CHAPTER I

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Adolescence as one of the most exciting yet challenging periods in human development generally thought of as a period of tremendous physiological, psychological and cognitive transformation during which a child becomes a young adult. Adolescents are full of energy, have significant drive and new ideas. They are a positive force for a Nation and are responsible for its future productivity provided they develop in a healthy manner. Since death rate in this age group is relatively low the adolescents are considered to be healthy, however it is a misleading measure of adolescent health. Historians have been aware of certain adolescent phenomena of variations in the human behavior with age. The claim that specialized youth group can be traced back to at least to 16th century in France.

Aristotle, however, usually cited as the first sense of detailed records of adolescent development. He described voice changes in male sex, breast development and menarche in females. Biologists describe the adolescence the period between puberty and the termination of physical growth. Adolescence is the most important period in human development about which poets, writers and historians have made occasional references and have held in high esteem the sacrifices made by the adolescences. It is the period and turning point in the life of the individual (Chauhan, 1983).

The first psychologist who systematically conducted research on adolescents was Hall (1844- 1924) who in the beginning of the last century collected enormous data on adolescents. He defined adolescent in terms of psychological changes occurring in adolescents. He begins this period from 10-13 years of age and ends when full adult status is attained by 22-25 years of age. According to him “adolescence is a period of storm and stress”.

Erikson (1964), a famous psychoanalyst, who developed very comprehensive theory of human development, defined ‘adolescence as a period of rapid changes physical,
physiological, psychological and social. In human growth and maturation, adolescence period is significant. Adolescence is a unique intervention point in the life-cycle for a number of reasons. Early adolescence after the first year of life is the second critical period of rapid physical growth and changes in body composition, physiology, and endocrine. Rapid growth and changes heighten their nutritional requirements and risks of under nutrition. Parents simply need to provide more nutrients and emotional support. Adolescence offers the last opportunity to intervene and recover growth faltered in childhood and also support growth spurt and skeletal development to break the vicious cycle of inter-generational undernutrition (Golden MH and Martorell R, 1994).

The task of defining adolescence has remained difficult due to the fact that each adolescent has different and unique transitions from early years to later years of life. According to Lenhart et al. (2010) adolescence cannot be defined in one single term because various developments take place from childhood to adulthood. Paula (2004) mentioned adolescence as a transitory period between childhood and adulthood. It is also known as formative stage when different behaviours are learned and developed. Kurz et al. (1994) mentioned adolescents fall in the category of 10-19 years. Kaplan (2004) mentioned adolescence a stage of life which falls between early years of adolescence till they attain maturity. Das and Biswas (2006) mentioned that adolescence is characterized by increased physical growth which brings many social and psychological changes in individuals. Apart from moving from childhood to adulthood they also mature mentally and gain independence.

The term adolescence derives from the Latin word Adolescere, which means “to grow” or “to develop towards maturity”; therefore it is the individual dimension of transition into adult life. The beginning of adolescence is linked to puberty, coming from the Latin word Pubertas, meaning “the virile age” and making reference to the sexual maturity, both feminine and masculine (Feixa,2011).
World Health Organization (WHO) is trying to make universal accepted definition of Adolescents. According to WHO (1986a), adolescents include persons aged 10-19 year and the phase of life marked by special attributes, these attributes include:

- Rapid physical growth and development
- Physical, social and psychological maturity, but not all at the same time
- Sexual maturity and the onset of sexual activity
- Experimentation
- Development of adult mental processes and adult identity
- Transition from total socio-economic dependence to relative independence.

Adolescence may be divided into three developmental stages based on physical, psychological and social changes (WHO/UNICEF, 1995): early adolescents (age 10-13 years), middle adolescents (age 14-16 year), and late adolescents (age 17-19 year). According to WHO (2007), adolescence is a period of major physical and psychological change, as well as great changes in social interactions and relationships. Adolescence is characterised by rapid increase in height and weight, hormonal changes resulting in sexual maturation and causing wide swings of emotion. It is an anabolic phase of life and warrants increased nutrient requirement per unit body weight.

Chaturvedi S et al., (1996) stated that Adolescence is a period of transition between childhood and adulthood. It occupies a crucial and important place in the life of human beings whereby transition is characterized by rapid rate of growth. Adolescence is a vulnerable period in human life cycle characterized by rapid growth and development couple with in numerous physiological and psychological changes (Mussein, 1990).

