**Original Research Article**

**Impact of socioeconomic background on the age at menarche among Bengali adolescent**

**ABSTRACT**

Menarche was the symbol of a shift from a girl to woman. Age at menarche is important as it influence health in adulthood. This study was aimed to investigate the impact of socio-economic background on age at menarche among school going adolescents.

This was a cross sectional questionnaire based study was conducted among school girls having age limit 10-14 years. Only unmarried adolescent females were included in the study however, females with gynaecological, psychological or other medical problems were excluded from the study.A self-administered questionnaire having questions related to their age, age when menarche appear, parental education, household income, family member etc. were applied to collect data. Subjects were divided into two group- experimental (those attained menarche < 11.5 years) and reference (11.5 to 14.0 years). Quantitative data were presented as percentage and/or mean + standard deviation. We evaluated correlation between age at menarche and socioeconomic background. Logistic regression analysis was done to assess impact of socioeconomic background on age at menarche. The significance level of the tests was considered at a significance level of 0.05.

About one-fourth of study population acquired menarche at age below 12 years and remaining three-fourth acquired menarche at 12-14 years. Significant negative correlation was noted tween age at menarche and parental education standard as well as family income. Girls coming from small family attained menarche earlier than those coming from large family. Girls without any siblings attended early menarche than those with siblings. Results from logistic regression analysis suggests that socio-economic background significantly affects the age at onset of menarche. Family size and family income were significantly correlated with parental education. Thus parental education standard indirectly affects age at menarche by modulating lifestyle.

Results of this study suggest a significant impact of socio-economic background of family on age at menarche. Socio-economic background may influence age at initiation of first menstruation by modulating lifestyle.

Key words: Menarche, Parental education, family income, family size, siblings

KEYWORDS: gynaecological, Parental education, psychological, population

**INTRODUCTION**

Menarche is the first menstruation experienced by adolescent girls. It is considered to be the symbol of a shift from a girl to woman. It usually occurs suddenly and without precise predictability. Age at menarche is an indicator to assess the developmental status of a pubertal female. Age at menarche is important as it influence health in adulthood. The mean age at menarche among US girls was 12.34 years (1). Literature survey indicates that the average age of menarche has been decreased significantly in last 100 years. In the most developed countries like Europe and USA menarcheal age is decreased at a rate of 2-3 month per decade (2). Recently such a decline tendency has also been reported in developing countries (3). 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 higher blood pressure, glucose intolerance, cardiovascular disease and mortality from cancer (4-6). Younger age at menarche is a well-known risk for unplanned pregnancy, unsafe abortion, endometrioses sexually transmitted diseases including AIDS (7-8), depression (9) and metabolic syndrome (10). Early menarche is also associated with shorter height in adults from early closure of epiphyseal plate (11), breast cancer (12), and cardiovascular disease (13). Fida et al reported that women who had early menarche were more likely to get asthma than their counterparts who got menarche at 12 year or more (14). Late menarche is associated with increased risk of osteoporosis (15) and type-I diabetes (16).

Diet having high contents of calories and rich in protein causes early menarche (17). A family based cross sectional study suggested that early menarche was associated with increase in body fat (18). Large scale studies suggested that a higher gain in body mass during childhood is related an early onset of puberty (19). Girls involved in physical activities had a lower chance for early menarche (20). Family size, family income and parental education influences age of menarche (21). Various factors like socioeconomic status, genetic, heredity, ethnicity, psychological stress and chronic illness have been postulated to affect the age at menarche (22-23). This study was aimed to investigate the impact of socio-economic background on early onset of menarche among school going girls in West Bengal, India. .

1. **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 months to avoid significant change in BMI. It has been reported that there is no change in body weight greater than 5% in the previous three month (19). Willingness of the subject was considered. A total of 1644 female students were involved in the study. Students having age less than 10 years or more than 14 years, married, who had not started menstruating, Who had previous experience 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.

***Questionnaire*:** A self-administered questionnaire having questions related to their age, age when menarche appear and socioeconomic characteristics like parental education, household income, family member etc. Menarcheal age was obtained through recall, by calculating the time period between the day subjects menstruated first time and the date of birth. The questionnaires were translated to the local language (Bengali) as well.

