REVIEW OF LITERATURE
A Review of literature pertaining to the study titled “Educational Intervention Programme To Empower School Going Adolescent Girls On Their Reproductive and Nutritional Health” is given under the following headings:

2.01 Adolescents’ perceived problems and need on ARH and ANH
2.02 Pubertal growth among girls
2.03 Menstruation - awareness and myths
2.04 Adolescent pregnancy
2.05 RT1/STD/HIV/AIDS among adolescents
2.06 Adolescents’ nutritional status
2.07 Adolescents’ nutritional requirement
2.08 Eating patterns of adolescents
2.09 Major Nutritional deficiencies among adolescents
2.10 School based reproductive and nutritional health education

2.01 Adolescents’ perceived problems and need on ARH and ANH

Gupta [2003] reports that a large proportion of adolescent girls suffer from various gynecological problems, particularly menstrual irregularities such as hyper menorrhea, hypo menorrhea, and dysmenorrhea. These problems arise primarily as a result of changing hormone patterns. A study conducted in Madras city revealed that 42 per cent of the college and 34 per cent of the school-going students reported problems during menstruation. The problems included headache, stomach pain, excessive bleeding, and other vague or non-specific symptoms like lethargy and loss of appetite. Although most of these are normal symptoms of menstruation among adolescents, these need to be mentioned particularly in the Indian context because most of the girls are not aware of this natural phenomenon.
Kumar et al. [2000] conducted a cross-sectional household survey in rural areas in Sirmaur, Himachal Pradesh, to assess the knowledge, beliefs and practices of adolescents about their reproductive health. 643 unmarried adolescents aged 15-19 years were selected by cluster sampling method from 2400 households. They were interviewed using a semi-structured schedule. 56 per cent were girls. Findings showed that most of the boys (88 per cent) and only 58 per cent girls knew how female conceive. Boys considered poor body built and less growth of hair as reproductive health problems, whereas, girls were worried about menstruation and inadequate breast development. Thus knowledge on reproductive health was found to be low and there was a big gap between actual and desired practices.

Sharma and Gupta [2003] conducted a study to find out the menstrual pattern, and awareness of the abnormalities in menstrual pattern among school going pubertal age group girls in Dharan, Nepal. The study was carried out with the aim to follow it with school health education. Cross sectional study was done on 96 girls of two different schools of Dharan, of the age group ranging from 11 years to 17 years. The median age of menarche was 12 years. There were 6.9 per cent cases of oligomenorrhea and 10.0 per cent of hypomenorhea. Menorrhagia was seen in 6.2 per cent of the girls. Spasmodic dysmenorrhea was seen in 67.0 per cent of the girls but the daily activity was hampered only in 20.0 per cent. Out of the 96 students 73.0 per cent were prepared psychologically beforehand. A few students (8.0 per cent) knew about the abnormalities in menstruation, rest were ignorant about it. Thus, it was seen that these school going girls needed education about the abnormalities of menstruation so that they can differentiate the normal phenomenon from abnormality and report in time in case of aberrance in the menstrual cycle.

Andrew et al. [2003] report that if health services for adolescents are to be successfully integrated into the existing health care system, one need to reach out to meet the needs that adolescents themselves perceive as salient.
A study aiming to elicit the needs of adolescents in higher secondary schools in Goa in India was conducted in 1999-2000. The objective was to generate information which will guide the development of adolescent-friendly health services by integrating the health needs identified by adolescents themselves. The study began with free-listing, followed by focus group discussions and in-depth interviews to identify areas of concern. Then, a survey of 811 students with a self-report questionnaire was carried out. The findings demonstrated that there is clearly an unmet need for information about reproductive health.

The need for educational response at the school stage felt necessary to provide scientific knowledge to adolescents about various aspects of the process of growing up in particular reference to the reproductive health needs and enable them to cope with the problems during this transitional phase. This need is particularly felt in India, because the school curriculum has not been able so far to incorporate critical elements of reproductive health such as sexual development during adolescence, which are closely interrelated concerns having decisive bearing on their reproductive health. There is a need to make educational efforts primarily aimed at influencing attitudes, behaviors and value orientation (Subramanian and Usharani, 2006).

According to ICPD, the Reproductive Health needs of adolescents as a group have been largely ignored till date by existing Health Services. To meet the reproductive health needs of adolescents, information and education should be provided to them to help them attain a certain level of maturity required to make responsible decisions. In particular, information and education should be made available to adolescents to help them understand their reproductive health and protect them from unwanted pregnancies, sexually transmitted diseases and subsequent risk of infertility (UNESCO, 1998).

Joseph et al. [1997] conducted a study to know the general and reproductive health of adolescent girls in rural south India. Both quantitative and qualitative methods were used to assess the general and reproductive health
of female adolescents in a rural district in Tamil Nadu, India. There was a reluctance to discuss reproductive health problems, but many reported concerns about menstrual irregularities. Girls participating in groups stated they would feel more comfortable attending a separate adolescent clinic run by female physicians. In interviews with 190 girls, the most frequently cited health complaints were fatigue, palpitations, frequent headaches, backache, and abdominal pain. Over 20 per cent suffered from weight loss, poor appetite, and recurrent respiratory problems. 30 per cent were anemic, and heights, weights, and body mass indexes were typical of those found in chronically undernourished populations. Adequate knowledge levels on topics such as menstruation, nutrition, and AIDS were extremely low. Overall, these findings indicate a need for both health education and special treatment services for girls who have suffered the health consequences of low socioeconomic status, unhygienic practices, and poor nutrition.

Waslien and Stewart [1994] view that poorer nutritional status becomes apparent during adolescence, with a delay in maturation which may have repercussions for subsequent ability of the biologically immature woman to carry through a normal pregnancy. Another sign of malnutrition is the percentage of growth which takes place after menarche. Factors which contribute to the malnutrition of adolescent girls include a lack of understanding of their needs which is exacerbated by taboos which prevent women from consuming some foods during menses.

2.02 Pubertal growth among girls

The beginning of biological growth and development during adolescence is signified by the onset of puberty, which is often defined as the physical transformation of a child into an adult. A myriad of biological changes occur during puberty including sexual maturation, increase in height and weight, completion of skeletal growth accompanied by a marked increase in skeletal mass, and changes in body composition. The succession of these
events during puberty is consistent among adolescents; however, there may be a great deal of deviation in the age of onset, duration, and tempo of these events between and within individuals (Stang and Story, 2005).

