education level. About 87.0% respondents' fathers' occupation (FO) were self-employed (i.e., business, agricultural and others), and t-test demonstrated that girls of parents who worked in government or non-government service tend to reach menarche significantly ($p<0.01$) earlier than those whose father was self employed and mother was house wife. More than 48% school girls came from low income family and low-income family girls reached menarche significantly ($p<0.05$) later than girls who came from middle and high-income family. More than 50% school girls' chest circumference (CC) value were in the range of 75-83 cm. Girls who had chest circumference more than 83 cm got menarche significantly ($p<0.01$) earlier than their counterparts. 23.7% school girls were underweight (BMI ≤18.5 kg/m^2), only 4.0% girls were overweight and obese (BMI≥25 kg/m^2). Underweight school girls got menarche significantly ($p<0.05$) later than normal weight and overweight and obese girls (Table 2). The t-test exhibited that taller girls reached menarche significantly ($p<0.05$) earlier than shorter girls.

Table 2. Difference between mean age at menarche of school girls by their body measurements and socio-demographic factors

Characteristics	Categorical	Number (%)	MAAM	SD	p-Value
FEQ	Illiterate	35 (11.7)	11.94	0.97	0.176*
	Primary	159 (53.0)	12.28	1.01	
	Secondary and above	106 (35.3)	12.14	1.10	
MEQ	Illiterate	40 (13.3)	12.33	0.94	0.682*
	Primary	189 (63.0)	12.18	1.04	
	Secondary and above	71 (23.7)	12.15	1.09	
FO	Self-employed	261 (87.0)	12.23	1.02	0.006**
	Service	39 (13.0)	11.95	1.12	
MO	Service	7 (2.33)	10.71	0.95	0.001**
	House wife	293 (97.67)	12.23	1.06	
MFI	Low	146 (48.7)	12.27	0.91	0.033*
	Middle	99 (33.0)	12.15	1.14	
	High	55 (18.3)	12.05	1.18	
CC	<75 cm	93 (31.0)	12.33	0.90	0.009*
	75-83 cm	151 (50.3)	12.25	1.05	
	>83 cm	56 (18.7)	11.82	1.15	
BMI (Underweight vs Normal weight)	≤18.5 kg/m^2	71(23.7)	12.39	0.89	0.045**
	18.5 kg/m^2-25.0 kg/m^2	217(72.3)	12.15	1.09	
BMI (Underweight vs Overweight & obese)	≤18.5 kg/m^2	71 (23.7)	12.39	0.89	0.041**
	≥25kg/m^2	12 (4.0)	11.83	1.11	
Ht	≤151cm	159 (53.0)	12.33	1.02	0.013**
	>151cm	141 (47.0)	12.04	1.04	
FS	<4	113 (37.7)	12.11	1.01	0.260**
	>=4	187 (62.3)	12.25	1.05	
OB	1	127 (42.3)	12.25	0.99	0.403**
	>1	173 (57.7)	12.15	1.07	

Note: MAAM = Mean Age at Menarche; SD = Standard Deviation; FEQ & MEQ = Father's & Mother's Educational Qualification; FO = Father's Occupation; MO = Mother's Occupation MFI = Monthly Family Income; CC = Chest Circumference; BMI = Body Mass Index; Ht = Height; FS = Family Size; OB = Order of Birth.
* F-test (ANOVA), ** T-test.

5. Discussion

The mean age at menarche of secondary school girls in Bangladesh was found to be 12.19 ±1.04 years, and median 12.75 years. Age at menarche among school girls living at Rajshahi city in Bangladesh was almost similar to that in India, 12.70 years (Nair et al., 2013); in Iran, 12.50 years (Pejhan et al. 2013), in Kuwait, 12.41 years (Al-Awadhi et al., 2013), in Malaysia, 12.45 years (Hossain et al., 2013), in USA, 12.50 years (Anderson et al., 2003), in Canada, 12.72 years (Al-Sahab et al., 2010); in Portugal, 12.32 years (Padez, 2003); in Iran, 12.20 years (Gharrravi et al., 2008); and in China, 12.76 years (Song et al., 2011). Age at menarche of Nigerian (13.44 years; Onyiriuka and Egbagbe 2013), Ethiopian (15.8 years; Zegeye et al., 2009) and Indonesian (12.96 years; Batubara et al., 2010) females appeared to be later than school girls in Rajshahi, Bangladeshi.

The present study also found that, 23.30% respondents report earliest age of menarche (<12 years of age) and 76.70 % normal/ideal age of menarche (12 to 14 years of age). More recently Hossain et al. (2010) studied on age at menarche among female students of Rajshahi University taking data in the period July 2004 to May 2005. They reported the age at menarche of university students as 13.12±1.16 and median age 13.17 years. We used one-sample t-test to compare the age at menarche of school girls in Rajshahi with earlier study (Hossain et al., 2010). It was demonstrated by the t-test that school girls in Rajshahi experience menarche significantly ($p<0.001$) earlier than female students of Rajshahi University. The result suggests that the age at menarche of Bangladeshi girls has been decreasing during the last decades.

The present study explored the variation of age at menarche of secondary school girls across socio-demographic factors and anthropometric measures. The daughters of fathers who were working in government or non-government service tended to reach menarche earlier than those whose fathers were self-employed. Identical results were found in Bangladesh (Hossain et al., 2010). Present study showed that the respondents with chest circumference value high (>83 cm) tended to reach menarche earlier than the respondents whose chest circumference value was middle/normal (75-83 cm) and low (<75 cm). Father's occupation was found to be significantly associated ($p<0.01$) with age at menarche. A similar result was found by (Hossain et al., 2010). Monthly family income which was an important predictor showed significant ($p<0.05$) relationship with age at menarche and the result was matched with previous study found by Ofuya (2008). The current study showed that girls, who came from families with higher income, got menarche earlier than their counterparts. Heavier girls reached menarche earlier than thinner girls. Girls in rich family usefully get more nutrition and calorie than poor and school girls, and they are not conscious about their health. So their BMI values are more, thus they become heavier, which is one of the most important reasons for rich girls to get menarche earlier than poor girls in Bangladesh.

Since this present study was to investigated mean age at menarche and its association with selected anthropometric measures and socio-demographic factors of secondary and higher secondary school adolescent girls at Rajshahi City in Bangladesh, other important factors that directly related to age at menarche, such as, physical activity and the pattern of childhood weight gain (Cooper *et al.*, 1996), food habits in childhood (Windham *et al*., 2004), urban/rural residence (Padez, 2003), life-style factors and nutrition (Merzenich *et al*., 1993) are not looked into. Clearly, more research is needed in these areas.

This study will help the government to decide the appropriate age of children at which the topics like sex education; contraception, sanitary practices etc. can be incorporated in schools. It will help the government to design and implement the various health programmes related to reproductive health of women of appropriate age. The knowledge of early age at menarche in a given population may help the clinicians for deciding high risk factors for breast carcinoma, leading to its early detection and hence prompt and effective treatment.

6. Conclusions

The mean and median age at menarche of Bangladeshi secondary school girls was found to be 12.19±1.04 and 12.00 years, respectively. About 77% girls was ideal age at menarche. Parents' socio-economic status and subjects' anthropometric measures were considered to be influential factors towards determination of age at menarche of secondary school girls. Menarcheal age was associated with respondents' body size, chest circumference, height and family income. Early menarche was especially pronounced among girls whose parents work in government or non-government service.

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Conflict of Interest

All authors declare that there is no conflict of interest in relation to this study.

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