

EFFECT OF PHYSICAL MEASURES ON MENARCHEAL AGE

SHITAL R. SODHA, Dr. NILAMBARI DAVE

Smt. S.B. Gardi Institute of Home Science, Saurashtra University, Rajkot(Gujarat) India.

Abstract : Adolescence is the period between childhood and adulthood. It is a time of rapid change and difficult challenges. Menarche is an unforgettable event in adolescent girls. It denotes the start of reproductive capacity. With varying rate the age at menarche has been getting earlier in all over the world. The menarcheal time is associated with the health of the adolescent girls. The aim of this study was to find out the present age at menarche among porbandar girls and to correlate with physical variables. This study was performed in three schools of Porbandar. The inclusion criterion was adolescent girls aged between 9 to 14 years who underwent menarche. Every girl was subjected to anthropometric assessment including weight, height, mid upper arm circumference (MUAC), waist circumference and hip circumference. Body mass index (BMI), body fat percentage (BF %) were calculated. Median age at menarche was 11.89 ± 1.21 years. 39% of menstruating girls were found underweight whereas 44% of menstruating girls were found with normal weight. Minimum age of menarche was 108 month and maximum with 168 month. 27% of girls had an average body fat and 20% of girls were over fat. According to waist hip ratio 34% of girls were at below risk category.

Key words: Menarche, Adolescent, Physical Measures

INTRODUCTION:

Adolescence is a transition period from childhood to adult life during which pubertal development and sexual maturation take place. Menarche is an essential event of sexual maturation. Menarche is the major indicator of female maturity. The menarcheal age is known to be affected by various parameters such as body fat accumulation, nutrition, socio-economic status, environmental conditions, genetic cause and neuro-endocrine disorders. (Parent AS, Teilmann et al 2003) and (Kaplowitz PB, Slora EJ et al 2001).

The first menstrual period is known as menarche. Menarche, or the age at which girls begin to menstruate, has been gradually but steadily falling since the mid-19th century. Researchers have explored various reasons for this decline, ranging from improved nutrition, environmental toxins, and psychosocial stressors. Most studies suggest that a number of factors likely interact to affect the timing of menarche and other markers of puberty. Early menarche and early puberty raise a number of issues for the health and well-being of girls and women.

“EARLY PUBERTY IS A PROBLEM THAT DOES NOT ARISE FROM A SINGLE TOXICANT, LIFESTYLE OR DIETARY SHORTCOMING. RATHER, MANY DIFFERENT ENVIRONMENTAL STRESSORS—SOME PSYCHOSOCIAL, SOME NUTRITIONAL, SOME CHEMICAL—INTERACT IN THE BODIES OF YOUNG GIRLS IN WAYS THAT RESULT IN ACCELERATED SEXUAL MATURATION WITH ITS ATTENDANT RISKS FOR HEALTH AND WELL-BEING.” (Steingraber, 2007).

Age at menarche is an important indicator for certain diseases. Early age at menarche has been reported to be associated with several health complications including higher risk of obesity (Van Lenthe FJ, Kemper CG, van Mechelen W 1996), cardiovascular disease (Lakshman R, Forouhi NG 2009), breast cancer (Stoll BA, Vatten LJ, Kvinnsland S 1994), ischemic heart disease (Cooper GS, Ephross SA 1999), type-2 diabetes and uterine fibroid (Velez Edwards DR, Baird DD, Hartmann KE 2013). On the other hand delayed menarche has been indicated as a high risk factor for irregular menstrual cycle, low peak bone mass (Anai T, Miyazaki F, Tomiyasu T, Matsuo T 2011) and osteoporosis (Karapanou O, Papadimitriou A 2010). Early menarche has also been found to be related to depression, anxiety symptoms, premature intercourse and violent behaviour (Blumenthal H, Leen-Feldner EW et al 2009). Early menarcheal age causes precocious shutdown of the plates. Girls undergoing early menarche have a shorter final adult height when compared to late menarche group (Onland-Moret NC, Peeters PH et al 2005). Thus anomalies in pubertal timing (early or delayed pubertal development) could be associated with higher risk of poor health.

Age at menarche is strongly correlated with body size parameters, such as weight or BMI and height (Karapanou O, Papadimitriou A 2010). Frisch and Revelle proposed a critical body weight and weight gain for the onset of menarche (Frisch RE, Revelle R; 1970). Current evidence does not support critical weight hypothesis (John J, Verma M, Chhatwal J 2014). Higher subcutaneous fat levels and BMI at prepubertal ages are reported to be associated with early menarche (Freedman DS, Khan LK et al 2002). Ellison had related menarcheal age to height rather than weight (Elison PT 1981). A positive correlation had been reported between menarche and height (John J, Verma M, Chhatwal J 2014) It has been observed that the mean Mid-Upper Arm Circumference (MUAC), triceps skin fold thickness, hip circumference and waist circumference were higher among menstruating girls when compared to non-menstruating girls (Mounir GM, Ei-Sayed NA et al 2007). The present study attempts to find out the variation of age at menarche among the Porbandar girls and its relationship with anthropometric index. The study further attempts to investigate physical determinants of age at menarche.