The common order of change during puberty in girls is accelerated gain in weight and height, breast changes like pigmentation of areola and enlargement of breast, increase in pelvic girth, appearance of pubic hair, activity of auxiliary sweat glands, appearance of auxiliary hair, onset of menses (menarche). The first bleed occurs usually 2 years after the first manifestation of puberty (Gupta, 2001).

Gupta et al. [2007] report that adolescent girls are the future mothers. Height less than 145 cm and weight less than 45 kg are considered to be high obstetric risk factor for adverse maternal and prenatal outcome including low birth weight. They conducted a survey to study the height and weight of girls of vulnerable urban slums and rural areas. They also studied the pattern of onset of menarche and attainment of sexual maturity in relation to age. The descriptive observational study was carried out by the Indian Council of Medical Research during the period of 1986 to 1991 in selected rural areas of Chandigarh, Hyderabad, Jabalpur, Varanasi, Vellore and two urban slum areas of Vellore and Delhi in different regions of India. Girls of 10-12 years were followed till 16 years for their height and weight. Weight increased from 22.3 to 39.4 kg in rural and 23.4 to 41.9 kg in urban areas from 10 to 16 years. Height increased from 126.2 cm to 150.2 cm in rural and 128.2 to 153.0 cm in urban areas. The data on physical growth parameters during adolescence revealed that girls from rural areas were shorter and weighed less compared to those from urban slums. It also revealed that adolescent girls were undernourished in both urban slums and rural areas.

Acharya et al. [2006] opine that nutrition has an important bearing on age at menarche. Adolescence gain 50 per cent of adult weight and more than 20 per cent of their adult height during this period. Menarche is attained earlier
by well nourished adolescents. A minimal amount of body fat is essential for initiation of menarche. They conducted a community based cross-sectional study in Dr Ambedkar Nagar, an urban resettlement colony in New Delhi. A sample size 250 female adolescents in the age group of 10-19 years was chosen for the study. The mean age at menarche in those who had attained menarche \( [n=166] \) was 13.34 years. Majority [74 per cent] were undernourished, out of which 38.4 per cent had BMI less than 16. They found that nutritional status has important role in attainment of menarche, as nutritional status improves, age at menarche is lower. It was seen that as the BMI increased, the number of girls attaining menarche also increased.

Banerjee et al. [2007] report that there are contradictory reports of lowering of age at menarche due to increasing body mass index (BMI) in the population. They conducted a study in which the age at menarche was determined in 273 Bengali girls of middle income families. Their objective was to find whether BMI has correlation with age at menarche. Their findings showed that there was no influence of BMI on age at menarche.

### 2.03 Menstruation - awareness and myths

Dasgupta and Sarkar [2008] view that menstruation and menstrual practices are still clouded by taboos and socio-cultural restrictions resulting in adolescent girls remaining ignorant of the scientific facts and hygienic health practices that sometimes result in adverse health outcomes. They conducted a descriptive, cross-sectional study among 160 adolescent girls of a secondary school in Singur in West Bengal. Their objective was to study the beliefs and source of information regarding menstruation among adolescent girls and to find their menstrual hygiene. They conducted the study with help of pre-tested questionnaire. Data was analyzed statistically by simple proportions. Out of 160 respondents, 67.5 per cent girls were aware about menstruation prior to attainment of menarche. The mother was the first informant regarding menstruation in case of 37.5 per cent girls, 86.25 per cent girls believed it as a
physiological process, 48.75 per cent girls knew the use of sanitary pads during menstruation. Regarding practices, only 11.25 per cent girls used sanitary pads during menstruation.

Puri and Kapoor [2006] conducted a study to know the practices and myths concerning menstruation and knowledge of diet taboos practiced in society during pregnancy and lactation. For this they interviewed overall 5000, school \ college going adolescent girls [2500 urban and 2500 rural] of Patiala, Punjab aged 10-19 years. The results showed that various myths and taboos pertaining to menstruation were almost equally prevalent among girls in both urban and rural areas. The most common practice observed by urban girls was not to enter pooja room [41.5 per cent] whereas for rural girls it was not to go to kitchen [40.0 per cent]. They also had many false notions regarding certain foods and lacked proper knowledge regarding their diet.

Studies in Tamil Nadu and Pondicherry conducted by Narayan et al. [2001] report that although menarche is associated with considerable ceremonial attention as a rite of passage only few adolescent girls are well informed about the change they are undergoing; rather, they are well informed about the kinds of restrictions on movement and behavior that are expected of a mature girl. They conducted a study in urban and rural field practice areas of Jawaharlal Institute of postgraduate Medical Education and Research in Pondicherry. The aim of the study was to focus on puberty rituals and reproductive knowledge of adolescent school girls in South India. The result from the survey showed that adolescent girls’ knowledge on reproductive health was very weak. It also revealed a large number of traditional beliefs and restrictions surrounding menstruation.

Tiwari et al. [2006] conducted a survey of knowledge, attitudes and beliefs towards menstruation in 22 schools in Anand district in Gujarat state. Out of 900 schoolgirls aged 11-17 years, only 38.5 per cent felt comfortable about menarche and only 31.0 per cent believed that menstruation was a
normal physiological process. Many (37.2 per cent) had not been informed about menarche before its onset and 48.2 per cent felt they were not mentally prepared. The major sources of information were the mother (60.7 per cent) or an elder sister (15.8 per cent).

There is evidence that adolescents are poorly informed even about the physiological changes associated with maturation including menstruation (UNESCO, 2000). Adolescent girls generally are told nothing about menstruation until their first personal experience of it. A study of Mumbai noted that the silence surrounding menstruation burdens adolescent girls by keeping them ignorant of this biological function. First menstruation is often a traumatic and very negative experience for adolescent girls in India although among almost all communities in Tamil Nadu the event is marked with festive celebrations (Bhatiacharya, 1996).

Mumtaz and Rauf (1996) report that some practices related to menstruation are worrisome from the health and hygiene point of view. They found that girls are considered unclean while menstruating some were made to sleep on a mat on the floor, forbidden to bathe, and advised to avoid some foods (in the belief that certain foods would make them ill). Aahung [1999] interviewed some girls aged 11-19 years of low income community of Chanessar Goth, Karachi, and found that 64 per cent of the girls believed that it was harmful to take shower during menstruation.

