Journal of Chitwan Medical College 2021;11(38):73-77
Available online at: www.jcmc.com.np

ORIGINAL RESEARCH ARTICLE

AGE AT MENARCHE AND BODY MASS INDEX AMONG SCHOOL GOING ADOLESCENT GIRLS IN BHARATPUR METROPOLITAN CITY CHITWAN

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Received: 21 Oct, 2021
Accepted: 17 Dec, 2021
Published: 25 Dec, 2021

Key words: Adolescent girls; Age at menarche; Body mass index.

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*DOI:*https://doi.org/10.54530/jcmc.567

Citation

Bhusal P, Khatiwada S, Poudel P. Age at menarche and body mass index among school going adolescent girls in Bharatpur metropolitan city Chitwan.Journal of Chitwan Medical College.2021;11(38):73-7.

Peer Reviewed

ABSTRACT

Background: Menarche is a milestone for adolescent girls. The age of menarche is influenced by genetic, social status, place, race, ethnicity, nutritional and physical activity. There have been many studies on age at menarche but very few in this part of the country. This study aimed to assess the age of menarche and Body mass index among school going adolescent girls in Bharatpur Metropolitan city Chitwan.

Methods: Total participants of 163 adolescent girls in this cross-section study were chosen from three private schools of Bharatpur Metropolitan city during June-September 2021. A pre-tested self-administrated questionnaire for menarche and anthropometric measurements were carried out for body mass index. The data were then entered to Statistical Package for Social Science (IBM SPSS, version 20) for the analysis.

Results: The study revealed that the age at menarche ranged from 10-14 years of age. BMI of students ranged from 14.68-40.26 with 47.2% of the study population being a healthy weight. Girls having the habit of exercise/yoga attained menarche at 12years or after 12 years whereas girls having no habit had their menarche before 12 years of age.

Conclusions: Our finding from the present study forms a baseline to estimate the mean age of menarche. Physically, inactive adolescents were more likely to see menarche earlier than the average age. Many girls were seen overweight as well. Regular exercise and a healthy life style need to be promoted among school going adolescent.

INTRODUCTION

Menarche is the start of menstruation and is one of the most remarkable events in female puberty, which is a part of adolescence.[1] According to World Health Organization (WHO), adolescence is a period between 10-19 years. Adolescence is a critical phase for development that brings bodily changes associated with a physical, mental, psychological, and social development.[2] The age at menarche averages between 12 and 13 years worldwide.[3] The mean age at menarche was found to be 12.2 ± 0.9 years ranging between 9 and 15 years.[4] The mean age of menarche varies significantly by geographical region, race, ethnicity, nutritional and socio-economic factors along with the physical activity of the girls and sleeping patterns.[5,6] Age at menarche appears to have been declining in recent decades not only in western industrialized countries but also in Asian countries.[3,5,7] The decline of the age of menarche is drawing attention because early menarche is known to be a risk factor for diseases like obesity, metabolic syndrome, cardiovascular disease, and breast cancer.[8]

The Adolescent population comprised around one-fourth of the total population of Nepal.[2] In the present day overweight and obesity contribute to major health problems not only in developed countries but also in developing countries like Nepal.[2, 9, 10]

This study thus aimed to assess age at menarche and factors affecting menarche. We also noted body mass index (BMI) of adolescent girls. Literature about the age of menarche in the Nepalese population is scanty and hence, it is worth studying.

METHODS

A cross-sectional study was conducted among the girls of private schools of Bharatpur metropolitan city, Chitwan from June-September 2021. The research proposal was approved by the Institutional Review Board of Chitwan Medical College (Ref: CMC-IRC/078/09-049). Permission letter was also obtained from respective schools before conducting the research. Schools were selected by convenience sampling technique. All the girls who have had menstruation comprised the sample frame in our study.

