REVIEW OF LITERATURE

Age at menarche, the beginning of menstruation, is believed to be influenced by a number of factors including body composition, physical activity and nutritional status. Age at menarche is greatly influenced by participation in sports. It is viewed as an excellent physiological marker of adolescent maturation. It has been observed that the average age at menarche has been reducing in the past few decades. Most sources agree that the average age at menarche in girls in modern societies has declined through the degree and remains subject of controversy.

Menarcheal age varies from population to population. It is influenced by various factors, which are both genetic as well as exogenous. The factors affecting age at menarche are nutrition, diseases, body composition, physical activity, psychological stress and place of living. Most of the exogenous factors are related to nutrition directly or indirectly.

There are numerous studies regarding age at menarche in India and all over the world. Different authors have studied various factors effecting age at menarche. The present study aims to study the effect of body composition, physical activity, nutritional status and place of living on age at menarche also an effort is made to study the secular trend.
The literature relevant to the present investigation has been discussed under the following headings.

2.1 Age at menarche and secular trend.

2.2 Age At Menarche And Nutritional Status

2.3 Age at Menarche And Body Composition

2.4 Age at menarche and physical activity

2.5 Age At Menarche And Place Of Living

**2.1 AGE AT MENARCHE AND SECULAR TREND**

Tanner (1962) described the secular trend in age at menarche. According to tanner, the average age of menarche dropped from about 17 to 12.8 during the period 1830-1962. The rate of decline was 4 months per decade. Tanner has also noticed a decline in the age of initiation of the growth spurt. The trend seems to have stopped, with the age of menarche leveling off at 12.6.

Wyshak & Frisch (1982) present data documents the secular trend towards age at menarche. They concluded that age of menarche has become earlier by two to three months per decade in past century & half.

Sanchez-Andres (1997) studied genetic and environmental factors affecting menarcheal age of daughters and mothers. The mean age at menarche of mothers was significantly greater than in
daughters. Year of birth and family size accounted for the variation in age at menarche. They concluded that genetic and environmental factors affect age at menarche, even though the influence of environmental variables may change over time.

Arora and Singh (1999) concluded from the comparison of first degree relatives (female cousins) that the age at menarche was highly genetically controlled event. In the higher socio-economic group the height and weight values of mother and daughter was significantly higher than the lower socio-economic group.

Graham et al. (1999) studied the secular trend in age at menarche in rural parts of China. The study showed that the mean age at menarche decreased by 2.8 years from 16.5 to 13.7 over an approximate 90 years time interval. They found association between age at menarche and a number of covariates like country, physical labour, general health status, exposure to pesticides before menarche.

Khanna and Kapoor (2004) studied the secular trend in stature and age at menarche among Punjabi Aroras girls and their residing in New Delhi, India. An increase in stature and decrease in age at menarche was reported when the data of daughters was compared with that of their mother's thereby indicating secular trend in these two parameters. Better living conditions, improved nutrition and medical facilities, changes in environmental and socio-economic
factors may account for increase in stature and early biological maturation

Ersoy et al. (2005) studied the factors affecting the relation between the menarcheal age of mother and daughter. Their results suggested that the menarche occurs earlier in the daughters and their mothers. The correlation between the menarcheal age of the girls and their mothers persists under all circumstances except in obesity. The mother's menarcheal age is good predictor of the daughter's menarcheal age in non-obese girls.

Kalarov et al. (2005) investigated the correlation of age at menarche of mothers and daughters in Backa Palanka. They concluded that genetic factors have the greatest influence on the age at menarche. However there is also an acceleration phenomenon. The average age at menarche in girls was 12.17 and their mother's was 13.08 years that clearly shows the acceleration phenomenon.

Lakshmi, et al. (2006) studied menarcheal age in three endogamous Vysya populations, Arya Vysya, Thrivarnika and Kalinga Vysya.. It had been observed that there was a decrease in mean menarcheal age with moving down in social hierarchy. Further, among the three population groups of Andhra Pradesh which had been studied at different times, decrease in mean menarcheal age had been found which show a secular trend.
Dundor et al. (2008) reported the mean age at menarche and factors affecting menarche in girls in Isparta. The mean age at menarche was found out to be 12.6 ± 3 years. The age at menarche were found to be significantly lower than mean age at menarche of mother and elder sisters. They found out positive correlation between age at menarche and mother age at menarche and a negative correlation was found out between age at menarche and BMI.