2.04 Adolescent pregnancy

Among married adolescents, early childbearing and subsequent pregnancies are closely spaced than among adults. The experience of early and closely spaced childbearing is particularly risky for adolescents because large proportions are anemic and may not have reached physical maturity (Jejeebhoy et al, 2003).
The adverse health consequences of early childbearing in anemic condition include damage to the reproductive tract, maternal mortality, pregnancy complication, perinatal and neonatal mortality and low birth weight (Kulkami, 2003).

UPS [2000] reports that pregnancy and child bearing characterize the experience of a large proportion of adolescents in India. In many cases pregnancy and childbearing occur even before adolescents are physically fully developed, and may expose young girls to particularly acute health risks during pregnancy and childbirth. Adolescent fertility rates are high: roughly 107 births take place per 1,000 girls aged 15-19, and the fertility of this age group makes up 19 per cent of the nation’s total fertility rate. Over one in five give birth by age 17 and the median age at first birth is 19 years, suggesting that significant proportions of women undergo pregnancy at ages below which obstetric risks are particularly elevated. A national study conducted by the Indian Council of Medical Research (ICMR) on 43,550 women reports that maternal mortality among adolescents was 645 per 100,000 live births compared to 342 per 100,000 among adult women aged 20-34 years. Neonatal mortality, a key outcome of unsafe pregnancy conditions, is significantly higher among adolescent mothers than among those aged 20-29.

There are numerous negative consequences of bearing children at adolescent stage. It brings not only risks to the mother’s health, but reduces her life ambitions in terms of education and economic independence. Some studies suggest that girls who give birth during adolescence are likely to be more economically disadvantaged than those who give birth later (Mensch et al., 1998).

Pratinidhi et al. [1990] have reported from their study findings in India that risk factors such as prolonged labor, short stature, and anemia were associated more with women under 18 years old. Statistically significant differences were found in the rate of low birth weight infants, stillbirths, and
late neonatal deaths among women aged less than 18 years compared to other women aged above 21 years. Recommendations were to provide general health education about risks of teenage pregnancy, strictly enforce the minimum age at marriage, and provide at-risk mothers with education about child bearing and rearing.

2.05 RTI/STD/HIV/AIDS among adolescents

Ram et al. [2006] conducted a study to estimate the prevalence of reproductive tract infection among female adolescents. The study was conducted in the immunization clinic run by the department of Community Medicine of Calcutta - National Medical College, among the female adolescent aged 10-19 years who accompanied the beneficiaries to the clinic for vaccination. 106 adolescents attended during the study period were selected for interview. It was observed that 35 per cent of the girls had given the history of excessive vaginal discharge without low backacheMower abdominal pain and they were supposed to suffer from vaginitis and 29 per cent have history of lower abdominal pain Mow backache with vaginal discharge. So considering both the groups together 64 per cent of the girls were suffering from RTI. Among them 12 per cent had history of burning sensation during micturition and 50 per cent had dysmenorrhoea.

Hari [2006] studied the prevalence of STI among sexually active adolescent women attending the clinic at RIGID hospital, a care centre in Tamilnadu, India. Results showed that all adolescent women who were infected were infected sexually. This study revealed that reducing the infectiousness of STI through early detection and treatment is an important strategy to preserve the reproductive health of adolescent girls.

Sharma et al. [2004] report that reproductive tract infections (RTI) are one of the most common health problems in women during reproductive age. There are gaps in the knowledge regarding the prevalence and determinants of these infections among women. A cross-sectional study was conducted at
Primary Health Centre, Palam. Three hundred currently married women from antenatal and gynaecology clinic were interviewed followed by clinical examination and microbiological investigations. The prevalence of RTI was 37.0 per cent based on symptoms and 36.7 per cent by laboratory investigations. Factors which were found to be significantly associated with reproductive tract infections in women were, not cleaning genitals daily, last delivery being domiciliary, not bathing daily during menstruation.

Some experts argue that the STD epidemic among adolescents is growing globally, probably due to the large proportion of older adolescents who are sexually active either within or outside marriage (Mensch et al., 1998). While adolescents are becoming an international focus for STD efforts, our knowledge about the epidemiology of STD in Asian population remain limited (Hannum, 1997).

Banerjee et al. [2005] after reviewing the knowledge, perceptions and attitudes of adolescents in India regarding HIV/AIDS, informed that 35 per cent of the girls were aware of the existence of AIDS and only 21.5 per cent of girls in their later teens (15-19) years were aware of any sexually transmitted infections.

According to the NACO National behavioral surveillance survey, some 3 per cent and 5 per cent of young, mostly unmarried males and females, respectively reported experiencing symptoms of infections (STI or RTI) as discharge, ulcers or sores in the genital area. These proportions undoubtedly reflect that awareness of symptoms may be limited among youth. The NACO also reveals that although 80-90 per cent of adolescents have the simple awareness of HIV but they lack in depth knowledge of symptoms, modes of transmission or methods of prevention of HIV (UNICEF, 2002).

Studies highlight the lack of in depth awareness of health-promoting actions and risky sexual behavior among adolescents. While awareness of RTI/STI and HIV/AIDS may be almost universal at a superficial level, in depth
knowledge of sexual health issues is sketchy. For example, a case study of adolescent girls and boys aged 14-19 residing in slum setting in Allahabad, Utter Pradesh reports that large proportion had heard of STI (66 per cent and 87 per cent respectively) only 2 per cent could name STI other than HIV/AIDS (Sebastian et al., 2002).

Dangerous misconceptions are common among adolescents. Many adolescents believe that symptoms of STD go away on their own, one can clearly identify an HIV-infected person by his/her appearance, pregnancy can occur through physical embrace and HIV infection is transmitted through everyday activity [Brown et al, 2001].

