ABSTRACT

The age at menarche is fairly an accurate measure of physical development and the approaching psychosexual maturity of pubertal girls. Described as the most striking factor in the whole process of female maturity, the age at menarche is an important factor in health planning and future development.

Most of the research studies in this area have revealed that age at menarche is affected by a number of factors like heredity, family size and place of residence. Research workers like Tanner 1976, Alan D. Rogol et al. 2000; T. Kazrerooni et al. 2000, had shown in their studies that age at menarche is affected by both heredity and environment. According to other research workers like Kakkilaya Bevinje and Dr. Srinivas (2005, in Nigeria), Th. Somola Devi and W.Nabakumen et al. (2007, in Manipur); Farruggia Chen and Farrugia S. (2002, in California); Evelette and Tanners (1990); factors such as SES and nutritional status play a vital role than others.

In spite of much pioneer work done on adolescent growth during recent years, there is lack of knowledge on different aspects of adolescents especially on the development of secondary sexual characteristics in developing countries like India. The rate at which girls progress through the stages of puberty, the relationship of one event to another and the association of occurrence of menarche has been well documented in various longitudinal studies done only in various European countries by Marshall W.A., Tanner J.M. (1969); Tanner J.M., White House R.H.,(1976); and by M. Siegel (2002) in New York. According to Marshall and Tanner, 1976, the adolescent growth spurt, the development of the breasts
and growth of the pubic hairs occur more or less concurrently and take on an average about 3 years from beginning to completion, with menarche occurring usually in the later half of this period. Tanner (1962) explained that sexual maturity rating comprise of two parts in the girls namely breast stages and pubic hair stages, with five developmental stages in each category. Besides these, studies are confined regarding various factors affecting menarche age especially weight, height, BMI & SMR stages reported from India. Also there is lack of research on aspects as relation between amenorrhea, dysmenorrhea, and age at menarche.

Keeping the above mentioned facts in mind, the present cross sectional study was conducted on adolescent secondary school girls (aged 10-15 years) with an objective to know the mean age at menarche and its associated correlates. The aim of the study was to establish possible correlation between variables like SES, nutritional intake, BMI, anemia, blood pressure and age at menarche. Comparisons of sexual maturity rating (SMR) stages of menarcheal and non-menarcheal subjects was done using Tanner's (1976) classification. Relationship of age at menarche with various menstrual problems like PMS, amenorrhea and dysmenorrhea were also noted.

In order to arrive at the above mentioned objectives, the present study was conducted in four secondary schools at Aligarh city. Schools were selected by stratified random sampling procedure from four different regions keeping in mind that girls of all socioeconomic groups are included in the study, so that the possible correlation between different variables including SES and age at menarche
could be established. Each of the selected schools included students from all religions.

The total population of females attending schools in Aligarh city in the age group 10 – 15 years was approximately 26,450 [source: District Basic Education Officer (session, 2004-2005)]. The population in the four selected schools was approximately 2,250, which was calculated out to be 8.5% of total. The selected sample of study (N=700) was 2.6% of the total female population. A prior pilot study was done to assess the prevalence of menarcheal girls between 10 – 15 age group. The sample size was calculated on that prevalence basis. The number of girls selected from each school was proportional to the sample size. The whole sample was divided into two groups – menarcheal and non-menarcheal.

A detailed personal and family history, specially age of the girl, her age at menarche, mothers age at menarche was enquired into. Each girl was then subjected to a thorough physical examination with emphasis on anthropometric measures and sexual maturity Rating (SMR) stages. Each selected girl during a regular classroom hour was asked to fill in a preformed and modified questionnaire including the above mentioned details. The questionnaire was divided under the five main headings as General information, SES, Physical examination, History of menstrual cycle and Diet survey.