Gaudineau et al (2010) studied the factors associated with early menarche. Early menarche was assessed in the health behaviour in school aged children. A total of 1072 15 years old girls were studied Median age at menarche was 13.0 years 57 girls (5.31%) were early matured. Early maturing girls may engage in risk behaviour linked to their appearance than the maturity level

Rokade and Mane (2010) studied the age of menarche its secular trend and factors associated with it. The study was conducted on Punjabi arora girls and their mothers to see the phenomenon of secular trend in stature and age at menarche. An increase in stature and decrease in age at menarche was reported when the data of daughters was compared with that of their mothers thereby indicating secular trend.
2.2 AGE AT MENARCHE AND NUTRITIONAL STATUS

Frisch & Revelle (1970) found that menarche occurs at the same mean weight in both early and later maturing girls. The early maturer girls were taller. Frisch and Revelle proposed the hypothesis of critical body weight. Frisch proposed that height and weight at menarche were studied for subjects in three longitudinal growth studies. Early and late maturing has menarche at same mean weight, but late maturers are taller at menarche. Frisch work concluded that a minimum of 17% body fat is necessary for the onset of menarche. A female must weigh 48 kg for menarche to occur, regardless of her height and age. A minimum of 22% of body fat is necessary for maintenance of regular cycles.

Frisch (1972) reported relationship of weight with age at menarche. The mean weight at menarche of 30 undernourished girls did not differ from that of 30 well nourished controls, although the undernourished girls attained menarche two years later than controls and at a significantly greater height. This supports the hypothesis that a critical weight triggers menarche.

Gross and Smith (1987) studied the effect of nutritional status on age at menarche from the data of girls and young woman. The nutritional variables investigated and found to be associated with the age at menarche were height, weight and triceps skin fold thickness.
They concluded that at any given age girls whose nutritional status was better, particularly in terms of weight were more likely to have commenced menstruation.

Abioye-Kuteyi et al. (1997) studied the influence of socioeconomic and nutritional status on menarche in Nigerian school girls. They conducted study on 352 secondary school girls in urban population in Southern Western Nigeria. The mean age at menarche was found to be 13.94 +1.31. Age matched pre and post menarcheal girls did not differ significantly in biophysical measurements, however nutritional status was strongly and positively associated with attainment of menarche. School girls from the upper socio-economic class reached menarche eleven months earlier than girls from lower socioeconomic class.

Simondon et al. (1997) examined the nutritional status and age at menarche of Senegalese adolescent. Mean age at menarche was estimated to be 16.1 years. Puberty as assessed by age at menarche in Senegalese adolescents girls was delayed by about 3 years, probably due to malnutrition.

Amrita Bagga, S. Kulkarni(2000) studied the effect of nutritional status on age at menarche on maharashtrian girl .They found that both measurements, the height (the indicator of skeletal maturity), and the weight (the indicator of fat accumulation), were positively
correlated with age at menarche. The well known phenomena of children achieving greater size and maturing earlier as manifested by menarche in girls and the secular trend in the age at menarche are well demonstrated in the present study on the Maharashtrian girls of Pune city. The lowering of age at menarche at an average rate of about 6 months per decade in the last three decades in the present study, as compared to 3-4 months in some countries of Europe, North America, and several parts of the world, reflects upon the now improved socio-economic, nutritional and general health conditions in India as compared to these countries where similar standards were achieved much earlier.

Berky et.al. (2000) examined the relation of childhood diet and body size to menarche and adolescent growth in girls. Age at menarche, age at peak height growth velocity were all associated with diet and body size much earlier in childhood. Menarche occurred earlier in girls who were taller and who consumed more animal protein and less vegetable protein as early as ages 3-5 years. Although factors closer to puberty are more important

Thomas et.al. (2001) conducted a study on international variability of ages at menarche and menopause. This study identified the causes of age variation in the timing of menarche and menopause. They revealed that among several variables reflecting living conditions,
the factors best explaining the variations in age at menarche were adult illiteracy rate and vegetable calorie consumptions. They suggested that age at menarche reflects more a trend in energy balance than merely nutritional status.