Agarawal et al. [1999] conducted a cross-sectional descriptive study using a questionnaire with mostly close-ended questions on 990 pupils and 46 trainee teachers to investigate their knowledge and attitudes on HIV/AIDS. There were many misconceptions about transmission and prevention. 16.9 per cent of pupils were found to possess very little knowledge of HIV/AIDS. Teachers were quoted as the main sources of knowledge. It was found that 24.3 per cent pupils and 6.3 per cent of trainee teachers thought there is a cure for HIV/AIDS and 27.4 per cent of pupils and 14 per cent of trainee teachers thought there is a vaccine to prevent HIV infection. Pupils were reassessed after a health talk and distribution of handouts. The pupils showed significant improvement in their knowledge and a change in attitude (p < 0.01). Pupils of rural, private and English-speaking schools scored better. The necessity of formal reproductive health education was expressed by 98.5 per cent of pupils and all the trainee teachers. The findings also revealed that even though the mass media are important in disseminating knowledge on HIV/AIDS in India but due to lack of inter-personal approaches to the education system, knowledge is inadequate and misconceptions exist.
2.06 Adolescents’ nutritional status

Adolescents are nutritionally vulnerable group for a number of specific reasons, including their high requirements for growth, their eating patterns and lifestyles. Inadequate nutrition in adolescence can potentially retard growth and sexual maturation (WHO, 2005).

Srihari et al. [2007] reviewed available literature on nutritional status of Indian school children 6-18 years from middle and high socio economic status (MHSES). Studies showed that anemia prevalence ranged from 19 to 88 per cent across five different cities in India. Other micronutrient deficiencies including, folate, riboflavin, niacin, vitamin C, vitamin A, and vitamin B12 were also present based on biochemical parameters and clinical signs of deficiency. Overweight and obesity were prevalent among 8.5-29.0 per cent and 1.5-7.4 per cent respectively among school children. Predominant components in children's diet were cereals and pulses, followed by milk and milk products. The fruits and vegetables component was comparatively lower. Nutritional status of MHSES children in India needs attention especially with respect to the high prevalence of anemia, overweight and obesity.

Malhotra and Passi [2007] conducted a study to assess the diet quality and nutritional status of beneficiaries of Adolescent Girl scheme, a national programme targeted towards their nutrition/health needs. 209 girls (aged 11-21 years) from six rural blocks in Delhi, Haryana, Rajasthan and Uttar Pradesh comprised the sample. The study reveals not only a high incidence of under-nutrition but also an inadequate energy/micronutrient intake among the beneficiaries of Adolescent Girl scheme.

Deshmukh et al. [2006] conducted a cross sectional study. The objective was to study the nutritional status of adolescents in rural area of Wardha. Study was carried out in two PHC areas of Wardha district with two stage sampling method. In the first stage, cluster-sampling method was used to identify 30-
clusters in each Rural Health Training Centre (RHTC) area separately. In the second stage, systematic random sampling method was used to identify 10 households per cluster. All adolescents in the household thus selected were included in the study. The mean body mass index (BMI) for age was used for classifying the nutritional status. Overall, 53.8 per cent of the adolescents were thin, 44 per cent were normal and 2.2 per cent were overweight.

Rao et al. [2006] made an attempt to assess the diet and nutritional status of adolescent population from the different tribal areas of India. The available database collected by National Nutrition Monitoring Bureau (1998-99) was utilized for this purpose. Data on a total of 12,789 adolescents (10-17 yrs) was included for the analysis. The mean intake of all the foodstuffs, especially the income elastic foods such as pulses, milk & milk products, oils & fats and sugar & jaggery were lower than the recommended levels of ICMR. A significant association between under nutrition and socio-economic parameters like type of family, size of land holding and occupation of head of household was observed.

Das and Biswas [2005] conducted a community based, cross-sectional study to know the nutritional status of adolescent girls. The study was conducted during June to December 1999 in Amdanga block of North 24 Parganas district, West Bengal among a sample of 143 adolescent girls (10-19 years), selected through multistage sampling procedure. Data was collected by interviewing the adolescent girls and their parents, using pre-designed, pre-tested, semi-structured schedule. Anthropometric measurements were recorded using standardized methodology as recommended by WHO and standard clinical examination procedures were followed. Overall prevalence of 'thinness' and 'stunting' were found to be 14.7 per cent and 37.8 per cent respectively. There was no significant association (p > 0.05) of thinness or stunting with per capita monthly family income and literacy status of parents. Common nutritional deficiency disorders were anemia, dental caries and angular stomatitis.
2.07 Adolescents’ nutritional requirement

At the peak of the adolescent growth spurt, the nutritional requirements may be twice as high as those of the remaining period of adolescence. Nutrient intakes of adolescents suggest that many female adolescents consume inadequate amounts of vitamins and minerals. Most adolescents do not consume diets that comply with the Food Guide Pyramid. On an average, adolescents consume diets that are inadequate in several vitamins and minerals, including folate, vitamins A and E, iron, zinc, magnesium and calcium. Dietary fiber intake among adolescents is also low. Many teens exceed current recommendations for total fat and saturated fat, cholesterol, sodium and sugar (Lino et al, 1999).

Adolescents may require 60-80 kilocalories per kilogram of body weight per day. Boys need more kilocalories than girls [Carroll & Karen, 2001]. Calorie requirement for adolescent girls as per recommended dietary allowance: 10-12 years - 1970 kilocalorie; 13-15 years - 2060 kilocalorie; 16-18 years - 2060 kilocalories [Gopalan et al, 2002]. Adolescents who participate in competitive sports and those who are more physically active than average may require additional energy to meet their daily caloric needs. Adolescents who are not physically active and those who have chronic or handicapping conditions that limit mobility require less energy to meet their needs (Troiano et al., 2000).

Protein needs of adolescents are influenced by the amount of protein required for maintenance of existing lean body mass and accrual for additional lean body mass during the adolescent growth spurt. Protein requirements per unit of height are highest for females in the 11 to 14 year age range. When protein intakes are consistently inadequate, reductions in linear growth and delays in sexual maturation are the outcomes (Gleason and Suitor 2001).
Carbohydrate is the body’s primary source of dietary energy. Carbohydrate-rich foods, such as fruit, vegetables, whole grains, are also the main source of dietary fiber. Dietary recommendations suggest that 50 per cent or more of total daily calories should come from carbohydrate. Adolescents consume approximately 53 per cent of their calories as carbohydrate (Devaney, 1995).

Foods that contribute the most carbohydrate to the diets of adolescents include bread, soft drinks, milk, cakes, cookies, quick breads etc (Subar et al., 1998). Soft drinks are a major source of added sweeteners in the diets of adolescents (Morton et al., 1998).

The human body requires dietary fat and essential fatty acids for normal growth and development. The Dietary Guidelines recommend that adolescents consume no more than 30 per cent calories from fat, with no more than 10 per cent of calories derived from saturated fat. Studies consistently show that adolescents’ intakes of total fat and saturated fat exceed recommendations (Fox et al., 2001).