MATERIALS AND METHODS

This study was performed in schools of Porbandar. The prior written permission of school authority was taken. Written consent from the parents of the students experimented in the study was obtained. The inclusion criterion was adolescent girls aged between 9 to 14 years undergone menarche.

Research Tool

A Questionnaire and semi structured interview (questionnaire) method were used for collecting data. Semi structured interview with the mothers of the respondent was utmost important for collecting efficient and reliable data. The questionnaire was verbally interpreted in. The questionnaire contained questions about the following issues: date of birth, age of first menstruation, paternal/maternal education, size of family, economical status, weight, height, sleeping hours, sporting, absence of father.

Ethical Approval

The study was conducted after obtaining approval from the District Education Officer.

Informed Consent

Informed consent was obtained from the principals and heads of administrations of the schools used. Privacy was also provided for respondents while explaining the procedure to answer the questionnaires. Respondents were also told about their rights to decide whether to participate in the study or not.

Anthropometric measurements

Body weight was measured using bathroom scale accurate to 0.5 kg. It was kept on a flat surface and adjusted with „0“ mark. After that the subject was requested to step on it in bare feet. Weights were taken in light cloth and recorded to the nearest 0.5kg. (Pramanik P, Banerjee SB, Ghosh A 2014).

Height was measured using anthropometric rod. It was recorded in bare feet and expressed to the nearest 0.1cm. (Pramanik P, Banerjee SB, Ghosh A 2014).

MUAC was measured in centimetre with non-stretched measuring tape with right arm hanging relaxed. The measurement was taken in the midway between the tip of acromion and olecranon process. The tape was placed gently but firmly around the arm avoiding compression of soft tissues.

Waist circumference was measured at a point midway between the lower border of the ribs and the highest point of iliac crest using a non-stretchable flexible tape in horizontal position at the end of normal expiration, with the subject standing erect and looking straight forward. Hip circumference was measured over light clothing at the widest point over the buttocks when viewed from the side. Measurement was recorded to the nearest 0.1 cm

Estimation of body mass index (BMI)

BMI was calculated from the height and weight using the equation: $BMI (kg / m^2) = weight (kg) / height^2 (m)$. (Pramanik P, Banerjee SB, Ghosh A 2014). Weight status was determined using BMI.

Estimation of body fat percentage (BF %)

Body fat percentage: calculations was made according to the following equation: (Frisancho AR 1981) $Body\ fat\ percentage = (0.353 \times waist (cm)) + (0.756 \times triceps\ fold (cm)) + (0.235 \times age (years))$

Estimation of waist- hip ratio

Waist hip ratio was obtained by dividing the waist circumference by hip circumference.

Statistical analysis

All the anthropometric values obtained were expressed as mean \pm standard deviation. Menarcheal age was also expressed as mean \pm standard deviation.

RESULTS

Mean anthropometric values of study subjects were represented in Table 1. Mean menarcheal age of study subjects was 11.89 ± 1.21 years.

Table 1: Anthropometric data of school going adolescent who already attained menarche

Variable	Value
Age (Year)	11.89 ± 1.21
Height(cm)	152.69 ± 6.62
Weight(cm)	47.18 ± 11.37
BMI	20.32 ± 9.48
MUAC (cm)	22.43 ± 3.23
Waist circumference (cm)	61.21 ± 9.44
Hip circumference (cm)	84.52 ± 9.31
MUAC/height	0.147 ± 0.022
Waist circumference/height	0.402 ± 0.065
Hip circumference/height	0.554 ± 0.061
Body fat percentage	25.71 ± 3.75
Age at menarche (month)	143 ± 15

Table 2: Distribution of study subjects by age at menarche.

Age at menarche (month)	Frequency	Percentage	Cumulative percentage
108-120	12	12	12
121-144	58	58	70
145-168	30	30	100
Total	100	100.00	

Table 2 represents the distribution of study subject on the basis of their age at menarche. Lowest age at menarche was 108 month and highest age was 168 month. The age of the respondents was between 11 to 14 years. 12 % of menstruating girls were 108-120 months old. 58% were between 121-144 months old, 30 % were between 145 -168 months old. It was inferred that the most common menarche age was 121-144 months old.