***Statistical analysis***:

Pearson’s correlation coefficient was used to determine the relationship between socio-economic background and age at menarche. On the basis of parental education distribution of study population were represented as percentage. Mean age at menarche on the basis of parental education was also evaluated. Logistic regression analysis was done to assess the impact of socioeconomic background on age at menarche. Statistical significance was determine at p value <0.05.

**RESULTS:**

Parental education level of study population was represented in table-1. Education level varies from primary to post graduate. Education level of fathers comparatively better than mothers. 9.55% mother having higher qualification (graduate or above) however, 28.23% father having same qualification.

Table-1: Distribution of study population on the basis of parental education

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Education level** | **Maternal** | | **Paternal** | |
|  | n | % | n | % |
| Up to primary | 481 | 29.26 | 43 | 2.62 |
| V to IX | 581 | 35.34 | 483 | 29.38 |
| X | 236 | 14.36 | 387 | 23.54 |
| XI to Xii | 189 | 11.50 | 267 | 16.24 |
| Graduate | 123 | 7.48 | 349 | 21.23 |
| Masters or above | 34 | 2.07 | 115 | 7.00 |

Most of the study population coming from families having total monthly household income from RS 5000 to 105000 and per capita income varies from RS 600 to RS. 35000. Maximum percentage of study population were from family having monthly household income with in 10,000 and per capita income with in RS 5000 (table-2).

Table-2: Distribution of study population on the basis of economic background

|  |  |  |  |
| --- | --- | --- | --- |
| **Monthly household income** | | **Monthly per capita income** | |
| Monthly income (RS) | Percentage | Per capita income (RS) | Percentage |
| Up to 10000 | 38.56 | Up to 5000 | 61.13 |
| 10001 to 20000 | 18.00 | 5001 to 10000 | 10.40 |
| 20001 to 30000 | 8.94 | 10001 to 15000 | 9.00 |
| 30001 to 40000 | 2.74 | 15001 to 20000 | 11.19 |
| 40001 to 50000 | 5.11 | > 20000 | 8.27 |
| > 50000 | 26.64 |  |  |

Family size of study population was given in Fig-1. Family size varies from 3 to 12. Most of study population were from families having family member 6.

Family size and family income significantly correlated with parental education standard. There is inverse correlation between parental education and family size. Family income positively correlated with parental education (table-3).

Table-3: Correlation between parental education level with family incomes and family size

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Family income** | **Paternal Education** | | **Maternal education** | |
| **r** | **p** | **r** | **p** |
| Per capita income | 0.797 | < 0.001 | 0.515 | < 0.001 |
| Total household income | 0.762 | < 0.001 | 0.539 | < 0.001 |
| Family size | (-) 0.107 | < 0.01 | (-) 0.762 | < 0.001 |

Fig-2 and fig-3 represent distribution of study population according to their age at menarche in respect to their maternal and paternal education level respectively. In bath cases percentage of girls with early menarche was more whose parental education level were better than lower parental education level. Percentage of girls with early menarche was increase gradually with increase of education standard.

Correlation between socioeconomic background and age at menarche was represented in table-4. Significant negative correlation was noted between age at menarche and parental education as well as per capita income. Family size positively correlated with age at menarche.

Table-4: Correlation between parental education level and age at menarche

|  |  |  |
| --- | --- | --- |
| **Parameter** | **r** | **p** |
| Mother education | (-) 0.297 | < 0.001 |
| Father education | (-) 0.116 | < 0.001 |
| Family size | 0.172 | < 0.001 |
| Per capita income | (-)0.216 | < 0.001 |
| Total household income | (-)0.176 | < 0.001 |
|  |  |  |