LeBourgeois et al (2005) stated that adolescence is a period characterized by important changes in cognitive, behavioural, social, and emotional functioning attributable to biological development (i.e., puberty) and to new roles and demands in the familial and social milieu (i.e., decreased parental involvement and increased academic requirements).
Patterns of Growth during Adolesences

Physical Growth
Differences between sexes and between individuals of the same sexes become more pronounced during adolescence period. During this age span the peripheral parts of the extreme ties tend to be more advanced in maturation than proximal. The peak growth of leg length is usually reached before hip width reaches its maximum increase. Trunk length and chest depth are usually the last of the skeletal measurements to reach their peak growth. Therefore, the ratio of trunk to leg length rises during adolescence in both the sexes. The peak velocity in muscle size and in strength usually follows the age of maximal increase in stature and the peak velocity of weight gain occurs approximately 6 months after peak height velocity (Virginia, 1980).

Height
The first phase of adolescent growth is linear. On an average boys grow inches inches and girls grow six inches during puberty. This growth is uneven. The hands and feet enlarge first. The calves and forearm lengthened next, followed by expansion of hips, chest, shoulders and trunk. As a result adolescent often appear awkward or clumsy. After the main growth spurt growth continues for 2-3 years but at a much slower rate.

For girls peak growth occurs about one year before menarche, the onset of menstruation. A typical girl has achieved about 95 percent of her adult height by menarche and grows only 2-4 inches during the remaining part of adolescence. Growth rates are closely related to sexual maturation reflected in breast development; in girls’ change of voice, in boys’ development of sexual organs and growth of pubic hair. When the growth plates at the end of long bones (epiphysis) close, skeletal growth is complete. This is a critical point in development. An adolescent who is malnourished and of small stature at the point of epiphysis closure may not achieve his or her height.
Weight
The second phase of adolescence involves lateral growth. Here the adolescence fills up or gains weight. External factors such as diet and exercise effect weight gain more than linear growth, so weight gain can vary widely among adolescent. A typical healthy girl will gain 35 pounds during adolescence; a typical boy gains about 45 pounds. Girl’s peak weight gain usually occurs around the time of menarche (Chauhan, 1983).

Growth Hormone: It may contribute to the maturation of central nervous system.

Thyroid Hormone: T3 and T4 help overall body growth and skeletal maturation. They contribute to the maturation of the central nervous system. Metabolic effect of thyroid hormone includes increase in oxygen consumption, heat production, nitrogen retention, protein synthesis, glucose absorption and glycolysis (Rivlin, 1969).

Insulin: The effect of insulin on growth is indirect. Insulin increases the uptake and metabolism of glucose glycogenesis and synthesis of fatty acids (Check, 1975).

Adrenal Cortical Steroids: The adrenal cortex secretes several steroid hormones that regulate and promote growth as well as sexual development and function (Timiras, 1972).

Gonadal Hormone: The accelerated growth of adolescence is sex hormone (Timiras, 1972).

Androgens: The steroids have potent anabolic action. They increase the retention of sodium, potassium phosphorus and calcium. They increase Protein synthesis. They accelerate skeletal maturation.

Estragon: In the male the testes secrete small amounts of estragon which may be responsible for the temporary rounding of hips and change in breasts.
**Progesterone:** This is secreted by corpora lutea of cortex. Progesterone causes changes in the endometrium and is responsible for cycle change in the vagina (Brasel, 1982). Historically, in our culture puberty signals the beginning of adolescence. In other cultures it marks the transaction of adulthood and this transaction may be highlighted by initiation ceremony that specifically signals the attainment of adult status. The ceremony is usually highly symbolic is an explicit and dramatic event that establishes for the comments as well as for the initiate the fact that he or she is now adult.

**DEVELOPMENT DURING ADOLESCENCE**

**Developmental Changes during Adolescence**
The timing of changes in the body varies between individuals and sexes, which are described as under:

**Developmental Changes in Girls**
Girls have less variation than boys. Total span of time from the onset of puberty to maturity is shorter and there is less difference between late and early maturing girls. The first visible change is development of breast between the age of 7-12 years and appearance of pubic hair. The secretion of estragon results in thickening of epithelium of the enlarging vagina. The ovaries continue to increase in size following menarche. Ovulation may begin shortly after the onset of menstruation cycle but regularity in ovulation may not be attained for as long as two years. It has been estimated that the average female become fertile at 14-15 years but it may be as early as 11 ½ ears for some females (Hammer, 1975).

