INTRODUCTION

"The Adolescent girl still remains a young plant that neither gets light nor water. She remains the flower that could have blossomed but didn’t....."

Kamla Bhasin (2002)

Girls up to the age of 19 comprise about one quarter of India’s population (WHO Report, O. P. Ghai, 2003). Despite the fact that the progress of a nation largely depends on them, girls receive less health care, nutrition and education due to gender discrimination. Apart from this, girls are caught in the cycle of early marriage, pregnancy and child bearing. The improvement in economy and provision of basic services in India does not help in bringing the ratio of females to males as par, which has been deteriorating. All these factors compound to difficulties of adolescent girls who are already vulnerable and face physical and psychological deprivations due to the onset of puberty.

Nutritional deprivation, increased iron demand for adolescent growth, excessive menstrual losses and early/frequent pregnancies aggravate and exacerbate pre existing anemia and its ill effects. Majority of girls are unaware of their nutritional needs (especially increasing their food intake to meet calorie demands of pubertal growth), resulting in under weight and short stature.

The poor nutritional status of these would be mothers heightens obstetric risks during pregnancy and child birth, and put their infants at risk. In this way the vicious cycle continues and in turn affects the national growth as the education and health of women, population changes and overall development are closely interrelated.
One of the main reasons for this menace is unawareness about the various important factors, which if adopted and implemented at earliest can solve this problem to some extend, as according to NFHS report, the average age of menarche is 13.4, yet 50% of the girls aged 12-15 years do not know about menstruation. The lack of information can be attributed to the veil of secrecy that surrounds menarche.

1.1 - Adolescence— the crucial phase:

In many countries, the concept of transitional period between childhood and adulthood is relatively new inspite of the importance of this period among adolescent girls. It is a period of greatly enhanced awareness of and attention to the physical status and well being. According to Agarwal K.N. et al (2004), “adolescence is a period of experimenting, experiencing and expanding. Adolescents need help and guidance in decision making, problem solving, critical thinking, developing interpersonal skills, self awareness, empathy, coping with stress and managing emotions.”

O.P.Ghai (2000) defined adolescence as the period, which extends from the onset of puberty till the time sexual maturity is completed. The age limit proposed by WHO expert committee (WHO technical report, 1984) on adolescents is 10 – 19 years.

1.2 - PUBERTY, the turning point of life:

The term ‘puberty’ is used to describe different phases of sexual maturation between childhood and adulthood, i.e. the point of life when procreation becomes possible. The term pubescent is applied to those in whom secondary sexual characteristics and early genital maturation are appearing. According to Harris and Robert, 1987, “Adolescent girls are those who have attained “MENARCHE” (First menstruation).
Harris Robert, 1987, referred puberty to the biological changes that result in the transformation of the child to the adult anatomically and physiologically with capacity to reproduce and with a clear physical distinction between the sexes.

According to Carpenter and Rock, 1992, attainment of puberty is associated with profound hormonal alterations, the acquisition of secondary sexual characteristics, a short lined increase in longitudinal growth rate, and numerous psychosocial changes. Thus, puberty is a rather general term that connotes the transitorily period between childhood and adulthood. The age at which the somatic changes associated with puberty occur is highly variable.

They concluded puberty as that period in the growth and development of the child which encompasses the initiations and progression of sexual and physical maturation. They describe menarche as only a single event in the combination of physical changes, which constitute puberty, and represents an ongoing sexual maturation turn point.

1.3 - The menstrual cycle:

Menstruation is defined as the periodic physiological bleeding from the endometrium. Its onset, the menarche, occurs usually between the ages 10 - 14; and it’s termination, the menopause, occurs usually between 45 - 55 years.

Each women’s menstrual cycle is an individual pattern of length, intensity and variability. Different authors from various parts of the country and outside world had reported a wide range of mean menarcheal ages commonly ranging from 11-15 years. The length of the menstrual cycle is traditionally a lunar month, but only 10 - 15% are exactly 28 days. The range is 24 - 35 days. The average menstrual flow is
approximately 30 ml, lasting for an average of 5 days. Length of the period does not appear to be an indicator of the degree of bleeding.

The first menstrual period, the menarche, is a late event in the sequence of pubertal development in girls, which occurs after the peak of height spurt. It is a sign of uterine development and does not signify the attainment of full reproductive function.

1.4 - Menstruation, problems and consequences:

The recurrent hormonal fluctuation associated with the menstrual cycle interacts with diet in important ways. Appetite, hunger, satiety, craving, aversion, all vary with the cycle. The variations are subtle in many women but quite performed in others. Variations in eating pattern and appetite are a well-recognized occurrence even in normal menstrual cycles. Even more extreme variations are characteristic of premenstrual symptom (PMS). According to Singh et al (1998), PMS consistent with the syndrome occur in up to 60% of women.