Regression analysis was done to assess the impact of socio-economic background on age at menarche (Table-5). Risk of early menarche was significantly lower among adolescent those coming from large family in compare to those coming from small family (OR: Family size-3 = 1; Family size 4 = 0.771; Family size 5 = 0.421; Family size 6 =0.203; Family size more than 6 = 0.083). Risk to attend early menarche was significantly higher among adolescent girls coming from families with higher household income ( OR: Up to RS.10000 =1; RS.10001 to RS.20000=1.24, RS.20001 to RS.30000= 1.52; RS.30001 to RS.40000 = 2.04, RS.40001 to RS.50000= 2.51; Above RS.50000 = 2.57) as well as higher per capita income ( OR: Up to RS.5000 =1; RS.5001 to RS.10000=1.31, RS.10001 to RS.15000= 1.82; RS.15001 to RS.20000 = 2.10 Above RS.20000 = 5.89) in respect to lower income families. We observed significant impact of parental education on menarcheal age. Higher educated mother’s (graduate of masters) girls were more likely to reach menarche earlier than primary, secondary as well as higher secondary educated mother’s girls ( OR: Primary=1. Secondary=2.19, Higher Secondary = 3.018; Graduate = 2.674, Masters = 4.795). Higher educated father’s girls had a more chance to get menarche earlier than that of primary and secondary educated father’s girls (OR: primary=1. Secondary=1.11, Higher Secondary = 1.18; Graduate = 1.71, Masters = 4.97). Thus adolescent girls of higher parental education level are more prone to attend menarche at an early age than girls of lower parental education. School girls had less number of siblings experienced menarche earlier than their counterparts (OR: Sibling 0 =2.95; Sibling 1 = 2.01; Sibling > 2 =1)

Table-5: Regression analysis for socio-economic background age at menarche

|  |  |  |  |
| --- | --- | --- | --- |
| Parameters | Odd ratio | 95% CI | p |
| **Numbers of family members** | | | |
| 3 | Ref |  |  |
| 4 | 0.771 | 0.527 to 1.131 | 0.184ns |
| 5 | 0.421 | 0.298 to 0.595 | < 0.0001\* |
| 6 | 0.203 | 0.144 to 0.286 | < 0.0001\* |
| > 6 | 0.081 | 0.034 to 0.195 | < 0.0001\* |
| **Numbers of sibling** | | | |
| 0 | 2.946 | 1.502 to 5.812 | 0.0016\* |
| 1 | 2.007 | 1.157 to 3.481 | 0.0112\* |
| > 2 | Ref |  |  |
| **Per capita income (RS.)** | | | |
| Up to 5000 | Ref |  |  |
| 5001 to 10000 | 1.310 | 0.895 to 1.918 | 0.164ns |
| 10001 to 15000 | 1.815 | 1.240 to 2.657 | 0.0022\* |
| 15001 to 20000 | 2.096 | 1.489 to 2.949 | < 0.0001\* |
| > 20000 | 5.894 | 4.057 to 8.562 | < 0.0001\* |
| **Monthly income (RS.)** | | | |
| Up to 10000 | Ref |  |  |
| 10001 to 20000 | 1.238 | 0.887 to 1.723 | 0.209ns |
| 20001 to 30000 | 1.522 | 1.008 to 2.300 | 0.046ns |
| 30001 to 40000 | 2.036 | 1.063to 3.900 | < 0.032\* |
| 40001 to 50000 | 2.506 | 1.548 to 4.057 | < 0.0002\* |
| > 50000 | 2.566 | 1.934 to 3.406 | < 0.0001\* |
| **Maternal education** | | | |
| Up to primary | Ref |  |  |
| V to IX | 1.522 | 1.124 to 2.062 | 0.0066\* |
| X | 2.190 | 1.524 to 3.148 | < 0.0001\* |
| XI to Xii | 3.018 | 2.071 to 4.397 | < 0.0001\* |
| Graduate | 2.767 | 1.788 to 4.281 | < 0.0001\* |
| Masters or above | 4.795 | 2.351 to 9.780 | < 0.0001\* |
| **Paternal education** | | | |
| Up to class IX | Ref |  |  |
| Class X | 1.109 | 0.807 to 1.520 | 0.5250ns |
| XI to XII | 1.181 | 0.831 to 1.681 | 0.354ns |
| Graduate | 1.714 | 1.258 to 2.337 | 0.0006\* |
| Masters or above | 4.973 | 3.252 to 7.605 | <0.0001\* |

**Discussion**

Significant correlation was found between monthly household income as well as per capita income and age at menarche. Girls having a higher household income experienced early menarche than those with lower household income. Results of our study support previous observations. (24-25). Negative association of age at menarche and higher socio-economic background can be attributed to the fact that girls from higher socioeconomic background have better access to nutritious foods and healthcare than girls those from lower socioeconomic status (26-27). Girls of higher socio-economic status also experience more stress due to academic pressure, extracurricular activities and social expectations which can trigger the release of hormones that contribute to early menarche (28). Thus according to our findings higher income and a better socio-economic status were somehow linked with early onset of menarche. Our results coincide with recent a published report (29).