**Developmental Changes in Boys**
The first sign is the increase in testes with development of somniferous tubules and interstitial cells as a result of stimulation of gonadotropins. This occurs at the age of 11 years, although the range may be from 9-15 years with maturation of the testes. Secretion of testosterone accelerates growth. The penis first increases in length and
then breadth. Genitalia are usually well developed by 14-15 years in the average male. During early puberty under the influence of estragon or adrenal corticoids the male may bear increased deposition of body fat and hips and breasts may show some signs of female configuration. Subcutaneous fat thickness in the male decreases once puberty has become established. The secretion of testosterone results in marked increase in muscle and shoulder width as well as linear growth. Peak height velocity occurs at an average of approximately 14 years close to the age of attaining adult genitalia but the timing may vary from 12-16 years, adolescent increase the strength. Facial and axillary hair usually does not appear until after the peak velocity of increase in statue. Voice changes are gradual and usually late in the sequence of adult development (Reynolds, 1951).

**Normal Psychosocial and Cognitive Development**

During adolescence teens develop a stronger recognition of their own personal identity, including recognition of a set of personal moral and ethical values, and greater perception of feelings of self-esteem or self-worth. Psychosocial and cognitive development is best understood when divided into three periods: early adolescence (11-14 years), middle adolescence (15-17 years), and late adolescence (18-21 years). Each of these distinct periods of development is marked by the mastery of new emotional, cognitive and social skills (Stang J, Story M, 2005).

**Psychosocial Development**

Adolescents experience dramatic biological changes related to puberty; these biological changes can significantly affect psychosocial development. An increased awareness of sexuality and a heightened preoccupation with body image are fundamental psychosocial tasks during adolescence. Dramatic changes in body shape and size can cause a great deal of ambivalence among adolescents, especially among females, leading to the development of poor body image and eating disturbances or disorders if not addressed by family or health care professionals. Similarly, a perceived delay in sexual maturation and biological development, especially among males, may lead to the development of poor body image and lowered self-esteem. It is imperative that health professionals who work with adolescents have a clear
understanding of how normal psychosocial and cognitive development relate to biological growth and development, and is able to appreciate how these processes affect nutritional intake and status (Stang J, Story M, 2005).

Peer influence is a dominant psychosocial issue during adolescence, especially during the early stages. Young teens are highly cognizant of their physical appearance and social behaviors, seeking acceptance within a peer group. The desire to conform can influence food intakes among teens. Focus groups comprised of adolescent females have revealed that food is divided into two classification groups: junk foods and healthy foods (Barr S, 1994). Eating junk foods, according to these focus groups, was associated with being with friends, having fun, gaining weight, and guilt, whereas eating healthy foods was associated with family, family meals, and home life. Obviously, teens adopt or develop food preferences and make food choices based on associations with feelings of being accepted and having fun with peers and may use food as a way to exert independence from families and parents. Young adolescents should be educated on normal variations in initiation and progression of biological growth and development in an effort to facilitate the development of a positive self-image and body image and to reduce the likelihood of early initiation of health compromising behaviors (Stang J, Story M, 2005).

Cognitive Development

The early stage of adolescence is a time of great cognitive development. At the beginning of adolescence, cognitive abilities are dominated by concrete thinking, egocentrism, and impulsive behavior. The ability to engage in abstract reasoning is not highly developed in most young teens, limiting their capacity to comprehend nutrition and health relationships. Young adolescents also lack the skills necessary to problem solve in an effort to overcome barriers to behavior change and the ability to appreciate how current behaviors can affect future health status.

Middle adolescence is characterized by growth in emotional autonomy and increasing detachment from family. The bulk of physical growth and development is
completed during this stage, however body image concerns may continue to be a source of trepidation, especially among males who are late to mature and females who have experienced great changes in body composition and size. Conflicts over personal choice, including food choices, become increasingly common during this stage of adolescence. Peer groups become more important than family and their influence with regard to making food choices peaks. Coinciding with the increased importance of peer acceptance, the initiation of health compromising behaviors such as smoking, alcohol consumption, using street drugs, and engaging in sexual activities often occurs during middle adolescence. Teens may consider themselves invincible and often still display impulsive behaviors (Stang J, Story M, 2005).

The late stage of adolescence is characterized by the development of a strong personal identity. Biological growth and development has concluded among most teens and body image issues are less common. Older adolescents are able to manage increasingly sophisticated social situations, are able to suppress impulsive behaviors, and are less affected by peer pressure. Economic and emotional dependence upon family is markedly decreased and conflict over personal issues, such as food choices, also decreases. Relationships with a single individual become more influential than those with a group of peers as a stronger sense of personal identity emerges. The expansion of abstract reasoning skills continues to occur during late adolescence, which assists teens in developing an ability to comprehend how current health behaviors affect long-term health status. This is an especially important skill for adolescent females who plan to have children or who become pregnant during late adolescence. Older teens are now capable of learning problem solving skills that can assist them in overcoming barriers to behavior change (Stang J, Story M, 2005).