For the assessment of nutritional status in the present study Body Mass Index (or Quetlet Index) was calculated (Kg/m²). A 24 hour dietary recall method of the previous day was utilized for the purpose of getting the dietary intake. The pubertal growth was assessed by means of Tanners (1976) stages of sexual Maturity rating (SMR).
For assessing the socioeconomic status (SES) B.G. Prasad method of socioeconomic classification (modified as per 2002) was used. Anaemia was assessed by the method of clinical examination and the presence of pallor was looked for.

On the basis of above mentioned techniques the following results were observed: among the total 700 selected girls 400 (57.2%) girls had attained their menarche and 300 (42.8%) were non menarcheal. The values of BMI given by ICMR (2002) were used to classify adolescents into underweight (BMI<23 Kg/m²), normal (BMI 18-23 Kg/m²) overweight (BMI 25-30 Kg/m²) and obese (BMI >30 Kg/m²). A significantly high proportion of menarcheal girls were found underweight, only 5 girls were overweight. None of the subjects was found obese. On analyzing and comparing Height and weight with ICMR norms (Aggarwal et al, 1992) and NCHS standards (2004), it was observed that girls who had attained menarche after the mean age (late matures) had weight below the expected weight at the respective ages, while the early matures had weight above the expected values. On the other hand the mean weight of non menarcheal girls was found less than the expected values at all ages except 10 years. There was no significant difference found in the height of menarcheal and non-menarcheal girls of same age.

On assessing the diet history, it was noted that a 24 hour dietary recall method is more likely to produce a reliable estimate of intake where a regular meal pattern is followed. After calculating the total intake of calories, proteins and iron per day, it was found that the differences between the calorie, protein and iron intakes of menarcheal and non-menarcheal girls were statistically significant. Among the menarcheal girls, a significantly high proportion of girls (66%) had low calories intakes.
(Below average). Only 22.7% girls took proper calories. The mean intakes of iron fall short of ICMR standards irrespective of age and menarcheal status.

The pubertal growth was assessed by means of Tanners (1976) stages of sexual Maturity rating (SMR). Majority of the menarcheal girls were found in the SMR stage III or IV, whereas the non menarcheal girls were found between stages I and III. On assessing the socioeconomic status (SES) by method of B.G. Prasad socioeconomic classification (modified as per 2002), the difference between the mean SES of menarcheal and own menarcheal girls was found to be statistically insignificant. For assessing the presence of anemia through clinical examination, for the presence of pallor, a significant proportion of the selected girls (31.8%) were found with mild anemia and 11% girls were moderately anaemic. None of the girls were found with severe degrees of iron deficiency, whereas 57.2% girls were free from anemia.

In the present study the maximum percentage of girls (28.3%) attained menarche at the mean age of 13.3 years. The percentage drops gradually as the mean age of attaining menarche decreased with minimum %age of girls (2%) attaining menarche at the mean age of 9.9. years. The overall mean menarcheal age in the present study was found to be 12.36 ± 1.16 years. The present finding compared well with most of the North Indian studies especially to a multi centric ICMR (1992) study and NFI (1989) study.

On analyzing the various problems faced at the time of menarche and afterwards it was found that age at menarche was strongly correlated with the presence of amenorrhea and pre-menstrual symptoms (PMS). On the other hand, preserves of painful
menstrual periods (dysmenorrhea) and dysfunctional uterine bleeding were not affected by age at menarche.

After taking into consideration the results of the study it may be concluded that the age at menarche was strongly correlated with religion. The maximum % age of early menarcheal girls (77.6%) found among Muslim, and maximum % age of late menarcheal girls (64.5%) were found among Hindus. In our country eating habits are highly influenced by religion. It is quite evident from studies that meat and fish taking girls experience menarche at lower ages (Seung Kupku and Jong won Kang et. al. 2006, in an study on North Korean refugee girls).

Age at menarche was positively correlated with fathers literacy level and occupation. Whereas no significant difference was found between menarcheal and non menarcheal girls according to mothers education and working status. This factor could be related to the fact that girls from higher social classes attain menarche earlier than girls from lower social backgrounds. SES was also significantly associated with age at menarche. The number of girls in early maturing population increased with rising income group.