Acharya et al.(2006) studied Nutritional Status and Menarche in Adolescent Girls in an Urban Resettlement Colony of South Delhi A community based cross-sectional study was conducted. It was found that the rate of under nutrition among adolescent girl was very high (74%). The nutritional status was associated with age at menarche. The higher the nutritional status, the lower is the age at menarche

Li et al (2006) studied the effect of dietary patterns with sexual maturation in Korean children. A cross-sectional study was conducted in 422 boys and 365 girls using three-day diet records. They suggested that dietary patterns were related to body composition and sexual maturation among the Korean children.

Singh et.al. (2006) investigated the health status of adolescent girls in slums of Lucknow. The study was carried out on adolescent girls of 10-19 years age group in slums of Lucknow. The mean age at menarche was 13.7 years. The mean hemoglobin was 10 g /100ml of blood. The mean height and weight in all groups was less than ICMR standards.
Banerjee et al. (2007) conducted the cohort study of correlation between body mass index and age at menarche in healthy Bengali girls. The study was conducted on healthy girls in age range of 8-16 years of adequate nutrition and from middle income families of Kolkata. The age at menarche in Bengali girls was 12.3 years. The age at menarche in girls in lower socio-economic group in western India was considerably delayed 15.4 years. So it reflects that malnutrition delay menarche. The correlation of age at menarche and BMI came out very weak.

Gupta et al (2007) investigated the menarche in urban slums and rural areas. Adolescent girls are undernourished in urban slums and rural areas. Urban girls are comparatively taller and heavier than rural girls.

Malhotra and Passi (2007) assessed the diet quality and nutritional status of adolescent girls in North India. They found out that nearly half of the girls they studied have energy intake less than 75% of RDA. The study revealed that there was not only a high incidence of under nutrition but also dietary inadequacy of rural girls particularly in respect of energy, protein and micronutrient intake.

Mounir et al. (2007) reported the effect of nutritional factors on the menarche of adolescent school girls in Alexandria. The mean age at menarche was 11.98 ± 0.96 years. Girls who had attained menarche
had a significant higher percent body fat as compared to non-menstruating ones. Mounir et al. concluded that nutritional status of the adolescents had a significant association with age at menarche.

Banik, S.D. (2011) evaluated the health status of pre-menarcheal and post-menarcheal girls in Purulia. In this study the mean age at menarche was estimated to be 1260 years. The index indicates very high prevalence of low health profile of the girls. The results also implies that among girls, post-menarcheal girls have worse health condition than pre-menarcheal girls.

Belachew et.al. (2011) studied the food insecurity and age at menarche among adolescent girls in Jimma Zone Southwest Ethiopia. Food insecurity is associated with delay of age at menarche by one year among girls in the study area. Stunted girls had menarche one year later than non-stunted peers.

### 2.3 AGE AT MENARCHE AND BODY COMPOSITION

Frisch and Mc Arthur (1974) suggest that a minimum level of stored, easily mobilized energy is necessary for ovulation and menstrual cycles in the human females. Weight loss causes loss of menstrual function (amenorrhea) and weight gain restores menstrual cycles. A minimal weight for height necessary for the onset of or the restoration of menstrual cycles in cases of primary or secondary amenorrhea due to under nutrition is indicated by an index of fatness.
of normal girls at menarche and at age 18 years, respectively. Amenorrheic patients of ages 16 years and over resume menstrual cycles after weight gain. Girls become relatively and absolutely fatter from menarche to age 18 years.

Anderson et al (1975) demonstrated that the girls from the age of 8 to 16 years who had advanced statural maturity were taller and heavier. The late statural maturers of the age 16 years had caught up to the early maturers in height only. The early mature had more stature as compared to late maturers. Earlier statural maturer had greater weight for their height and greater gain in weight and height from the age 8 to 12 years.

Vandenbroucke et al. (1982) assessed the effects of intensive physical activity and thinness on menarche. They proposed that results was compatible with the hypothesis that both thinness and physical activity may cause delayed menarche. In addition the effect of these two factors are synergistic.

Kaul and corrucini(1985) predicted no clear trend in adolescent spurts for stature and its components in the Chandigarh girls of 12 to 17 years of age. Also comparison was made between urban and rural girls which found slightly delayed menarche in rural girls than urban girls. Urban girls were taller than rural girls. Earlier mature girls were found to be taller than the late mature irrespective of the urban or
rural residence. They predicted that in Chandigarh girls the adolescent growth spurt occurs at 12-13 years.

Plowman et al. (1991) compared the premenarcheal athletes and non-athletes in terms of body composition and sexual maturation. There was no significant difference between athletes and non-athletes and groups exhibited similar and significant correlation between age, height, weight and physical development.