The following formula was used to calculate the required sample

size for the study :n =Z^2pd/d^2 (Cochran 1977)[11] where, Z=1.96 for the 95% CI and d=7% allowable error, P=12.2% [2] . The sample size for this study was 163. The girls who could not recall the date of their menarche were excluded from the study. A self-made questionnaire was constructed based on the several literature reviews and Pre-testing was done in SOS Hermann Gmeiner school, Bharatpur , with 10% of the samples for testing the reliability of this research using Cronbach's alpha reliability test and revealed a value of 0.85 (c_2=1743.2, p=0.001) in IBM SPSS 20.0 version. Content validity was achieved by using items from the previously validated surveys, by developing items based on an extensive literature search and by frequently reviewing the questions with the statistician. The questionnaires were designed to collect data on demographic characteristics of the girls (present age, class, dietary status, exercise/yoga habit, sleeping hours, religion), their parent's occupation, and also their menstruation. Under questions about menstruations; Age at menarche, regularity of their menstruation, source of information about their menstruation, if they have dysmenorrhea, any cultural restriction during menstruation. After completion of questionnaire, their height and weight were recorded. Digital scales and a portable stadiometer were used to measure their weight and height respectively. Measurement of individuals was taken without shoes. Body mass index was calculated by using the formula BMI = weight (kg)/height (m) [2]. After a brief explanation about the purpose of the study verbal consent was taken. Participants were also informed of their right to refuse or withdraw their participation at any time they want, and they would face no harm due to their refusal. The questionnaire was explained to the girls, and, then, they were asked to fill it. Difficulties faced by the girls during filling the forms were addressed by the research team.

First of all, the collected data were checked for the completeness. The data were then entered to Statistical Package for Social Science (IBM SPSS, version 20) for the analysis. Descriptive analysis of the age at menarche and BMI among school going adolescent were determined. Depending upon BMI, students were grouped into four groups: underweight (BMI<18.5), healthy weight (18.5-24.9), overweight (25-29.9), and obese (BMI>30) Normality test was done by Kolmogorov-Simron (K-S) test at 5% level of significance. Bivariate analysis was done between level of age at menarche and some independent variables among school going adolescent girls in Chitwan by using Pearson Chi-square ($\chi 2$) test at 5% level of significant. If the P value was < 0.05, then the results were considered to be statistically significant.

RESULTS

Our study showed menarche occurred in between the age range of 10-14 years old with median age to be 12 years old. BMI of school going adolescent student ranged from 14.68-40.26 (Table 1). Among 163 students 18.40% girls were underweight, 47.20% girls were of healthy weight, 23.90% were overweight and 10.40% were obese (Figure 1). Our findings demonstrate that 61.30% of girls had their menarche after 12 years old whereas 38.70% of the girls had menarche before 12 years old (Figure 2). Cultural restriction of participants were seen in 133(81.6%) girls where as only 30(18.4%) girls had no cultural restriction during their menstruation (Table 2).

Table 1: Descriptive analysis of age at menarche and BMI among school going adolescent girls in Chitwan (n=163)

Variables	Median (IQR)	Min/Max	Normality test
Age at menarche	12(1)	10/14	Not normal
BMI	22.07(7.07)	14.68/40.26	Not normal

Normality test was done through kolmogorov-simron (K-S) test at 5% level of significance

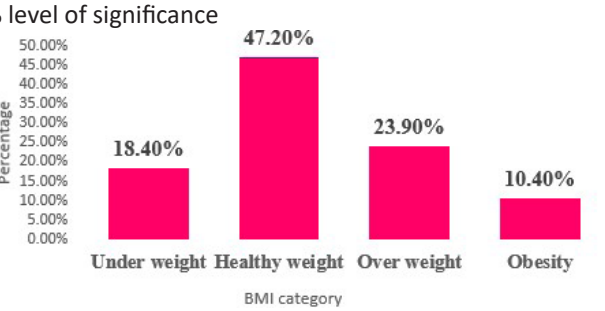

Figure 1: Distribution of BMI category among school going adolescent girls in Chitwan (n=163)

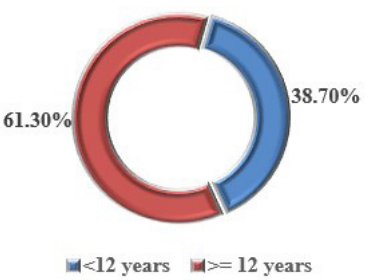

Figure 2: Age at menarche among school going adolescent girls in Chitwan (n=163)