Table 3: Distribution of study samples according to BMI

BMI	NO OF GIRLS	PERCENT
<18.5 (U)	39	39
18.5- (N)	44	44
24.9- (OV)	12	12
29.9- (OB)	5	5
Total	100	100

According to the table given below 44 % of menstruating girls possessed normal BMI whereas only 39 % of the menstruating girls were underweight. It was concluded that majority of the menstruating girls had normal BMI except 12% and 5% were Overweight and Obese.

Table 4: Distribution of study samples according to Body fat

BODY FAT PERCENT	NO OF GIRLS	PERCENT
15 - 19 (LEAN)	0	0.00
20 - 25 (IDEAL)	53	53
26 - 30 (AVG)	27	27
30 - 36 (OVER FAT)	20	2
Total	100	100.00

Table 4 shows that the 27% of the girls who were menstruating have an average body fat of 26 -30. Over fat was observed in 20 % of menstruating girls and 53% of menstruating girls had an ideal body fat.

Table 5: Distribution of study samples according to Waist and Hip ratio.

WAIST HIP RATIO	NO OF GIRLS	PERCENT
0.70 OR BELOW (LOW RISK)	34	34
0.71 - 0.80 (M R)	52	52
0.81 + (H R)	14	14
Total	100	100.00

According to table 5 majorities of the menstruating girls that is 34% were at low risk category whereas 52% and 14% of menstruating girls were belonging to moderate and high risk categories respectively.

Table 6: Relationship between age at menarche and Mean BMI, Body Fat and waist hip ratio

AGE AT MENARCHE	NO OF GIRLS	BMI MEAN	BODY FAT MEAN	WAIST/HIP MEAN
9	4	22.47	22.79	0.72
10	8	20.31	24.70	0.72
11	22	20.32	25.53	0.72
12	36	19.59	25.52	0.73
13	21	22.07	27.05	0.73
14	9	18.02	25.05	0.68
Total	100			

As the table 6 shows the result that there is no inverse relation was found between BMI and age at menarche. According to the table mean BMI of menstruating girls increases with increase in all age except at the age of 12 and 14. To conclude there were no significant differences in the age at menarche and BMI.

The same table also shows that the mean body fat is directly proportion to the age of menarche. As the age increases there was an increase in mean body fat percentage except at the age of 14. It was inferred that there is no significant difference in the age at menarche and body fat percentage of the study sample.

According to the above table the waist and hip ratios of menstruating girls was directly proportional to the age at menarche except at the age of 14. The mean waist and hip ratio of menstruating girl's increases with increase in all age except at the age of 14. To conclude there were no significant differences in the age at menarche and waist and hip ratio. To conclude all these variables i.e. mean of BMI, Body Fat and Waist and hip ratio of the study sample were not significantly different.

Discussion and Conclusion

Menarche is a vital incidence in a female life. The mean age of menarche in the present study was 11.89 ± 1.21 years. Minimum age of menarche was 108 month and maximum with 168 month. The results of our study suggest positive correlation between BMI, Body Fat and Waist hip ratio and age at menarche. Our results support previous observation of (Lee et al 2013). A steady increase in growth was reflected by the BMI which showed a gradual increase with age except at the age of 14. Only 12% of girls attained menarche at an age of 9. The mean age of menarche of the study sample was 11.89 ± 1.21 years which is lower than that reported in the national survey for Egyptian girls (13.68 years). (Ibrahim B et al 1999). It is also lower than that reported earlier by (Abou-Youssef et al 1975) which was 13.2 ± 1.12 years, that of (Hidayat et al 1972) was 13.37 ± 2.0 years and that of (Sammour et al 1970) was 13.4 ± 1.75 years. Insignificant positive relationship between age at menarche and BMI, Body fat and waist –hip ratio was noted. Not much difference was noted in anthropometric variables of girls menstruating at different age groups. Though there is a decrease in the menarcheal age of the study sample when compared to the above said researches, according to this study the factors responsible for earlier menarche may not completely attributed to the anthropometric variables. Other influential factors like genetic, environmental, hormonal etc, factors might be responsible for this earlier age of menarche.

Acknowledgements

The authors thankfully acknowledge the cooperation rendered by school authorities, school children and their parents. Their kind cooperation in this investigation is highly cherished from the core of our heart.