Social Development: Identity Development
Identity development is a stage in the adolescent life cycle (Kroger, J. 1996). For most, the search for identity begins in the adolescent years. During these years, adolescents are more open to 'trying on' different behaviours and appearances to discover who they are (Strasburger, V.C et al., 2014). In an attempt to find their
identity and discover who they are, adolescents are likely to cycle through a number of identities to find one that suits them best. Developing and maintaining identity (in adolescent years) is a difficult task due to multiple factors such as family life, environment, and social status (Kroger, J. 1996). Empirical studies suggest that this process might be more accurately described as identity development, rather than formation, but confirms a normative process of change in both content and structure of one's thoughts about the self (Steinberg, L., 2008). The two main aspects of identity development are self-clarity and self-esteem (Strasburger, V.C et al., 2014). Since choices made during adolescent years can influence later life, high levels of self-awareness and self-control during mid-adolescence will lead to better decisions during the transition to adulthood. Researchers have used three general approaches to understanding identity development: self-concept, sense of identity, and self-esteem. The years of adolescence create a more conscientious group of young adults. Adolescents pay close attention and give more time and effort to their appearance as their body goes through changes. Unlike children, teens put forth an effort to look presentable. The environment in which an adolescent grows up also plays an important role in their identity development. Studies done by the American Psychological Association have shown that adolescents with a less privileged upbringing have a more difficult time developing their identity (APA).
The World Health Organization defines nutrition as: the intake of food, considered in relation to the body’s dietary needs. An adequate, well balanced diet combined with regular physical activity is a cornerstone of good health. Poor nutrition can lead to reduced immunity, increased susceptibility to disease, impaired physical and mental development, and reduced productivity.

Adolescence is a time of intense physical, psychosocial, and cognitive development. During this period they gain up to 50 percent of their adult weight, more than 20 percent of their adult height, and 50 percent of their adult skeletal mass. Thus the nutritional needs for energy, protein, and many vitamins and minerals are increased. Inadequate stores or intake of nutrients, during this period can have adverse effects on the physical growth and cognitive development. So adolescence is a vulnerable period for the development of nutritional anaemia (DiMeglio, 2000; Chaudhary and Dhage, 2008).

Adolescents are considered to be a nutritionally vulnerable segment of the population. A rapid growth rate combined with a marginal nutrient intake increases the risk of nutritional deficiencies in this population. Healthy diets and regular, adequate physical activity are major factors in the promotion and maintenance of good health during adolescence and throughout the entire life course. As per WHO, approximately 2.7 million deaths are attributable to low fruit and vegetable intake and about 1.9 million deaths are attributable to physical inactivity (WHO, 2007). The phenomenal growth that occurs in adolescence, second only to that in the first year of life, creates increased demands for energy and nutrients. Total nutrient needs are higher during adolescence than any other time in the lifecycle. The most prevalent consequences of malnutrition in adolescents are underweight, overweight or obesity; iron deficiency Anaemia and eating disorders such as anorexia nervosa and bulimia. Undernutrition leads to stunted growth and low bodyweight, whereas over-nutrition leads to over-weight and obesity. Consumption of healthy foods such as milk, fruits and green leafy vegetables is low, while that of junk foods and fried or sweet foods is high. This poor dietary pattern is the
cause of several nutritional deficiencies, overweight and obesity in adolescents. Iron deficiency is one of the most prevalent nutritional deficiencies in adolescent girls (Bruner et al., 1996).

Effective health promotion requires an understanding of the numerous ways in which nutrition relates to human needs. When nutritional status is good, the harmonious result is indicated by the characteristics usually associated with good health. Thus, good nutrition is essential for good health and important for physical growth and development, good body composition and mental development. People’s nutritional state can protect them from or predispose them towards chronic disease. Thus, nutrition is both a preventive and therapeutic science (Carroll and Karen, 2001). Nutrition is an integral component of health and wellbeing of an individual. Good nutrition enables one to lead a socially and economically active life and it improves the quality of life as evidenced through enhanced nutritional status of the population groups, better work efficiency rate, reduced mortality and morbidity rate by raising the standard of living (Gopalan, 2003).

It is a fact that an individual’s nutritional status reflects the degree to which physiologic needs for nutrients are being met. Thus, nutrient intake depends on actual food consumption. When adequate nutrients are consumed to support the body’s daily needs and increased metabolic demands, the person moves into an optimal nutritional status. This status promotes growth and development, maintains general health, protect them from or predispose them towards chronic disease (Kathleen and Sylvia, 2008).