Table 2: Cultural restriction during menarche among school going adolescent girls in Chitwan (n=163)

Variables	Category	Frequency (%)
Any cultural restriction during menstruation	Yes	133(81.6)
	No	30(18.4)
If yes (n=133) ##	Can't cook food	122(91.7%)
	Can't visit temple	104(78.1)
	Can't attend religious function	64(48.1)
	Can't touch male member in the family	87(65.4)

multiple response

Table 3: Bivariate analysis between age at menarche and some independent variables among school going adolescent girls in Chitwan (n=163)

Variables	Number (%)	Age at menarche		p-value
		< 12 years (%)	>=12 years (%)	
Religion				
Hindu	137(84)	56(40.9)	81(59.1)	0.180
Non-Hindu	26(16)	7(26.9)	19(73.1)	
Dietary pattern				
Vegetarian	18(11)	6(33.3)	12(66.7)	0.623
Non-vegetarian	145(89)	57(39.3)	88(60.7)	
Sleeping hours				
Less than 8 hours	71(43.6)	23(32.40)	48(67.6)	0.150
8 and more hours	92(56.4)	40(43.5)	52(56.5)	
Habit of exercise				
Yes	52(31.9)	13(25)	39(75)	**0.014****
No	111(68.1)	50(45)	61(55)	
Painful period				
Yes	87(53.4)	31(35.6)	56(64.4)	0.397
No	76(46.6)	32(42.1)	44(57.9)	
Regularity of period				
Regular	115(70.55)	45(39.1)	70(60.9)	0.846
Irregular	48(29.44)	18(37.5)	30(62.5)	

** denotes significant association (By applying Pearson chi-square test at 5% level of significance)

DISCUSSION

In the present study, menarche occurred in between the age range of 10-14 years old with median age to be 12 years old. Our study is in line with studies in other parts of Nepal. [12,13] About 50% of Bangladeshi girls reached menarche by 10-12.[4] But in contrast with another study in Nepal, the estimated mean age of menarche was 14.3 years ranging from 12 to 15years.[13] This difference in menarche may be due to increase in urbanization, socio-economic status, better nutrition. Also, activities like watching television and mobile and involvement of less physical activities can be associated with a sedentary lifestyle resulting in increasing body mass and body fat.[12,14] The fat cell secretes leptin that can influence the secretion of gonadotropin- releasing hormone (GnRH).[14] Rise in GnRH leads to the production of gonadotropins (luteinizing hormone; LH and follicular stimulating hormone; FSH). A Higher levels of FSH and LH will lead to an increase in estrogen level leading to early initiation of menses causing early menstruation.[15]Another reason is the younger population that recently had their menarche with less chance of recall bias. Similarly, another study done in Kathmandu city, Nepal observed that mean age of menarche was 12.56 years with a standard deviation of 1.12 years and their mother was 14.30 years. This show that age of menarche is declining with the generation.[16] Our findings demonstrate that 61.30% of girls had their menarche after 12 years old whereas 38.70% of the girls had menarche before 12 years old. Early menarche before 12 years old was also seen in a study in Bangladesh.[4]

In our study, 48(29.44%) girls had an irregular period. One of the reasons may be due to anovulatory cycles which are common within the first two years after menarche.[17]Different studies reported irregular periods among adolescent girls.[5,17-19] Dysmenorrhoea was the major menstrual problem among adolescent girls and was reported by 87(53.4) of the girls with varying degrees of severity. This result collaborates with other studies.[5,17,19,20] This indicates that dysmenorrhea is still an important public health problem and most of females experience severe or moderate dysmenorrhea.[21]