REFERENCES

- Abou-Youssef E.Y, Hussien M, Gadallah FA(1975).” *Some biological changes during the adolescent years in school girls in Alexandria*”. Bull High Institute of Public Health. 1975; 5: 14.
- Anai T, Miyazaki F, Tomiyasu T, Matsuo T (2011);” *Risk of irregular menstrual cycle and low peak bone mass during early childhood associated with age at menarche*”. Pediatrics International, 43(5): 483-488.
- Blumenthal H, Leen-Feldner EW, Trainor CD, Babson KA, Bunaciu L (2009);” *Interactive pubertal timing and peer relations in predicting social anxiety symptoms among youth*”. J Adoles Health, 44(4): 401-403.
- Cooper GS, Ephross SA, Weinberg CR, Baird DD, Whelan EA, Sandler DP(1999);” *Menstrual and reproductive risk factors for ischemic heart disease*”. Endocrinology, 10(3): 255-259.
- Elison PT(1981);” *Prediction of age at menarche from annual height increments*”. Am J Phys Anthropol., 56(1): 71-75.
- Freedman DS, Khan LK, serdula MK, Dietz WH, Srinivasan SR, Berenson GS(2002);” *Relation to age at menarche to race, time period and anthropometric dimension*”: the Bogalusa Heart Study. Pediatrics, 110(4): e43.
- Frisancho AR(1981). “*New norm of upper limb fat and muscle areas for assessment of nutritional status*”. Am J Clin Nutr. 34:2540-5.
- Frisch RE, Revelle R;(1970)” *Height and weight at menarche and a hypothesis of critical body weights and adolescents*”. Science, 169(3943): 377-379.
- Hedayat N.(1972) “*Age of menarche among female population aged 7 to 19 in schools of Alexandria*” (Egypt). Thesis, Dr PH. Alexandria, Egypt: Alexandria University, Faculty of Medicine 1972.
- Ibrahim B, El-Tawila S, Sallam S, El-Gibaly O, El-Sahn F(1999). “*Transitions to adulthood: a national survey of Egyptian adolescents*”. Cairo, Egypt: The Population Council; 1999.
- John J, Verma M, Chhatwal J(2014);” *Physiological variables, psychological factors and age at menarche among Punjabi girls*”. Indian J Physiol Pharmacol.,; 58(2): 141-146.
- Kaplowitz PB, Slora EJ, Wasserman RC, Pedlow SE, Herman-Giddens ME(2001);” *Earlier onset of puberty in girls relation to increased body mass index and race*”. Pediatrics, 2001; 108(2): 347-353.
- Karapanou O, Papadimitriou A (2010);” *Determinants of menarche*”. Reproductive Biol Endocrinol.,2010; 8: 115.
- Lakshman R, Forouhi NG, Sharp SJ, Luben R, Bingham SA, Khaw KT(2009);” *Early age at menarche associated with cardiovascular disease and mortality*”. J Clin Endocrinol Metab.,; 94(12): 4953-4960.
- Lee SE, Yang JY, Lee JH, Kim HW, Kim HS, Lee HJ et al.(2013);” *Relationship of age at menarche on anthropometric index and menstrual irregularity in late adolescent girls*”. Annals Pediatr Endocrinol Metab., 2013; 18(3): 116- 121.
- Mounir GM, Ei-Sayed NA, Mahdy NH, Khamis SE (2007);” *Nutritional factors affecting the menarcheal state of adolescent school girls in Alexandria*”. J Egypt Public Health, 82(3- 4): 239-260.
- Onland-Moret NC, Peeters PH, van Gils CH, Clavel-Chapelon F, Key T, Tjønneland A et al (2005) .“ *Age at menarche in relation to adult height*”: the EPIC study. Am J Epidemiol., 162(7): 623-632.
- Parent AS, Teilmann G, Juul A, Shakkeback NE, Toppari J, Bourguignon I (2003);” *The timing of normal puberty and the age limits of sexual precocity: variations around the world, secular trends and changes after migration*”. Endocrinol Rev., 2003; 24(5): 668-693.
- Pramanik P, Banerjee SB, Ghosh A (2014);” *Lifestyle and Nutritional Status of School Going Adolescent Girls in a Semi Urban Area of West Bengal, India*”. IOSR Journal of Dental and Medical Sciences, 13(8): 37-42.
- Samnour, M.B.(1970).” *Menarche in Egyptian girls. A preliminary report*”. Ain Shams Med 1970; 212: 147-53.
- Steingraber, S. (2007). “*The falling age of puberty in U.S. girls: What we know, what we need to know*”. San Francisco, CA: Breast Cancer Fund.
- Stoll BA, Vatten LJ, Kvinnsland S (1994);” *Does early physical maturity influence breast cancer risk?*”. Acta Oncol., 33(2): 171-175.
- Van Lenthe FJ, Kemper CG, van Mechelen W (1996);” *Rapid maturation in adolescence results in greater obesity in adulthood: the Amsterdam Growth and Health Study*”. Am J Clin Nutr.; 64(1): 18-24.
- Velez Edwards DR, Baird DD, Hartmann KE (2013);” *Association of age at menarche with increasing number of fibroids in a cohort of women who underwent standardized ultrasound assessment*”. Am J Epidemiol., 178(3): 426-433.