Merzenich et al. (1993) conducted a study to evaluate the role of nutrition, physical activity and other lifestyle factors for the age at menarche. Parameters of physical development such as body weight or body fatness were found to be predictors of menarche. The study provides evidence that dietary effects on breast cancer risk might be indirect by influencing hormonal events like the age at menarche.

Karen Lin-Su et al. (1995) studied the body mass index and age at menarche in an adolescent clinic population. It was observed that the body fatness is the index of age at menarche. The average age at menarche was 11.87 in obese group, 12.14 in the overweight group, and 12.20 in normal group. Age at menarche and BMI SDS were negatively correlated. They suggested an important role of increased body weight on menarche that extends beyond underweight girls.

Ohsawa et al. 1997 studied the larger sample of 64322 school going Chinese girls from 8 to 18 years and observed that the post
menarcheal girls have more height and weight as compared to pre-menarcheal girls. Post menarcheal girls have a linear physique and more potential of increasing stature and lower limbs into late adolescence.

Rao et al. (1998) studied the menarche in relation to changes in physical measurements that take place during adolescence especially the changes in height velocity and changes in body fat. The subjects were girls in 9-16 years of age group from lower as well as upper socio-economic classes. The girls from lower socio-economic class had lower attained weight, height, skin field thickness and body fat and also there is significant delay in age at menarche.

Shu-Hui Chang et al. (2000) studied the height and weight change across menarche of school girls with early menarche. Their results support the hypothesis that height velocity reaches a peak one year before menarche but height velocity stopped increasing within one year after menarche. The change in velocity reveals no obvious growth spurt at age of menarche onset.

Talwar and Maninder (2001) investigate the growth pattern and age at menarche in 285 bania girls ranging in age between 9 to 16 years belonging to middle socioeconomic status. Study revealed a regular increase in anthropometric measurements with the advancement in age. A growth spurt for height and height has been
depicted from 12 to 13 years. These girls show less height up till 13 years where after it showed increase and thus girls had a heavier body build thereby. The BMI showed an increase with the age but a larger magnitude between 11 to 16 years of age was observed. The muscular development showed incline from 11 to 15 years of age.

Adair and Gordon–Larsen (2001) stated that early maturing black girls have significantly higher prevalence of over weight than late maturing girls. Early maturing girls were shorter and heavier than those who matured latter in all other ethnic groups (black, white, Asian and Hispanic)

Kaur and Sidhu (2003) examined in 121 Punjabi girls aged 11.5 to 15.5 years that the menarche occurred at 14 years of skeletal age in girls but the skeletally advanced girls experienced menarche at the age of 12 and 13 years of age. 83.3 percent average and 16.6 percent delayed girls experience menarche at 14 years of age. The post-menarcheal girls were significantly heavier, taller and have advanced skeletal maturity as compared to pre-menarcheal girls.

Onland et.al. (2005) studied age at menarche in relation to adult height. In this study trends in age at menarche, and adult height are investigated among 286205 women from nine European countries. Second the relation between age at menarche and height was
estimated. Women with earlier menarche reach a shorter adult height as compared with women who have menarche at a later age.

Laseek et al.(2007) reported that menarche is more closely related to fat distribution, than to skeletal maturity. They studied that in young women with completed growth, age at menarche is negatively related to hip and thigh circumference and positively related to waist circumference, stature, and iliac breadth; and blood leptin levels while the total estimated amount of body fat and weight are not significant predictors of menarche when added to skeletal growth, the distribution of body fat, as indicated by the relative amounts of upper-body and lower-body fat, is significantly related to menarche, especially in young women who reach this reproductive landmark with unusually low levels of total body fat.

Tanner et al (2007) studied age at menarche is relation to adult obesity. The study assessed the obesity risk and the relationship between obesity, metabolic parameters and age at menarche in a series of Turkish women. Age at menarche may simply be a maker for the pace of sexual maturation, leads to difference in adiposity that track into adult life.

Durrani and Bano (2009) studied dysmenorrheal in secondary school girls in Aligarh city. The results revealed that there was no
significant correlation between severity of dysmenorrhea and age at menarche.

Dahiya et.al. (2010) studied the relationship between age at menarche and early life nutritional status in India. They reported adolescent stunting as the most important determinant of age at menarche. Age at menarche was not affected by birth size. Age at menarche is strongly influenced by nutritional status in adolescence.