Proper nutrition at the growing stages of life not only helps to promote health but also prevent the occurrence of deficiency diseases and other health hazards. Ingesting too much or too little of a nutrient can interfere with health and wellbeing. Thus, malnutrition occurs when body cells receive too much or too little of one or more nutrients (Srilakshmi, 2002).
Energy
Calorie needs increases with the metabolic demands of growth and energy expenditure. Although individual needs vary, girls consume fewer kilocalories than boys. Boys need 2500-2800 kilocalories a day. Sometimes the large appetite characteristic of this growth period leads to adolescence to satisfy their hunger with snack foods that are high in sugar and fat and low in protein. During adolescence from the age of 10 years there are marked differences in the calorie needs of boys and girls (Mueller, 1976).

Proteins
For most adolescents eating to satisfy appetite offers a reasonably sensitive indicator of energy needs. Protein needs represent 12-14 percent of energy needs. Protein intake usually exceeds 1 gm/kg body weight. This means growth needs and for the pubertal changes in both sexes and for the developing muscle mass in boys. The protein needs for both boys and girls are the same up to the age of 10 years. But there is a gradual difference in their requirement from the age of 10 years where the boys have higher requirement compared to girls. This pattern is similar in calorie requirement. The RDA levels for males increase 1gm/kg body weight i.e. 45gm to 56 gm at 11-14 years and 0.85gm/kg at 15-18 years and 0.8gm/kg at 19-22 years; for females 46gm at 11-18 years and then decreases to 44 gm at 19-22 years. The allowances per kilogram are same for both sexes at comparable ages (Johnston, 1958; WHO, 1973).

Lipids
No allowances have been established for fat intake. The range from minimum to maximum intakes during adolescent was 27-47 percent for males and 24-51 percent for females.

Carbohydrates
Since carbohydrates can be made in the body from same amino acids and from glycerol of fat. No recommended allowances have been established. The median intake of meals ranged between 300-325gm/day from 10-17 years of age with 10
percentile levels close to 200 and 90 percentile levels approximately 400gm/day (Virginia, 1980).

Vitamins
The need for thiamine, riboflavin and niacin increased directly with increased calorie intake. Folic acid and B12 are essential for Deoxyribonucleic Acid (DNA) and Ribonucleic Acid (RNA) synthesis and needed in higher amounts when tissue synthesis is occurring rapidly. Tissue growth involves amino acid metabolism particularly transamination to synthesis non-essential amino acid. So requirement for B6 is increased. Premenstrual tension can be reduced if adolescent girls consume 100mg/day B6. The structural functional integrity of the new-formed cells depends on the availability of vitamin A, C and E (Mueller, 1976).

Calcium and Minerals
Calcium and iron are particularly needed during adolescence. Bone growth demands calcium. About 150 mg of calcium must be retained each day to allow for the increase in bone mass. Iron needed for haemoglobin synthesis is necessitated by considerable expansion of blood volume and for the myoglobin needed for muscle growth. The girls need to ensure adequate intake of iron as the loss 0.5 mg/day by way of menstruation. The daily menstrual loss of iron is computed from the iron content of blood lost during menstrual period averaged over a month. If this lost iron is not replaced it predisposes to iron deficiency anaemia. During adolescence there is an increase in body mass corresponding to about 4.3 kg/year in the males and 4kg/year in the females with a further increase in haemoglobin by 2gm/dl in the males and 1gm/dl in the females, the respective requirements for growth alone is 0.7 mg/day in males and 0.45mg/day in the females. While the obligatory losses also increase with age standard for calcium intake differ markedly during adolescence FAO/WHO standard allows 0.6-0.7gm between 10 and 15 years and 0.5-0.06gm from 16-19 years. Since bone grows in volume and densely as well as the length calculations of calcium requirement based in height increments alone under estimates calcium needs. It has estimated that females must retain 200mg of calcium/day for bone growth alone during the peak Increment to stature between 10 and 14years and male must retain
300mg/day for bone growth at his peak between 10 and 14 years. However, individuals of same stature may differ by at 30 percent in bone volume and therefore differ in calcium requirement (Srilakshmi, 2002).

**Phosphorus**

The dietary study shows that ratio of calcium and phosphorus is 1:1. The calcium and phosphorus ratio in the CRC study was 0.8: to 0.85 in males between 10 and 17 years in females by 18 years. When their milk consumption decreases, a wide variation in calcium and phosphorus ratio can be tolerated so long as the vitamin D intake is adequate. Large intake of phosphorus from soft drinks by adolescent with low milk intake has raised concern about low calcium and phosphorus (R D A, 1974: Srilakshmi, 2002).
MALNUTRITION

World Food Program (WFP) defines malnutrition as “a state in which the physical function of an individual is impaired to the point where he or she can no longer maintain adequate bodily performance process such as growth, pregnancy, lactation, physical work and resisting and recovering from disease”.