Calcium needs during adolescence are greater than they are in either childhood or adulthood because of the dramatic increase in skeletal growth. Because about 45 per cent of peak bone mass is attained during adolescence. Adequate calcium intake is important for the development of dense bone mass and the reduction of the lifetime risk of fractures and osteoporosis (American Academy of Pediatrics, 1999).

Milk provides the greatest amount of calcium in the diets of adolescents, followed by cheese, ice cream and frozen yogurt. Soft drink consumption by adolescents may displace the consumption of more nutrient-dense beverages, such as milk and juices (Subar et al., 1998).
Hamack et al., (1999) reports that adolescents who consume more soft drinks consume less calcium and vitamin C than non-soft drink consumers.

Iron is vital for transporting oxygen in the bloodstream and for preventing anemia. In female adolescents, the need for iron increases with rapid growth and the expansion of blood volume and muscle mass. The onset of menstruation imposes additional iron needs. The RDA for iron is 8 mg/day for 9-13 year olds; 15mg/day for females aged 14-18 (Stang and Story, 2005).

Zinc is important in adolescence because of its role in growth and sexual maturation. It is known that serum zinc levels decline in response to the rapid growth and hormonal changes that occur during adolescence. Serum zinc levels indicative of mild zinc deficiency have been found in 18 per cent to 33 per cent of female adolescents. The RDA for zinc for females aged 9-13 is 8 mg/day (Donovan, 1995).

Besides being important for normal vision, vitamin A plays a vital role in reproduction, growth, and immune function. To ensure adequate body stores of vitamin A, girls aged 9-13 years should consume 600 ng/day and aged 14-18 years should consume 700 jg/day. The low intake of fruits, vegetables and milk and dairy products by adolescents contributes to their less than optimal intake of vitamin A (Subar et al., 1998).

Vitamin E is well known for its antioxidant properties, which become increasingly important as body mass expands during adolescence. The RDA for vitamin E for 9-13 year olds is 11 mg/day and 15 mg/day for 14-18 year olds. National Nutrition Surveys suggest that dietary intakes of vitamin E are below recommended levels. Fortified breakfast cereals and nuts are good sources of vitamin E (Gleason and Suitor, 2001).

Vitamin C is involved in the synthesis of collagen and other connective tissues. For this reason, vitamin C is an important nutrient during adolescent growth and development. The RDA for vitamin C is 65 mg/day for females
aged 14-18. Almost 90 per cent of vitamin C in the typical diet comes from fruits and vegetables, with citrus fruits, tomatoes and potatoes being major contributors. The most common sources of vitamin C among adolescents are orange and grapefruit juice, fruit drinks and tomatoes (Subar et al, 1998).

Folate plays an integral role in DNA, RNA and protein synthesis. Thus, adolescents have increased requirements for folate during puberty. The RDA for folate is 300 p.g/day for 9-13 year olds and 400 ng/day for 14-18 year olds. National data suggests that many adolescent do not consume adequate amounts of folate. Teens who skip breakfast or do not commonly consume orange juice and cereals are at an increased risk for having a low consumption of folate (Subar et al, 1998).

Dietary fiber is important for normal bowel function, and may play a role in the prevention of chronic diseases, such as certain cancers, coronary artery disease, and type 2 diabetes mellitus. Adequate fiber intake is also thought to reduce serum cholesterol levels, moderate blood sugar levels, and reduce the risk of obesity. Significant sources of fiber in the diet of adolescents include whole grain breads, ready-to-eat cereal, potatoes, popcorn and related snack foods, tomatoes, and com. The low intake of fruit, vegetables, and whole grains is the greatest contributing factor affecting fiber intake among adolescents. Adolescents who skip breakfast or do not routinely consume whole grain breads or whole cereals are at high risk for having an inadequate consumption of fiber (Subar et al, 1998).

2.08 Eating patterns of adolescents

The cognitive, physical, social, and lifestyle changes during adolescence can create profound changes in their eating patterns. Teens as a group tends to snack, miss meals, eat away from home, consume fast foods, and diet more frequently than younger children (Stang and Story, 2005).
Eating patterns and behaviors of adolescents are influenced by many factors, including peer influences, parental modeling, food availability, food preferences, cost, convenience, personal cultural beliefs, mass media, and body image (Story et al, 2002).

Szabo and Hollands (1997) conducted a cross-sectional survey to establish factors in the environment, e.g. family, peer or media, as well as individual factors, e.g. self-perception, which may influence eating attitudes. Female high-school pupils were taken as subjects. They found that specific individual wishes, perceptions, behaviors and topics of conversation, appear to influence as well as predict eating attitudes. Family, especially maternal factors play a role in determining eating attitudes. Peer and media (television) factors are not significantly influential.

Eating patterns are frequently erratic in adolescents, and this may be a common factor of nutritional risk irrespective of the area. Personal preferences take precedence over eating habits learned at home as adolescents progressively take control of what they eat, where and how (Sheperd et al., 1996).

Snacks account for 25-33 per cent of daily energy intakes among adolescents. The prevalence of snacking and proportion of calories and nutrients from foods consumed as snacks is more among the adolescents (Jahns et al., 2001). Food choices made by adolescents while snacking tend to be high in sugar, sodium, and fat, while relatively low in vitamins and minerals. Soft drinks are the most commonly chosen snacks for adolescent females and account for about 6 per cent of total caloric intake. This high consumption of soft drinks increases the risk for bone fractures over an individual’s lifetime (Wyshak, 2000).
Meal skipping is common among adolescents, especially during middle and late adolescence. Breakfast is the most commonly skipped meal and is attributed to lack of time, desire to sleep longer in the morning, lack of appetite, and dieting to lose weight. Skipping breakfast may affect concentration, learning, and school performance (Gleason and Suitor, 2001).

Chitra and Reddy [2007] conducted a cross-sectional survey to ascertain the breakfast habits of 10-15-year-old schoolchildren and to assess the quality of the meal as well as its relationship to the food consumption pattern for the full day. Among 802 schoolchildren, boys and girls, aged 10-15 years, belonging to different urban schools located in Secunderabad, Andhra Pradesh in India were taken for the study. Only 42.8 per cent of the children ate breakfast regularly. The energy and protein composition of breakfasts eaten by the children indicated that those who did not skip breakfast met one-quarter to one-third of their total daily energy and protein requirements. Mean nutrient intakes calculated from 24-hour recalls revealed that the children's diets were inadequate compared with the recommended values for energy and protein.