Goon et.al. (2010) studied the age at menarche and growth status in adolescents in rural areas of Nigeria. They supported the theory that BMI is the key factor in the onset of menarche. Their study supports the trend of declining age of menarche but the difference in rural and urban girls was reported less than the other studies reported in Nigeria.

Nielson (2011) studied the trends in age of menarche. The author concluded that age at menarche is effected by BMI. As the BMI increased the age at menarche decreased. Therefore girls who have a higher BMI are likely to start menses earlier. The age at menarche was not found to be decreasing over time that can be due to leveling off of age at menarche due to optimal nutritional level.
2.5 AGE AT MENARCHE AND PHYSICAL ACTIVITY

Malina (1973) had studied the process of menarche in athletes. He reported that menarche occurs at a later age in exercising girls. It was also noted that age at menarche seems to be directly related to competitive level and years of intense training prior to menarche. Malina also proposed a two part hypothesis. According to him, inherited “physique” is the first factor explaining the later age in exercising trained girls. The second factor is “socialization process”. Late matureres tend to socially involve in sports because of their delay in biological maturity.

Sidhu and grewal (1980) studied that menarcheal age is also dependent on the intensity and duration of exercise performed by girls and also whether they have started exercising before or after menarche. They found that delay in menarcheal age is more significant in players who started playing before the onset of menarche than those who has started after it. They also concluded that players of different sports do not differ in their mean age among themselves.

Warren (1980) relates the menstrual dysfunction of athletes to imbalance in energy intake and expenditure. He explained that an imbalance between elevated energy expenditure and inadequate energy intake may modify the endocrine status of some athletes,
resulting in menstrual dysfunction. Anovulation and amenorrhea may occur in athletes with intense metabolic energy demands that are not adequately maintained by caloric intake.

Mathur and Toriola (1982) studied the age at menarche in Nigerian athletes. They conducted the study on 418 successful female athletes and 512 female non-athletes of Nigeria. They found that overall mean menarcheal age of athletes was (14.41) higher than that of non-athletes (13.57). Menarche was significantly delayed in those athletes who started physical activities earlier in life.

Malina (1983) reported a summary of the available data on the age at menarche and discussed the various explanations offered for the generally delayed menarche in athletes. The author reported data based upon several retrospective surveys of about 600 athletes, including high school, university and Olympic levels. Besides the intensive training there are other factors which may be responsible for delay in menarche. The author suggested that mechanism for the association between intensive physical training and delayed menarche is hormonal. He further suggested that intensive training and energy drain influence circulating levels of gonadotropic and ovarian hormones and in turn menarche. Exercise is also highly effective means of stressing the hypothalamic–pituitary axis.
Dey et al. (1985) studied the patterns of menstrual disorders of women gymnasts. Participation in training program dominated by high amount of stimulus in gymnastics especially at younger stages have developed either amenorrhea or irregular periods. The degree of anxiety arising among the young gymnasts participating from younger ages caused the delay in onset of menses.

Mokha and Sidhu (1989) studied the age of menarche in Indian female basketball and volleyball players at different competitive levels. Menarche is significantly delayed is players as compared with controls. There is a continuous trend of increase in the age of menarche with the increasingly levels of competition, menarche is more delayed in players playing at higher levels of competition.

Keizer and Rogol (1990) explained the mechanism of physical exercise and menstrual cycle alteration. They explained that physical training eventually might lead to shortening of luteal phase and secondary amenorrhea.

Malina et al. (1997) reported the association between family size and age at menarche in athletes representing seven sports. They reported that birth order and family size effect age at menarche. Larger family size and birth order tend to delay age at menarche.

Cavadini et al. (2001) conducted study on 3540 subjects aged 9-19 years to assess lifestyles, physical, sport activity and food habits.
They reported that food habits among athletic adolescents are healthier than non-athletic adolescents.

Warren & Perlroth (2001) studied the effects of intense exercise on the female reproductive system and specific mechanisms triggering reproductive dysfunction. An energy drain incurred by women whose energy expenditure exceeds dietary energy intake appears to be the primary factor effecting GnRH suppression in athletes engaged in sports emphasizing leanness. Increasing caloric intake to offset high energy demand may be sufficient to revise menstrual dysfunction.

Fuji et al (2002) studied the relationship between change in BMI with age and delayed menarche in female athletes they found that menarche occurs in ordinary girls at the age at MPV of BMI. The BMI at that time is not on average significantly different from that of athletes. They suggest that stress from training effects the menarcheal age in athletes.