Any understanding of the menstrual abnormalities requires a basic knowledge of the normal menstrual cycle. In most women the menstrual cycle is constant and predictable during the reproductive years. In adolescents the inter menstrual interval is often quite variable due to the frequency of anovulatory cycles. Menstrual irregularities are generally considered to be normal physiologic phenomena that spontaneously subside during the first few post menarcheal years (Merritt Diane F. 1994)
According to Merritt Diane F., 1994, the etiologies of late menarche could be chronic diseases, malnutrition, strenuous physical activity, low body weight, higher altitudes, rural dwelling or severe obesity.

Some of the common post menarcheal menstrual irregularities which occur mainly within few years after the onset of menarche are:

- Ovulatory events
- Amenorrhea
- Dysmenorrhea
- Dysfunctional uterine bleeding

1.5 - The Pubertal changes:

The first somatic change that occurs in females is either the beginning of breast (thelarche) or pubic hair (pubarche) development. Tanner has described five stages of breast and pubic hair development. The change in growth velocity has mean onset of 9.6 years (Large and Prader 1987). The peak height velocity (PHV) occurs almost 2.5 years later and proceeds the onset of menarche (mean age 12.7 years). The interval between the onset of breast development and menarche is 2.3 +1.0 years and is independent of the age at thelarche occur. Within the spectrum of normal pubertal development it is possible to see physical changes as much as 5 years prior to menarche. Adolescence progress through a wide range of chronological ages. This is related to genetic and environmental factors. The puberty usually begins around the age of 10 years in girls (range 8-13 years) during the next few years, there is rapid spurt in height and weight.
1.6 - ‘Critical weight’ hypothesis:

It is well established that the time of maximum growth in weight is closely correlated with sexual maturation (Meyer et al, 1990; Merzenich et al, 1993). Kochler and Rock (1992) found that menarche always occurs after the greatest increase in height.

In human beings relevant findings are: that early matures consume more Calories and Proteins than late matures (Sarah M. Phillips and Lind G. et al, 2004); that obese girls are younger at menarche than girls of average body weight (Donnovan and Ten Bosch 1995, Koprowaski et al 1999); that late matures weigh less for their height as early as two years of age (Tanner, 1976). According to Sarah E. Anderson, 2003, higher relative weight was strongly associated with age at menarche. Frisch and Revelle (1969) concluded that the weight of girls at the time of peak weight velocity did not change with increasing age of attainment or with increasing age of menarche i.e. late and early maturing girls had the same mean weight at the time of peak weight velocity.

1.7 - Scenario of adolescent population in India:

Adolescents constitute 22.8% of population in India as on 1st March 2000 (O.P.Ghai, 2003). According to United Nation’s population fund, 21.9% of India’s total population in 2001 belonged to the adolescent age group. According to world population prospects (2002), the population of adolescent females was 9.9% of the total population, with 5.1% in the age group 10-14 years.
According to United Nation's population Fund (August 2005), the total population of adolescent females in India in the age group 10-14 years was 59,214 (10.1%) and in the age group 15-19 years was 46,274 (9.3%). According to NFHS-2 (2000), there was an equal distribution of both adolescent girls and boys in rural and urban areas; the boys account 22.6% in urban areas and 22.5% in rural areas. The girls represented 21.9% in urban areas and 22.2% in rural areas. According to S.L. Goel, 2001, these youngsters are deprived of authentic and adequate knowledge about their physiological, psychological and emotional development in the developing countries including India.

1.8 - Plight of the girl child:

During adolescent age, girls constitute a more vulnerable group, particularly in India where female child is a neglected one; they are married at an early age and exposed to a greater risk of reproductive morbidity and mortality (Aggarwal K. N. and S. Gomber, 1997).

Adolescents have not received the attention they deserve in our country, especially in the context of girl child. It is a crucial period, as an adolescent girl is still a developing child. The dynamic growth associated with poor intake of all nutrients puts the adolescent girl at greater risk of nutritional morbidities. Nutritional deprivation, increased demand for growth, excessive menstrual losses, all aggravates deficiency and its ill-effects (Mehra Sunil and Deepti Agarwal, 1998).

A large number of women remain ill informed about basic facts related to their reproductive health (Goel S.L. 2001). According to population reference bureau (2000) around 44% of adolescents in India are illiterate. Only 33% of the females are attending school. Education of girls and women also contribute to child survival. Nearly 23% of all
births in India occur to adolescent mothers in the age group 15-19 years. According to NFHS-3 (2005-06) 44.5% of the adolescents are married by age 18 and 16% of the adolescent girls aged 15 – 19 years are already mothers or pregnant. Therefore, until and unless the adolescent bear good health, they are not going to produce healthy infants, which in turn helps in the progress of the nation.

1.9 - Health problems of adolescence girls:

Some of the common health problems faced during adolescence include medical problems, nutrition and diet problems, obesity, goiter and anemia. Anemia is the commonest health problem of adolescent girls irrespective of the socio economic status. According to NFHS-3 (2005-06) 57.9% of the females are anemic at the time of pregnancy. Anorexia nervosa is also a common eating disorder faced by adolescents resulting in excessive weight loss. According to NFHS-2 (2000) the mortality rate of adolescent girls in the age group 10-14 years is 1.4% and 2.5% among 15-19 years.