Early menarcheal girls (9.5 – 11.5 years) showed maximum mean body weight of 43.5 kg; 1.5 kg more than mean weight of normal menarcheal girls (11.6 – 13.5 years). Late matures showed minimum mean body weight of 39.7 kg, approximately 4 kg less than the weight of early matures. The mean BMI of menarcheal girls was found higher than the mean BMI of non menarcheal girls of same age. 48% menarcheal girls were found underweight as compared to 78% among non-menarcheal girls. 50.7% menarcheal girls were found with normal BMI as against only 22% non-menarcheal girls.
Only the prevalence of over weight was found to be 1.25% among menarcheal girls. None of the subjects was found obese.

The percentage of bottle-fed girls was highest among early matures (72.8%), whereas the percentage of breast-fed girls was highest among late matures (75.8%) as compared to early matures (27.1%). There is lack of available literature to date showing the extend to which breast feeding or bottle feeding during infancy affects the age at menarche. Therefore the present study covers the aspects which still need much attention in developing countries like India. The percentage of non-vegetarian girls was high (16%) among early matures as compared to only 2.7% vegetarian. Mean calories intake of menarcheal girls was found significantly higher than mean intake of non-menarcheal counterparts. Among 400 menarcheal girls, only 22.8% took appropriate calories. 8.7% girls had above average calorie intake which constituted early menarcheal population. Only 15.8% menarcheal girls took average protein in their diets. Very low percentage (7.5%) of girls took average iron. The mean intake of iron fall short of ICMR standards irrespective of age and menarcheal status.

The mean Blood pressure of menarcheal girls was found significantly higher than the mean B.P. of non menarcheal girl at same age. The number of girls experiencing anemia gradually increased with increasing age of menarche. Out of 700 girls the prevalence of anemia was found to be 19.3% among menarcheal girls as compared to 23.5% non-menarcheal girls. Maximum numbers of menarcheal girls were found in SMR III or IV. The mean age of attaining menarche in the present study was found to be 12.36 ± 1.16 years.
Early matures experienced more PMS (53.4%) as compared to normal and late matures (34.5% and 38.7% respectively). No significant correlation was found between BMI and PMS(s). Among 400 menarcheal girls, the prevalence of amenorrhea was found be 45.6% among early matures, 28.5% among normal matures and 8.06% among late matures. A significantly high percentage of non-vegetarian girls (16.5%) experienced amenorrhea as against only 6.8% vegetarians.

Prevalence of dysmenorrhea was found to have no significant correlation with age at menarche, but was affected by total dietary intake. The number of girls experiencing dysmenorrhea decreased with increasing caloric, protein and iron intake. Among the 400 menarcheal girls, the prevalence of dysfunctional bleeding (periods extending above 10 day) was found to be increasing with decreased caloric intake. The %age of girls without dysfunctional bleeding increased from 70% to 100% with increasing caloric intake. These were relatively new findings as there is lack of available literature regarding these aspects, especially from India.

A stepwise multiple regression was done to determine the combination of most confounding factors predicting age at menarche. Menarche age was found to be most significantly correlated with total calorie intake, mode of feeding in infancy, BMI, eating habits and heredity. Among the menstrual problems of the post menarcheal girls studied, amenorrhea was found to be the most confounding factor.

In the end it was found that there is a need of increasing public awareness concerning the needs of adolescent girls through community activities and conferences, implementing programmes to enable girls to acquire skills, and increasing joint programmes between girls and boys for improving gender sensitivity.
It is also worth mentioning that adolescent girls had not received the attention they deserve in our country. There is lack of researches regarding various aspects of adolescent health. Factors like menarche age and it's relationship with height, weight, BMI, and SMR stages are still least covered in researches. There is lack of enough literature on various menstrual problems like amenorrhea, dysmenorrhea, PMS and age at menarche. The results of the present study may be used as guidelines for nutrition and health promotion in the girls of menstruating age. Improved understanding of the physiology of menstrual cycle may result in the discovery of more effective treatment regimens.