Malnutrition is defined as an imbalance between the body’s supply of nutrients and the body’s demand for growth, maintenance and specific activities. When a person cannot take sufficient nutrients to meet their need, the body begins to waste away. First they lose fat and then muscle. Malnutrition and its associated disease conditions can be caused by eating too little, eating too much, or eating an unbalanced diet that lacks necessary nutrients.

According to Britannica Student Encyclopedia (2005), Malnutrition refers to any disorder of nutrition whether it is due to dietary deficiency, called under-nutrition, or to excess diet, called over-nutrition. Malnutrition results from imbalance between the needs of the body's and the intake of nutrients. According to Ratzan et al. (2000), Malnutrition worldwide includes a spectrum of nutrient related disorders, deficiencies, and conditions such as intrauterine growth retardation, protein energy malnutrition, iodine deficiency disorders, vitamin A deficiency, iron-deficiency anaemia, and overweight/obesity and other diet-related non communicable diseases.

Malnutrition refers to all deviations from adequate nutrition, including undernutrition (and overnutrition) resulting from inadequacy of food (or excess of food) relative to need (respectively). Malnutrition also encompasses specific deficiencies (or excesses) of essential nutrients such as vitamins and minerals. Conditions such as obesity, although not the result of inadequacy of food, also constitute malnutrition. Malnutrition can result from a lack of macronutrients (carbohydrates, protein and fat), micronutrients (vitamins and minerals), or both. Macronutrient deficiencies occur when the body adapts to a reduction in macronutrient intake by a corresponding decrease in activity and an...
increased use of reserves of energy (muscle and fat), or decreased growth. Consequently, malnourished individuals can be shorter (reduced growth over a prolonged period of time) and thinner than their well-nourished counterparts. It occurs when essential vitamins and/or minerals are not present in adequate amounts in the diet. The most common micronutrient deficiencies are iron (Anaemia), vitamin A (xerophthalmia, blindness), and iodine (goitre and cretinism). Others, such as vitamin C (scurvy), niacin (pellagra), and thiamine or vitamin B1 (beriberi), also can occur during acute or prolonged emergencies when populations are dependent on a limited, unvaried food source (WFP, CDC, 2005).

Grover and Ee (2009) noted that malnutrition has the potential to affect all organ systems in the body. Initially, clinical findings include lack of adiposity and subcutaneous tissue, poor muscle bulk, irritability, and oedema. As malnutrition progresses, growth is delayed, leading to stunting, and other systems become involved, with changes in hair, skin, nails, mucous membranes, and other organs. Micronutrient deficiencies, particularly deficiencies of vitamins and minerals, are common in malnourished patients; so many patients also will exhibit signs of these deficiencies. Malnutrition increases the risk of poor health and endangers growth and development in childhood (Whaley SE et al., 2003).

According to Mehrotra (2006), Malnutrition is a complex phenomenon. Malnutrition, defined as underweight, is serious public health problem that has been linked to a substantial increase in the risk of mortality and morbidity. Although it is rarely the direct cause of death. Malnutrition has been increases the over the period in developing countries. Half of the world malnourished children are to be found in just three countries-Bangladesh, India and Pakistan. Child malnutrition rates in south Asian countries are higher than sub-Saharan African countries. It commonly affects all age groups in a community, but infants and young children are most vulnerable because of their high nutritional requirements for growth and development. Another group of concern is pregnant women, given that a malnourished mother is at high risk of giving birth to a low birth weight (LBW) baby who will be prone to growth failure during infancy and early
childhood, and be at increased risk of morbidity and early death. Malnourished girls, in particular, risk becoming yet another malnourished mother thus contributing to the intergenerational cycle of malnutrition.

Many research studies have documented that malnutrition affects body growth and development, especially during the crucial period of adolescence (Babitha, 2003). Malnutrition is one of the most devastating problems worldwide. Malnutrition denotes impairment of health arising either from deficiency or excess or imbalance of nutrients in the body. It is an ecological problem. It is the end result of multiple overlapping and interacting factors, physical, biological, social and cultural environment and economic (Beegum, 2001). Malnutrition in one or more of its various forms frequently characterizes emergency situations, both natural and manmade. When the nutritional needs of the population or population subgroup are not completely met, some form of malnutrition soon emerges, usually among the most helpless or vulnerable individuals. The results are underweight children, anaemic mothers, marasmic babies, scurvy, beri beri, pellagra, vitamin A deficiency blindness and other deficiency syndromes (WHO, 2000).