During adolescence, teens spend less time with family and more time with friends. As teens become more independent, eating away from home increases. One-third of all teen eating occasions occur outside the home (Channel One Network, 1998).

Kumar et al. [2006] conducted a study on the food habits of teenagers and youth in relation to fast food consumption in Allahabad city of Utter Pradesh. A total of 123 respondents, comprising 63 males and 63 females, were interviewed for their fast food consumption pattern. Majority of fast food consumers [68.3 per cent] belonged to age group 15-18 years. Respondents whose mothers were housewives contributed maximum among fast foods consumers. Change from routine was the most common reason for consuming fast food, given by 68.3 per cent respondents. Mean calorie intake during last
24 hours was significantly higher for all age groups as compared to their respective RDA. Obesity is generally regarded as the most likely consequence of fast food consumption.

Karin [1999] reports that dieting is a common and widespread practice among adolescents, especially girls. In a survey they found that 59 per cent of high school girls reported trying to lose weight during the 30 days of survey. Almost 20 per cent of girls had gone without eating for 24 hours or more to lose weight, 11 per cent had taken diet pills, and 8 per cent had vomited or taken laxatives.

Steinhausen [2009] reports that both anorexia nervosa and bulimia nervosa are marked by a serious course and outcome in many adolescents. Patel et al. [1998] report that anorexia nervosa and bulimia nervosa are primarily psychiatric disorders characterized by severe disturbances of eating behavior and are most prevalent among female adolescent in order to become thin. Patients with anorexia nervosa manifest weight loss for the fear of becoming fat. Patients with bulimia nervosa present with recurrent episodes of binge eating and inappropriate methods of weight control such as self-induced vomiting, and abuse of diuretics and laxatives.

Anorexia nervosa (or nervous loss of appetite) is a potentially fatal eating disorder - one without any known organic cause - that may affect as many as 1 of every 200 adolescent girls. Anorexics have a morbid fear of becoming obese and will do whatever they can to purge their bodies of fat. The anorexic simply continues to diet, eating less and less until she is little more than skin and bones. Bulimia is another serious eating disorder that is much more common than anorexia. Bulimics are binge eaters who may consume several times their normal daily caloric intake in a single sitting and then purge themselves of this feast by vomiting or taking laxatives. Bulimia is most common among college adolescent (Shaffer, 1996).
Adolescents report several key factors influencing their food choices and eating behaviors, such as taste, hunger, convenience, availability, and parental and cultural influences. Many adolescents feel that healthy eating is not a primary concern during the teenage years. In general, the quality of the adolescent diet is a reflection of this lack of concern. Adolescents say that in order to improve their eating, healthy foods should be appealing and taste good (Neumark et al, 1999).

Research suggests that children and adolescent tend to request food products that are more frequently advertised on television. These products happen to be those which are low in nutritive value. A study was carried out to see the role of media (television) on food consumption pattern of school going children (7-15 years) in Tirupati. The results revealed that majority are purchasing different food products after watching television advertisements. The items like soft drinks, chocolates, ice creams, biscuits etc are consumed in large amounts by children and adolescents and very often take the place of normal meals. Nutritionally these products most of the time provide nothing else but only calories (Anuradha and Arana, 2006).

Utter et al. [2006] conducted a cross-sectional survey to explore how time spent watching television (TV) was associated with the dietary behaviors of New Zealand young adolescents. They found the odds of being overweight or obese increased with duration of TV viewing adolescents. These findings suggest that longer duration of TV watching (thus, more frequent exposure to advertising) influences the frequency of consumption of soft drinks, some sweets and snacks, and some fast foods among the young adolescents.

Television and magazines probably have more influence than any other form of mass media on adolescents’ eating habits (Sharma 1998). Verri et al [1997] conducted a research with an aim to analyze the eating disorder among adolescent and impact of media on it. They found psychological dependence of adolescent on the TV. They suggested that to prevent the observed increase in
prevalence and incidence of eating disorders among adolescents, it is appropriate to control the messages, myths and false hood propagated by media, TV in particular.

### 2.09 Major Nutritional deficiencies among adolescents

Bulliyy [2007] reports that anemia is a major public health problem among adolescent. He conducted a cross-sectional on a sample of 1937 healthy adolescent girls aged 11-19 years from three districts of Orissa, India. Anemia and nutritional status were evaluated according to standard procedures. Of the total adolescent girls, 96.5 per cent were anemic, of which, 45.2 per cent, 46.9 per cent and 4.4 per cent had mild, moderate, and severe anemia, respectively. Significant positive associations were found between Hb concentration and pre-menarche, community, education levels of girls and their parents' family income, body mass index, and mid-upper arm circumference.

Muthayya et al. [2007] report that anemia is a serious public health problem in Indian school children. Gawarika et al. [2006] conducted a school based survey in order to find prevalence of anemia in adolescent girls belonging to different economic group. Four government and four private schools were selected randomly from northern and southern part of Ujjain city, Madhya Pradesh. Students of the government schools belonged to the weaker economic group and students of the private schools belonged to the middle or higher middle income group. The ages of the adolescent girls ranged from 10.5-18 years. The overall per cent prevalence of anemia among the adolescent girls of weaker economic group was 95.5 per cent and among girls of middle and higher middle income group it was 65.18 per cent. The prevalence of severe anemia among adolescent girls of middle or higher middle income group was 11.0 per cent and among girls of middle or higher income group it was 2.63 per cent.
Sen and Kannani [2006] report that iron deficiency anemia during adolescence may reduce physical work capacity and cognitive function. They conducted a study in order to assess the physical work capacity and cognition of underprivileged anemic schoolgirls in Vadodara in early adolescence as compared to their non-anemic counterparts. They found that anemia is likely to adversely affect physical work capacity and cognition in young adolescent girls undergoing pubertal development.

A collaborative study done in the cities of Hyderabad, Calcutta and Madras showed the prevalence of anemia in girls between the ages of 6 and 14 was 63.8 per cent, 65.7 per cent and 98.7 per cent respectively (Kumar, 2001).