1.10 - Age at menarche; associated factors:

The average age of pubertal onset, as well as the age of menarche has declined steadily over the last century, in this country and throughout the industrialized world. The average age of menarche is 12.7 years (Tanner J.M., 1973). This has been attributed to improved nutritional and general health conditions, as well as to altered lifestyle. In isolated nomadic tribes, where living conditions and socializations practices have not changed significantly during recent times, the trend towards earlier menarche is not found (Krasnow and Sandar 1992). In addition strenuous physical activity, decreased body fat content, chronic diseases and malnutrition are all associated with delayed puberty as well as onset of menarche. Conversely, according to Carpenter and Rock, 1992, females with
with moderately increased fat content tend to experience menarche at an earlier age. Thus, geographic, nutritional and sociologically determined factors may effect the time at which puberty begins and its rate of progression. Further more, genetic factors may also contribute to the timing of pubertal events.

Tanner (1962) has discussed the effect of socioeconomic differential on the mean age of attainment of different puberty signs. He has found that children from higher socioeconomic classes attain puberty signs earlier than those from lower socioeconomic classes.

Tanner (1965) and Israel (1970) have observed that better nutrition is the factor chiefly responsible for the earlier sexual maturation together with giving infants more of proteins. Better diet induces better growth and development as well as to an earlier menarche.

It has been difficult to derive norms for Indian girls due to the wide variation in socio-economic status, nutritional condition and regional differences in our country. Various authors from different parts of the country have reported a wide range of means, however, the mean age of attainment of menarche resembles closely the means reported in Europe and Asian studies.

1.11 - Scope of the study:

Adolescence is the time of great and rapid physical growth: this brings with it not only increased nutritional needs but also the emotional needs and the needs to adjust to new attitudes and responsibilities. As they enter the reproductive age, they need services that can guard them against the risks of sexually transmitted diseases.
There is an urgent need to mount programmes for early detection and effective management of nutritional (under nutrition, anemia) and health (infections, menstrual disorders) problems in adolescent girls. Health and nutrition education to this group is essential. Adolescent girls are at high risk of anemia, Sexually Transmitted Diseases (STD) and infections. They should receive appropriate care throughout pregnancy and institutional delivery to ensure safety of both the mother and the baby.

There is a need of increasing women's access to appropriate affordable and quality health care throughout their life span and strengthening preventive programme that promote women's health.

The women is the pivot around which the family, the society and humanity itself revolves. Women play a significant role in the development of their offspring. Unless and until the adolescent girl is healthy, she can not enter her reproductive life and produce healthy babies. Healthy behavior adopted during adolescence continues into adulthood and can be passed on to the future generation. A healthy girl means a healthy nation. A study of the interrelationship between nutrition and health status and reproductive health will be of great help for the adolescent girls.

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. There is lack of research on various factors affecting menarcheal age especially weight, height, BMI & SMR stages reported from India. Also there is lack of research on aspects as relation between amenorrhea, dysmenorrheal, and age at menarche.
Results of the study will lead to remedial interventions. If a relationship is established, it will be helpful and planning for provisions of nutritional services, for adequate facilities for reproductive health and for development of health personnel for women's health. Investing resources in adolescent is a sound economic, socio-political and public health strategy and is cost effective in the long run.

Keeping the scope in mind, the present cross sectional study was conducted on adolescent girls aged 10–15 years with the following objectives

1. To establish relationship between birth order, religion, socioeconomic status and age at menarche.
2. To find out whether age at menarche depends on weight, height and Body Mass Index (BMI).
3. To analyze the relationship between menarche age, mode of feeding in infancy, dietary habits and total dietary intake.
4. To study the relation between menarche age, blood pressure and nutritional deficiency anemia.
5. To establish the relationship between mother's age at menarche, SMR stages and age at menarche.
6. To analyze whether age at menarche has any effect on the experiences of PMS (pre menstrual syndrome) and other problems faced at the time.

Keeping the above mentioned objectives in mind, the following hypothesis were put forth –

1) Early maturing girls have lower birth order; and higher SES; as well as Muslim girls reach menarche earlier than their non-Muslim counterparts.
2) Early matures are heavier, taller and had greater BMI than late matures and pre-menarcheal girls of same age.

3) Bottle fed girls, and girls with non-vegetarian diets reach menarche earlier than breast fed girls and girls with vegetarian eating habits.

4) Good nutrition accelerates age at menarche.

5) Girls reaching menarche at an early age had a higher blood pressure and low prevalence of anemia.

6) Mother's age at menarche is positively correlated with age at menarche, and early matures had a higher SMR stage than their late maturing counterparts.

7) Early matures face more problems and experience higher degree of PMS(s) than do late matures.