DIFFERENCES BETWEEN MALNUTRITION AND UNDERNUTRITION

"Malnutrition" and "undernutrition" are terms generally used interchangeably to mean more or less the same entity, and they both refer to nutritional situations characteristic of populations belonging to the low income and poor socioeconomic groups of developing countries. In practice, developing country population groups suffering from malnutrition or undernutrition as defined in this way are likely to be more or less the same. Although it is possible to arrive at the prevalence and the numbers of individuals within a population manifesting signs of specific nutrient deficiency, for instance Anaemia as a result of iron deficiency, when signs of vitamin or mineral deficiencies are observed, they are almost always associated with marginal or low dietary energy intakes (WFP, 2001).
Undernutrition is a condition associated with weakened immune systems and increased severity of illnesses. Chronic undernutrition has both short-term and long-term implications for physical growth (Kristjansson B, et al., 2009), mental development and productivity in adulthood.

Food and Agricultural Organization (FAO, 1999) makes a distinction between undernutrition and undernourishment. "Undernourishment" is when food intake is continuously insufficient to meet the dietary energy requirements, while undernutrition is the result or outcome of undernourishment, poor absorption and poor biological use of nutrients consumed. This distinction may be important when attempting to explain the differences in estimates of numbers of undernourished individuals by the FAO food balance method as compared with the nutritional anthropometric approaches that provide numbers of undernourished.

The term malnutrition generally refers both under and over nutrition. Many factors can cause malnutrition, most of which relate to poor diet or severe and repeated infections, particularly in underprivileged populations. Inadequate diet and disease, in turn, are closely linked to the meet its basic need such a food, housing and health care. Malnutrition is thus a health outcome as well as a risk factor for disease and exacerbated malnutrition (Blössner M & de Onis, 2005).

Malnutrition denotes impairment of health arising either from deficiency or excess or imbalance of nutrients in the body. Adolescence is an important period in the individual’s life. Adolescents represent around 20 percent of the global world’s population and around 84 percent of them are found in developing countries. Inadequate nutrition in adolescence can potentially retard growth and sexual maturation, although these are likely consequences of chronic malnutrition in infancy and childhood. Inadequate nutrition in adolescence can put them at high risk of chronic diseases particularly if combined with other adverse lifestyle behaviors the problem of malnutrition (Dasgupta A, 2010).
Malnutrition is an umbrella term for poor nutrition, whether that is excess consumption of nutrients (overnutrition) or inadequate consumption or absorption of one or more nutrients (undernutrition) (UNICEF, 2012).

According to FAO/WHO/UNU (1985) ‘Malnutrition or Undernutrition’ is the outcome of insufficient food of whatever kind caused primarily by an inadequate intake of dietary or food energy, whether or not any specific nutrient deficiency, such as iron deficiency Anaemia, is present. Undernutrition is defined as a dietary energy intake below the minimum requirement level to maintain the balance between actual energy intake and acceptable levels of energy expenditure.

ARE NUTRITIONAL NEEDS OF BOYS AND GIRLS THE SAME?

The transition from childhood into adolescence often results in diets becoming less healthy. An unhealthy diet during adolescence can negatively affect growth and development, and is likely to persist into adulthood (Haerens L et al., 2008). Stang and Story (2005) conveyed that prior to puberty; nutrient needs are similar for boys and girls. It is during puberty that body-composition and biological changes (e.g., menarche) emerge which affect gender-specific nutrient needs. Nutrient needs for both males and females increase sharply during adolescence. Nutrient needs parallel the rate of growth, with the greatest nutrient demands occurring during the peak velocity of growth. Also, energy needs of adolescents are influenced by activity level, basal metabolic rate, and increased requirements to support pubertal growth and development. Basal metabolic rate is closely associated with the amount of lean body mass. Adolescent males have higher caloric requirements since they experience greater increases in height, weight, and lean body mass than females. The girls constitute a more vulnerable group especially in the developing countries where they are traditionally married at an early age and are exposed to greater risk of reproductive morbidity and mortality. In general adolescent girls are the worst sufferers of the ravages of various forms of malnutrition because of their increased nutritional needs and low social power (Chaudhary S, 2009).
Adolescents needs special attention because of the turmoil of adolescence which they face due to the different stages of development that they undergo, different circumstances that they come across, their different needs and diverse problems. Rural adolescent girls have been considered a low risk group for poor health and nutrition. Despite all these important consideration, adolescent girls did not receive adequate attention in rural areas in our country (Patil, S.N. 2009; Chaudhary S. 2009; Venkaiah K, 2002).