Kanani [1994] conducted a study on anemia in adolescent girls living in slum areas in Gujarat. Hundred and five girls, aged 10 to 18, participated in qualitative (focus group discussions; open ended, in depth interviews) and quantitative (structured survey and hemoglobin estimation) research activities before and after intervention. Perceptions of mothers were also surveyed. The girls described symptoms (weakness) associated with anemia. After intervention there was a significant increase in awareness of the symptoms of anemia and the importance of diet in preventing anemia.

Kurz [1996] reports that much of the attention has been on adolescent health, in particular adolescent pregnancy and sexually transmitted diseases, including HIV infection, but adolescent nutrition have aroused little interest. Eleven studies on nutritional status of boys and girls conducted in Benin, Cameroon, Ecuador, India, Jamaica, Mexico, Nepal, Guatemala, and the Philippines have shown anemia as the most important nutritional problem.

Verma and Singh [2006] opine that iodine deficiency is most common cause of mental handicap in the world. In their study which was conducted in Bhavnagar district, Gujarat they found that prevalence of goiter is maximum
among teenagers and adolescent girls had significantly higher goiter than male adolescents. They found that prevalence of goiter is maximum among teenagers because of physiological demand.

Gopalakrishnan et al. [2006] conducted a study to know the prevalence of goiter in school children in Delhi, India. A total of 4,320 school children aged 10-16 years were studied. Goiter was detected in 396 children and overall prevalence of goiter was 9.2 per cent.

Ahluwalia [2002] is of the view despite advances in scientific knowledge regarding multiple etiologies, treatment, and potential strategies for combating iron deficiency and deficiencies of other micronutrients, iron deficiency anemia, vitamin A deficiency and iodine deficiency remain significant public health challenges for adolescents. The short-term efficient supplementation approach, although technically feasible, has not been successful due to problems with delivery and compliance. Evidence is building that preventive supplementation coupled with nutrition education may be a more effective strategy in improving the nutritional status of adolescents. Primary health care system and school infrastructure and staff, along with community members, can be powerful resources for addressing malnutrition among adolescents.

Sharma et al. [2007] conducted a cross-sectional study to investigate the prevalence of obesity in affluent schoolchildren of Delhi, covering over 4000 students. Anthropometric measurements and birth weights of all the students were recorded. The study was carried out in a school catering to the affluent section of Indian society and included both boys and girls in the age range 4 to 17 years. Of the subjects studied, 22 per cent were overweight. They reported that prevalence of obesity is rising among children because of the change in their lifestyle and Nutrition education can play an important part in reducing the incidence of overweight/obesity and its associated complications.
Laxmaiah et al. [2007] conducted a study with an objective to assess the prevalence of overweight among school-age children in Hyderabad, India, and to identify its associated factors. A cross-sectional and institutional study, adopting a multistage stratified cluster sampling procedure, was carried out during 2003 on adolescents 12 to 17 years of age of both sexes from Hyderabad, India. The overall prevalence of overweight was 6.1 per cent among boys and 8.2 per cent among girls. The prevalence was significantly higher among adolescents who watched television, or belonged to a high socioeconomic background whereas it was significantly lower among those participating regularly in outdoor games and household activities. The logistic regression analysis revealed that the prevalence of overweight was 4 times higher among the adolescents of high socioeconomic status 3 times higher in those not participating in outdoor games and 1.92 times higher in those watching television. This study confirmed the findings of earlier studies carried out in Western countries and emphasized that regular physical exercise, doing household activities, regulated television viewing, and healthy eating behaviors could contribute to controlling overweight and obesity.

2.10 School based reproductive and nutritional health education

Schools are considered as one of the most significant social institutions where the development of knowledge and skills which promote health can be addressed. They represent an effective strategy of reaching those adolescents who are in school. Establishing healthy eating habits at an adolescent stage is critical, and schools have an important role to play in this regard. School-based health education may be effective when well done. Health education is usually given by science teachers at the secondary level and these teachers should be well-trained and have interest in health subjects otherwise the outcome will not be effective (WHO, 2005).
In order that adolescents do not grow up with beliefs and notions that are dangerous for the future reproductive life and protect themselves from sexual abuse and exploitation, it is being increasingly realized that reproductive health education in a well conceptualized way should be given in schools by the specially trained teachers. If needed the help from doctors, psychologists / psychiatrists and sexologists may also be sought for this purpose. We must empower adolescents with knowledge and information so that they may fight the cancer of untruths with confidence (Gupta, 2001).

With more children than ever attending school, school based education can be an effective way to reach young people and their families with reproductive health education. School based reproductive health education programs that have appropriate curricula, adequate time, and trained, supportive instructors can help prevent early pregnancy, HIV/AIDS, and STL. According to the United States based Sexuality Information and Education Council, age appropriate sexuality education should be given to adolescence. Courses should be taught by trained teachers, community involvement is essential in the development and implementation of the program [SIECUS 1996].

Teachers can play a vital role in the process for imparting adolescent education to students. Teachers need to be convinced about the need and urgency of imparting adolescent education in schools and have to equip themselves well for imparting the education effectively. It is very natural that teachers like any other groups of society are influenced by the cultural settings and have inhibitions regarding reproductive health related matters. They have to be helped in getting rid of these inhibitions. Studies have found perceptible improvement in the image of those teachers who interact with students on elements of adolescent education. Quite often teachers convey their personal values while discussing a value laden topic with students. It is not desirable to be prescriptive while dealing with sensitive contents of adolescents’ education. Preaching always proves to be counter - productive. Teachers should employ
non-traditional methods of teaching, for effective percolation of adolescent education. They should encourage the use of proper vernacular without inhibition, provide accurate and scientific knowledge and promote open communication in the classroom (Voluntary Health Association of India, 2002).

Obasi et al. [2002] reports that teachers’ knowledge and attitudes are key to the effectiveness of school-based adolescent reproductive health programmes. They conducted an educational intervention programme on adolescent reproductive health [RH], in which 186 teachers were trained to facilitate a 10-15 session on adolescent RH programme in 62 rural schools in Mwanza, Tanzania. After the 5 day training, the impact of the training on teachers’ knowledge and attitudes was evaluated. Changes in RH knowledge, perceived appropriateness of RH education, and attitudes towards RH education, were assessed using pre and post-training questionnaires during the training courses. They found that before training, baseline levels of reproductive health knowledge among teachers was low and attitude was negative, however, training led to significant improvements in RH knowledge and a sustained increase in positive attitudes towards RH education among trained teachers.