Parental education inversely associated with age at menarche i.e. higher parental qualification causes early onset of menarche of their daughters. It was reported that parental education and employment does not have any direct effect on menarcheal age and might exert its effect indirectly through influencing family lifestyle (30). Parental education positively correlated with family income. Thus family income is more in family with higher parental qualification than lower parental education. Higher income is one of the risk factor for early menarche. Parental education particularly maternal education restrict family size. Girls from smaller family obtained menarche earlier than those from larger families. A previous study reported that girls coming from families having family member more than four were attend menarche at 13.54 years (31). Present study showed that girls having less number of siblings experienced menarche earlier than their counterparts. A similar findings was suggested in a recent report (32).

**CONCLUSION**: In this study we investigated the impact of socio-economic background on onset of first menstruation among school going adolescents living in West Bengal India. Among study population 26.3% attained menarche at an early age (<11.5 years). Parental education and family income inversely correlated with age at menarche where as family size directly correlated. Girls coming from family having higher income and higher education levels attained menarche earlier than girls coming from lesser income and lower parental education levels. Girls of small families obtained menarche earlier than those coming from larger families. Thus present study demonstrated that family background including paternal education, maternal education, total household income, per capita income, family size and number of siblings significantly influence age at menarche.

**CONSENT**

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. Participants were informed that the data obtained from them would be kept confidential.

**ETHICAL APPROVAL**

Written ethical approval has been collected and preserved by the author(s).

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

**REFERENCES**

1. Rokad S, Mone AJ. A study of age at menarche, secular trend and factors associated with it. J Biol Anthropol. 2008; 3: 1-7.