Vodacz et al (2002) estimated the age at menarche in 159 competitive figure Skater aged 11-22 years. They found out that late maturation was characteristic of competitive figure skaters particularly in elite and more specialized pair skaters, and there was a significant familial resemblance.

Claessens et al (2003) investigates the age at menarche in anthropometric characteristics, competition level and boat category in
elite junior rowers. They author studied 212 females rowers participants in 1997 FISA World Junior rowing championship rowers who started a significant later age at menarche compared with rowers who started their training after menarche. No significant relationship between the age at menarche and physical and body composition characteristics could be demonstrated.

Erlanson et al. (2007) reported the growth and maturation of Adolescent female gymnasts, swimmers and tennis players. They reported that average at menarche of swimmers and tennis players were similar to the contemporary British girls. Whereas gymnasts average age at menarche was much later. Age at menarche in gymnasts was significantly older than swimmers and tennis players. They interpret that gymnasts training did not seen to compromise adult height but it is likely that gymnasts if are selected into participating the sport most suited to their body size which in turn is related to their maturity.

Kabir et al. (2007) evaluated the age at menarche and relevant factors in physically active Iranian girls. The study was conducted on female athletes who participated in 2000 & National school sport Olympics. This study includes that age of beginning exercise had a direct relation to menarcheal onset age which shows the positive effects of mild exercise on earlier menarcheal onset. On the other
hand, intense exercise before puberty has been reported to delay menarche.

2.5 AGE AT MENARCHE AND PLACE OF LIVING

Zacharias & Wartman (1969) studied the genetic & environmental influences on age at menarche by compiling different studies on age at menarche. They compared the age at menarche for many regions of the world. Menarcheal age has lowered in certain places and not in others. The age at menarche varies from population to population and changes with time. It is more susceptible to modification by certain socio-economic influences such as nutrition & urban vs. rural living.

Teresa 1970 studied the effect of ecological and socio-economic factors on the age at menarche, body height and weight of rural girls in Poland. There was a significant difference in age at menarche between girls of different regional groups.

Pillai and Srivastava (1979) investigated the age at menarche in population of Karnataka. The mean age at menarche of girls of northeastern region was 12.88 and that of South-western region was 14.13 that showed significant difference. The girls of north-eastern region reach menarche earlier than girls of southwestern region.
Knaul F (1999) conducted a study of evolution of age at menarche and labour earnings among adult Mexican women. She concluded that the average age at menarche has been decreasing in Mexico over the last 40-50 years. The factors associated with the decline were urbanization, increased level of education and improved living conditions.

Moisan et al (1990) conducted a case control study of correlates of early menarche. They concluded that age at menarche shows both a downward secular trend and marked differences by socioeconomic status, both presumably the reflection of dietary variation. A cohort study was conducted in Quebec City, Canada, to access the relationship between diet, physical activity and menarche. They found that there was a week association between energy intake, energy expenditure and early menarche. Weight, height, skin fold thickness, mother’s age at menarche, and participation in dance, ballet, gymnastics or figure skating club also effects age at menarche.

Proos et.al. (1991) studied the median menarcheal age of 107 girls adopted from India by families is Sweden. The mean age at menarche of those girls was 11.6 years which was significantly lower than Swedish and most Indian studies. No difference in menarcheal age found with respect to geographic origin.
Ulifaszek et al. (1991) reported age at menarche of European, Afro-Caribbean and Indo-Pakistani school girls living in London. The authors find out that mean age at menarche of European girls is significantly higher than those for Afro-Caribbean and Indo-Pakistani girls. Social class had an effect on the age at menarche in Afro-Caribbean and European girls but not on Indio-Pakistani girls.

Bilquis and Madhavillatha (2003) indicated in a study on girls of 11 to 18 years of age that the age of menarche was lower in Rayalaseema girls (12.5 years) as compared to the Andhra Pradesh and Telangana (13 years) girls. The girls from rural area of Andhra Pradesh attained menarche at the age of 12, 13 and 14 years followed by 11 years as compared to other socio economic groups. The higher group girls experienced menarche earlier than the lower group.

Gogoi and Sengupta (2003) analysed age at menarche among the orans of Assam on the basis of religious affiliation and place of residence. There is no significant difference in respect of mean age at menarche in the oron sub-samples with residence and religious affiliation. the Hindu oron found to attain their menarche relatively late as compared to Christian oroans.