Iyoke et al. [2006] views that adolescents in Nigeria have poor knowledge of reproductive health issues and that there was a need to provide them with correct broad-based information on reproductive health as part of nationally-approved school curriculum. However, the non-application of the curriculum on reproductive health education in many secondary schools in Nigeria has been blamed on a negative attitude of teachers. They conducted a study to determine the attitude of secondary school teachers in Enugu, South-eastern Nigeria, towards adolescent reproductive health education and to determine whether this depends on their socio-demographic characteristics. A cross-sectional study of the attitude of teachers to adolescent reproductive health education was done. A total of 249 teachers were studied. Their mean
age was 38.7 years, 84 per cent were females, 90 per cent were married and 67.5 per cent were of Roman Catholic faith. The awareness on reproductive health was high. There was a high proportion of respondents who approved of reproductive health education for adolescents (77.5 per cent) and an equally high proportion who believed that it was important (89 per cent). Seventy nine per cent of the respondents were willing to teach reproductive health education. The attitude to reproductive health education was independent of religion, sex or marital status (p>0.05). It was concluded that secondary school teachers in Enugu urban were willing to offer reproductive health education to adolescents under their care irrespective of their religion, sex or marital status. It is, therefore, recommended that teachers in Enugu be given the necessary special training in the teaching of reproductive health education and that reproductive health education be officially incorporated into the school curriculum in Enugu, preferably as part of moral studies.

Shreejana et al. [2006] considers adolescents a key target group for information and services for the National Adolescent Health and Development Strategy (2000) of Nepal. The extent to which reproductive health education is being provided in schools has received little attention. In a study in 2002 among adolescents in eight schools in the Nawalparasi District in the Western Region of Nepal, they interviewed eight teachers responsible for teaching this subject. They also collected survey data from 451 students and held four focus group discussions with 26 of them. They found that adolescents in these schools did not appear to be getting the information they needed. Most of the teachers did not want to deal with sensitive topics and feared censure by their colleagues and society. Some lacked the skills to give such instruction. Many students also felt uncomfortable with the topics. The challenge is to strengthen reproductive health education, make it more appropriate for the students and ensure that teachers are more comfortable and able to give instruction on the topic.
Bhasin and Aggarwal [1999] conducted a cross sectional study to find out the knowledge and attitudes of school teachers regarding adolescent education. Information was collected from 476 senior secondary school teachers belonging both to the government and public schools, selected randomly in National Capital Territory of Delhi using pre-tested close ended questionnaires. A majority of school teachers (73 per cent) were in favor of imparting adolescent education to school children. Regarding the contents of adolescent education, 90 per cent agreed to the inclusion of reproductive anatomy and physiology including menstruation. A majority of school teachers did not want adolescent education to include topics like abortion, premarital sex and masturbation etc. Fourteen years of age was considered to be the most appropriate for imparting adolescent education by 28.6 per cent of school teachers. School teachers and doctors were considered by 69.4 per cent and 63.6 per cent of the respondents respectively to be the most appropriate persons for providing adolescent education.

Nayak and Bose [1997] report that to reduce the incidence of adolescent pregnancy, unsafe abortion, and sexually transmitted diseases (STD) in India, Parivar Seva Senstha (PSS) Family Planning Program has launched a program to provide family life education to young people. A preliminary survey administered to 236 South Delhi youths between 12-20 years of age revealed widespread lack of knowledge about reproduction and STD and a lack of comfort discussing sexuality. Based on the survey results, PSS designed a curriculum for aged 12-14, 15-17, and 18-20 years and to be disseminated through schools and colleges, the National Service Scheme, Bharat Scouts and Guides, nongovernmental organizations, teacher training institutes, and a distance learning program. As the program evolved, a reproductive health hot line, face-to-face counseling sessions, workshops for engaged couples, and a radio question-and-answer program were added. Although teachers are supportive of the program, they remain inhibited about discussing sexuality with their students and prefer that PSS conduct the classes. At present, PSS is training trainers to teach the curriculum.
Parwej et al. [2005] conducted an education intervention trial to measure the effectiveness of a reproductive health education package in improving the knowledge of adolescent girls aged 15-19 years in Chandigarh (India). A reproductive health education package developed in consultation with parents, teachers and adolescents, was delivered to randomly sampled classes of two senior secondary schools and one school was selected as control. In one school, a nurse conducted 15 sessions for 94 students in three batches using conventional education approach. In another school she conducted sessions for a selected group of 20 adolescents who later disseminated the messages informally to their 84 classmates (peer education). Using a 70-item structured questionnaire the knowledge of 95 adolescents from conventional, 84 from peer, and 94 from control school were assessed before and one month after the last session. Change in the score in intervention and control groups was tested by ANOVA taking age and socio-economic status as covariates. Teachers, parents and students overwhelmingly (88 per cent, 95.5 per cent and 93 per cent respectively) favored reproductive health education program. Reproductive health knowledge scores improved significantly after intervention in conventional education (27.28) and peer education group (20.77) in comparison to the controls (3.64).

Thakor and Kumar [2000] conducted a cross-sectional, interview-based study to assess the impact of adolescent education on the students and the feasibility of such a program. Study sample consisted of 189 students from two secondary schools of Surat city. Impact was assessed by "before and after" administration of questionnaires. Adolescent education influenced the need perception and the knowledge of the students. Doctors remained the first choice to impart the adolescent education, followed by school teachers. Knowledge about the STD and the methods of prevention improved significantly after the adolescent education.
Rao et al. [2007] conducted a study to assess dietary habits and nutrition knowledge levels of the adolescent girls from different schools and to study the efficacy of nutrition education in improving their nutrition knowledge in the classroom setting. A significant improvement in the nutrition related knowledge was observed among the experimental group after interventions as compared to the baseline data.

Tragler [1991] conducted a study to assess health knowledge of school children in India. Researcher compared responses to a pretest questionnaire with those of a posttest questionnaire completed by 304 school children, 12-16 year old, attending either a public school or a private school in Bombay. The researcher administered the posttest 4 weeks after health education talks and demonstrations. Before the health education course, children at all 3 schools had limited health knowledge. After undergoing health education, more improvement was seen in private schools compared to public and rural schools.

An examination of the literature presented in this section reveals that though there are many studies focusing on the needs and problems of adolescents, there are only few studies highlighting the methodology of intervention to empower adolescent girls on their reproductive and nutritional health as a school based training programme.