1. Rah JH, Shamim AA, Arju UT, Labrique AB, Rashid M, Christian P. Age of onset, nutritional determinants and seasonal variations in menarche in rural Bangladesh. J Health Popul Nutr. 2009; 27(6): 802-807.
2. Ersoy B, Balkan C, Gunay T, Onag A, Egemen A. Effect of different socio economic conditions on menarche in Turkish female students. Early Hum Dev. 2004; 76(2): 115-125.
3. Wang G, Shao W, Chen X, Zhengo C, et al. Age at menarche and its association with blood pressure in adult women of developing countries: a systematic review and meta-analysis. Annals Human Biol. 2023; 5091): 127-136.
4. Braun MM, Overbeek-Wager EA, Grumbo RJ. Diagnosis and management of endometrial cancer. Am Fam Physian. 2016; 93(6): 468-474.
5. Goldberg M, D Aloisio AA, O Brien KM, Zhao S, Sandler DP. Pubertal timing and breast cancer risk in the sister study cohort. Breast Cancer Res. 2020; 22(1): 112; <https://doi.org/10.1186/s13058-020-01326-2>.
6. Laurie B. Late age of menarche linked to lower risk for endometriosis. American J Obsterit Gynecol. 2010. <http://www.medscape.com/viewarticle/714499>.
7. Golub MS, Collman GW, Foster PM, et.al. Public health implications of altered puberty timing. Pediatrics. 2008; 121(3): 218-230.
8. Hirtz R, Libuda L, Hinney A, Focker M, et al. Age at menarche relates to depression in adolescent girls: comparing a clinical sample to the general paediatric population. J Affective Disorders. 2022; 318: 103-112.
9. Bubach S, Horta BL, Goncalves H, Assuncao MCF. Early age at menarche and metabolic cardiovascular risk factors: mediation by body composition in adulthood. Scientific report. 2021; 11: 148. <https://doi.org/10.1038/s41598-020-80496-7>.
10. Lee HS. Why should we be concerned about early menarche? Clin Exp Pediatr. 2021; 64(1): 26-27.
11. Bodicoat DH, SchoemakerMJ, Jones ME, Griffin J, Ashworth A, Swerdlow AJ. Timing of pubertal stages and breast cancer risk: the Breakthrough Generation Study. Breast Cancer Res. 2014; 16(1): R18. <https://doi.org/10.1186/bcr3613>.
12. Won JC, Hong JW, Noh JH, Kim DJ. Association between age at menarche and risk factors for cardiovascular diseases in Korean women. Medicine. 2016; 11(3): e3580. <https://doi.org/10.1097/MD00000000003580>.
13. Fida NG, Williams MA, Enquobahrie DA. Association of age at menarche and menstrual characteristics with adult onset asthma among reproductive age women. Reprod Syst Sexual Disord. 2014; 11(3): 111. <https://doi.org/> 10.4172/ 2161-038X1000111.
14. Yang Y, Wang S, Cong H. Association between age at menarche and bone mineral density in postmenopausal women. J Artho Surg Res. 2023; 18: 51. doi/org/10.1186/s130-18-023-03520-2.
15. Ghitha L, Vathania N, Wiyono L, Pulungan A. ayed menarche in children and adolescents with type-1 diabetes mellitus: a systematic Review and meta-analysis. Clin Pediatr Endocrinol. 2024; 33(3): 104-112.
16. Roger IS, Northstone K, Dunger DB, Cooper Arness AR, Emmett PM. Diet throughout childhood and age at menarche in a contemporary cohort of British girls. Pub. Health Nutr. 2010; 13(12): 2052-2063.
17. Karapanou O, Papadimitriou A. Determinants of menarche. Reprod Biol Endocrinol. 2010; 5: 115.). Karapanou O, Papadimitriou A. Determinants of menarche. Reprod Biol Endocrinol. 2010; 5: 115.
18. Agarwal M, Agarwal A. Study of correlation between age at menarche and body mass index. Int J Reprod Contracep Obstet Gynecol. 2022; 11(8): 2171-2174.
19. Calthrope L, Barge S, Ong KK. Systemic review and meta-analysis of the association between childhood physical activity and age at menarche. Acta Paediatrica. 2019; 108: 1008-1015.
20. Jadav RA, Choubey JB. Effect of socioeconomic status on the onset of menarche. Ind J Sci Res. 2017; 13(2): 217-219.
21. Idris IM, Wolday SJ, Habteselassie F, et al. Factors associated with early age at menarche among female secondary school students in Asmara: a cross-sectional study. Global reprod Health. 2021; 6: p e51.
22. Steppan M, Whitehead R, McEachran J Currie C. Family composition and age at menarche: finding from the international health behaviour in school-aged children study. Reprod Health. 2019; 16: 176. <https://doi.org/10.1186/s12978-019-0822-6>.
23. Milatha JM, Islam MA, Islam S, Al Mamun ASM, et al. Early age at menarche and its associated factors in school girls (age, 10 to 12) in Bangladesh: a cross sectional survey in Rajshahi District, Bangaladesh. J Physiological Anthropology. 2020; 39(1): 6, <https://doi.org/10.1186/s40101-020-00218-w>).
24. Amena MA, Sara AB, Shahad A, Hiyam Husam ES, et al. Factors associated with age at menarche, menstrual knowledge and hygiene practices amlong school girls in Sharjah, UAE. Int J Adolescence Youth. 2024; 29:1, 2367117, https://doi: 10.1080/02673843.2024.2367117.
25. Meher T, Sahoo H. Secular trend in age at menarche among Indian women. Scientific Report. 2024; 14(1): 5398. <https://doi.org/10.1038/s41598-024-55657-7>.
26. Tarannum F, Khalique N, Eram U. A community based study on age of menarche among adolescent girls in Aligarh. Int J Community med Pub Health. 2017; 5(1), <https://doi.org/10.18203/2394-6040>, ijcmph20175820.
27. Mishra GD, Cooper R, Tom SE, Kuh D. Early life circumtances and their impact on menarche and menopause. Womens Health (London). 2009; 5(2): 175-190. <https://doi.org/10.2217/17455057.5.2.175>.
28. Meher T, Sahoo H. Secular trend in age at menarche among Indian women. Scientific Report. 2024; 14: 5398. <https://doi.org/10.1038/s41598-024-55657-7>.
29. Tehrani FR, Mirmiran P, Gholami R, Moslehi N, Aziz F. Factors influcing menarcheal age : results from the cohort of Tehran Lipid and Glucose study. Int J Endocrinol Metab. 2014; 12(3): e16130. <https://doi.org/10.5812/ijem.16130>).
30. Szwed A, John A, Czapla Z, Kosinska M, Infiuence of socioeconomic factors on age at menarche of Polish girls. Anthropologisher Anzeiger. 2013; 70(4): 455-470.
31. Kim D, Sohn K. Having more siblings delays menarche in Indonesia. Am J human Biol. 2018; 30(6): e23189. <https://doi.org/1o.1002/ajhb.23189>.