Deo and Gattarji (2004) analysed the age at menarche and associate factors in rural and urban girls. The mean age at menarche of urban girls is significantly less than rural girls. The age of
menarche was significantly influenced by socio-economic status. The authors did not find any association between region, birth order, number of family members and religion.

Ikaraoha et al (2005) studied the menarcheal age of secondary school girls from urban and rural area of Rivers State, Nigeria using questionnaires and interview method. A statistically significant lower mean menarcheal age was observed in urban area girls, compared to their rural counterparts. Girls from families of high socio-economic class have significantly lower mean menarcheal age in both urban and rural area. The mean age of menarche was significantly higher in girls involved in vigorous sporting activity in rural areas compared to their non-sporting counterparts. Urban school girls attain menarche earlier than those in rural area.

Siung-Yup Kiu et al. (2005) reported the age at menarche and its influencing factors in North Korea female refugees. Region of residence, food preferences and sleep duration were found to influence age at menarche. Age at menarche was affected by place of residence.

Hossain & Golam (2006) studied the 450 sample of girls in age range from 11 to 15 years belonging to Nilphamari and Panchagar district (Bangladesh). They revealed that the girls from southwestern part were early mature than the north western part of the Bangladesh.
The southwestern girls were taller, heavier and have better economical condition as compared to their northwestern Counterparts.

Mokha et al (2006) investigated the difference in the age at menarche of Jat Sikh girls residing in urban and rural areas of Ludhiana district. An urban-rural comparison of median age of menarche reveals that urban girls have an earlier menarche than rural ones that can be due to difference in physical activity.

Sharma et al (2006) determined the age at menarche in two caste groups from rural areas of Jammu. The study reveals that there is no difference in the mean age at menarche between rural Brahmin and Rajput girls. The mean age at menarche for both groups was 13.85.

Ofuya Z M (2007) studied menarcheal age of girls, half of which were from middle class families and the other half from low income class families from the Niger delta region of Nigeria. Social class was based on parental occupation. The mean age at menarche for girls from middle class families was found $12.22 \pm 1.19$ years while that for girls from low income families was $13.01 \pm 1.44$ years. He found that most of the children from the middle class families attained menarche at the ages of 12 and 13 while those from the low income families attained menarche at the ages of 12, 13 and 14 years. The age at menarche of girls from middle class families was significantly lower
than those of girls from the low socioeconomic class and is similar to those obtained for U.S. girls. The age of menarche of girls from low income families is lower than a result of similar study obtained for rural India.

Reddy et al. (2007) studied age at menarche and some bio-social factors among the girls of Nellore, Andhra Pradesh. They studied the effect of factors such as income, skin colour and birth order on age at menarche. Girls belonging to high income group were found to attain sexual maturity (13.67 ± 0.20) earlier than those of middle (13.83 ± 0.11) and lower (13.92 ± 0.14) income groups.

Pacarada et al. (2008) studied the impact of socio-economic status on age at menarche. The onset of menarche differ significantly between girls from villages and girls from cities, girls from villages experienced menarche an average of two month later than girls of cities. They also concluded that food intake has an important effect on onset of menarche.

Zegeye et al. (2009) conducted a study on age at menarche of adolescents of Ethiopia from rural & urban areas. The menarcheal age was 15.8 years which is delayed even compared to other African countries. The mean age at menarche of rural girls was significantly higher than urban ones which the authors contributed to better socioeconomic status for urban girls than rural ones and malnutrition.
Al-sahab et.al. (2010) conducted a study to assess the distribution of age at menarche for Canadian girls and to explore its variation across socio-economic and demographic factors. Variations across the menarcheal groups were statically significant for the province of residence, household income and family type.

Ray et al. (2010) studied the effect of lifestyle and place of residence on 715 adolescent girls on rural and urban areas of West Bengal. Place of residence was found to be a significant predictor of age at menarche. Various socio-economic variables pertaining to place of residence significantly affect the menstrual characteristics among adolescents.

Maiti et al. (2011) reported the nutritional status of urban and rural early adolescent school girls of West Bengal. The study was conducted on 2545 girls aged 10-14 years in Kharagpur town. Undernutrition constituted major health problem among the early adolescent school girls in rural areas of India. The mean nutritional Indices were found to be much lower in rural girls than urban girls.