Leptin stimulate the reproductive hormone axis and trigger reproductive maturation in women. Low level of leptin in physically active girls may mediate the effects of negative energy balance resulting in delaying of menstruation via suppression of GnRH pulsatility.[22] This statement was justified in our result as well; among total girls, 52(31.9%) girls, who had exercise habits had their menarche in more than 12 years. Our study is in line with a study in Canada, where Girls who participated in physical activities had a lower risk of reaching menarche at an early age.[7] Calthorpe et al. reported that mean menarchial age is higher in athletes than in non-athletes. Our study also observed a significant association between age at menarche and physical activity.[22] Most of the girls 133(81.6%) were practicing cultural restriction in our study. The result of our study was parallel with the other studies in Nepal [23] and India.[24] The girls in our study were not allowed to enter the kitchen and cook food 122(91.7%), could not visit temple 104(78.1%) and also could not attain religious functions 64(48.1%) and were not allowed to touch the male member of the family 87(65.4)

The present study revealed that BMI among school going adolescent girls ranged from 14.68- 40.26. Among the participants 10.40% were obese, 23.90% were overweight, 47.20% were of healthy weight and 18.40% were underweight. Even though the majority of respondents are of healthy weight, yet the oth-

er values are considerable and alarming. Similar to our study, a study in dang had adolescents with a healthy weight.[25] We found that 23.90% of the respondents were overweight. One of the possible explanations for overweight may be because girls were in pubertal age where there is higher production of estrogen which increases fat deposition in peripheral adipose tissues.[1] Similar studies done in other districts of Nepal found high a prevalence of overweight among girls.[12,25,26] A study in Nepal explained that adolescents studying in private schools were twice as likely to be overweight than those studying in government schools. The reason might be higher socio-economical background of the adolescence studying in private school. Students from higher socio-economical background purchase more junk food leading to overweight and obesity.[2]

This study was limited by the small sample size and cross-sectional design. Therefore, cannot be generalized to the whole nation. Larger studies regarding age at menarche need to be carried out in a larger representative population.

CONCLUSION

In conclusion, the age of menarche among adolescent girls in Bharatpur Metropolitan city Chitwan was 10-14 years. The study also investigated the BMI of the adolescent girls and found that maximum girls are of healthy weight. Girls having Exercise/yoga habit have their menarche in more than 12 years old. Chitwan is one of the developed cities of Nepal; most of the girls follow cultural restrictions.

ACKNOWLEDGEMENTS

First of all, we would like to thank my brother, Kushum Giri for his help. We would like to thank all the participating students and we are also grateful to the school management that allowed us to work with their students.

CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

REFERENCES:

1. Al-Awadhi N, Al-Kandari N, Al-Hasan T, AlMurjan D, Ali S, Al-Taiar A. Age at menarche and its relationship to body mass index among adolescent girls in Kuwait. BMC public health. 2013 ;13(1):1-7. [DOI]
2. Piryani S, Baral KP, Pradhan B, Poudyal AK, Piryani RM. Overweight and its associated risk factors among urban school adolescents in Nepal: a cross-sectional study. BMJ open. 2016 ;6(5):e010335. [DOI]
3. Wang Z, Dang S, Xing Y, Li Q, Yan H. Correlation of body mass index levels with menarche in adolescent girls in Shaanxi, China: a cross sectional study. BMC women's health. 2016;16(1):1-8. [DOI]
4. Malitha JM, Islam MA, Islam S, Al Mamun AS, Chakrabarty S, Hossain MG. Early age at menarche and its associated factors in school girls (age, 10 to 12 years) in Bangladesh: a cross-section survey in Rajshahi District, Bangladesh. Journal of physiological anthropology. 2020;39(1):1-9. [DOI]
5. Sharma S, Deuja S, Saha CG. Menstrual pattern among adolescent girls of Pokhara Valley: a cross sectional study. BMC women's health. 2016; 16(1):1-6. [DOI]
6. Gemelli IF, dos Santos Farias E, Souza OF. Age at Menarche and Its Association with Excess Weight and Body Fat Percentage in Girls in the Southwestern Region of the Brazilian Amazon. J. Pediatr. Adolesc. Gynecol. 2016;29:482-8. [DOI]
7. Moisan JO, Meyer FR, Gingras SU. Leisure physical activity and age at menarche. Medicine and science in sports and exercise. 1991;23(10):1170-5. [DOI]
8. Oh CM, Oh IH, Choi KS, Choe BK, Yoon TY, Choi JM. Relationship between body mass index and early menarche of adolescent girls in Seoul. Journal of Preventive Medicine and Public Health. 2012;45(4):227. [DOI]
9. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet. 2014;384(9945):766-81.[DOI]
10. World Health Organisation. Obesity and overweight Fact sheet, January 2015. [LINK]
11. Kotrlik JW, Higgins CC. Organizational research: Determining appropriate sample size in survey research appropriate sample size in survey research. Information technology, learning, and performance journal, 2001;19(1), 43. [LINK]
12. Sunuwar L, Saha CG, Anupa KC, UpadhyayDhungel K. Age at menarche of subpopulation of Nepalese girls. Nepal Med Coll J. 2010; 12(3):183-6. [DOI]
13. Aryal TR. Age at menarche: differentials and determinants. Journal of Nepal Medical Association. 2004;43(152):71-5. [DOI]
14. Chan Jean L, Mantzoros Christos S. Leptin and the hypothalamic-pituitary regulation of the gonadotropin-gonadal axis. Pituitary. 2001; 4: 87-92. [DOI]
15. Gutyon AV, Hall JE. Textbook of Medical Physiology. 11th edition. Philadelphia: Elsevier Saunders 2006; 1011-2. [LINK]
16. Chalise U, Pradhan A, Lama CP, Pant PP, Dhungel S. Age at Menarche among the School Going Children of Jorpati, Kathmandu. JCMS Nepal. 2018;14(3):142-6. [DOI]
17. Anikwe CC, Mamah JE, Okorochukwu BC, Nnadozie UU, Obarezi CH, Ekwedigwe KC. Age at menarche, menstrual characteristics, and its associated morbidities among secondary school students in Abakaliki, southeast Nigeria. Heliyon. 2020;6(5):e04018. [DOI]
18. Ali AA, Rayis AD, Mamoun M, Adam I. Age at menarche and menstrual cycle pattern among school girls in Kassala in eastern Sudan. J Public Health Epidemiol. 2011;3(3):111-4. [LINK]
19. Dars S, Sayed K, Yousufzai Z. Relationship of menstrual irregularities to BMI and nutritional status in adolescent girls. Pakistan journal of medical sciences. 2014;30(1):141. [DOI]
20. Katwal PC, Karki NR, Sharma P, Tamrakar SR. Dysmenorrhea and stress among the nepalese medical students. Kathmandu University Medical Journal. 2016;14(56):318-21. [PMID]
21. Singh A, Aryal B, Deo S. Efficacy of Mefenamic acid and Ginger on Pain Relief in Primary Dysmenorrhea Among Basic Sciences Students of Nepalgunj Medical College. Europasian Journal of Medical Sciences. 2020 Jan 22;2(1):4-10. [DOI]
22. Calthorpe L, Brage S, Ong KK. Systematic review and meta-analysis of the association between childhood physical activity and age at menarche. ActaPaediatr. 2019; 108 1008-15. [DOI]
23. Mukherjee A, Lama M, Khakurel U, Jha AN, Ajose F, Acharya S, et al. Perception and practices of menstruation restrictions among urban adolescent girls and women in Nepal: a cross-sectional survey. Reproductive health. 2020 ;17:1-0. [DOI]
24. Yaliwal RG, Biradar AM, Kori SS, Mudanur SR, Pujeri SU, Shahnnawaz

M. Menstrual Morbidities, Menstrual Hygiene, Cultural Practices during Menstruation, and WASH Practices at Schools in Adolescent Girls of North Karnataka, India: A Cross-Sectional Prospective Study. Obstetrics and Gynecology International. 2020; 2020. [DOI]

25. Bhattarai S, Bhusal CK. Prevalence and associated factors of malnutrition among school going adolescents of Dang district, Nepal. AIMS Public Health. 2019;6(3):291. [DOI]

26. Panthi S, Upadhaya HP, Prasai N, Prasai M, Pathak P. Prevalence of Overweight and Obesity among Secondary School Students of Bharatpur, Nepal. JCMS Nepal. 2020; 16(3):157-62. [DOI]