Among girls, the “growth spurt” normally takes place between 12 and 18 months before the onset of menarche, which occurs between the ages of 10 and 14. Then growth in stature continues for up to 7 years. Growth of pelvic bones continues for another 2-3 years after height growth has stopped (Moerman, 1982). Maximum bone mass is not achieved before 25 years (National Academy of Sciences, 1997).

The nutritional needs of males and females of the same age differ little in childhood but diverge after the onset of the pubertal growth spurt. After puberty, the differences in nutrient needs persist. The reason for the sex differences in nutrient recommendations after the age of 10 include earlier maturation of females for example, protein requirements of 11-14 year old girls are higher than the boys of the same age group but are much less for 15 to 18 year old girls as compared to their male counterparts, and variations in physiological needs for some nutrients by sex e.g., difference in the requirement of iron. Besides differences in height and weight, boys gain proportionately more muscle mass than fat as compared to girls. They experience increased linear growth to produce a heavier skeleton and develop greater red blood cell mass than girls. Girls on the other hand have more fat than muscle tissues. These differences in body composition have important implications for nutritional needs.
ADOLESCENT AND MALNUTRITION

As emphasized by the Executive Director of UNICEF (2005), one of the major reasons for focusing on adolescents is that this period is a unique opportunity to break a range of vicious cycles of structural problems that are passed from one generation to the next, such as poverty, gender discrimination, violence, poor health and nutrition. Adolescence is a stressful period of life both physiologically and psychologically. The adolescents need greater care in these few years owing to the increased nutritional requirements caused by growth spurt and increased academic burden.

Growth during adolescence is faster than at any other time in an individual’s life except the first year. Good nutrition during adolescence is critical to cover the deficits suffered during childhood and should include nutrients required to meet the demands of physical and cognitive growth and development, provide adequate stores of energy for illnesses and pregnancy, and prevent adult onset of nutrition-related diseases. The hormones mediating the pubertal growth spurt are sex steroids and growth hormone, which are modulated to a great extent by nutritional factors. All these changes create special nutrition needs. The requirement of some of the nutrients is as high as, or higher in adolescents than in any other age groups and therefore many micronutrients, including Vitamin A, Thiamine, Riboflavin, Niacin, Folic acid, Vitamin B 12, Vitamin C, and Iodine and reach levels required by adolescents (WHO, 2000).

Adolescent period is considered as a nutritionally critical period of life for several reasons; Firstly, the dramatic increase in physical growth and development puts greater pressure on the need for nutrients. During this period, children will experience a weight gain equivalent to 65 percent of their weight at the beginning of the period or 40 percent of their final weight, and a height gain equivalent to 15 percent of their adult height (Brasel, 1982). Secondly, there may be socio-cultural factors or change of lifestyle and food habits of children that can affect both nutrient intake and needs (Spear, 1996). Thirdly, growing children have increased nutrient requirements (Scholl et al 1994, Story et al 1995). Fourthly, school age can be the second opportunity to catch up growth if
environmental conditions, especially in terms of nutrient intake are favorable (Gopalan, 1989). Finally, psychological changes and development of their own personality can impact on their dietary habits during a phase when they are very influenceable (Brasel, 1982).

Nutritional needs during adolescent period are increased because of the increased growth rate and changes in body composition associated with puberty. The dramatic increase in energy and nutrient requirements coincides with other factors that may affect adolescent’s food choices and nutrient intake and thus nutrition status. There are many body changes which results due to the influence of hormones. Greatest nutrients need for boys is between 12-15 years and for girls is 10-13 years. They attain their adult stature between 18-20 years but bone mass continues to increase up to age of 25 years. With profound growth of adolescence there is increased demands for energy, protein, mineral and vitamins (Srilakshmi, 2002).

Growth during adolescence is faster than at any other time in an individual’s life except for the first year (FAO, 2001; Brasel, 1982). Due to the high velocity of growth, adolescents have some of the highest energy and protein requirements of any age group (Woodruff and Duffield, 2000). Similarly, micronutrient requirements are increased particularly for iron, calcium, zinc and vitamin D (WHO and FAO, 2004), which leaves adolescents vulnerable to deficiencies (Arimond et al., 2011). According to UNFPA (2013a), adolescents are a nutritionally vulnerable group for a number of specific reasons, including their high requirements for growth, their eating patterns and lifestyles, their risk-taking behaviours and their susceptibility to environmental influences. Inadequate nutrition in adolescence can potentially retard growth and sexual maturation, although these are likely consequences of chronic malnutrition in early infancy and childhood. It can affect adolescents’ current health and put them at high risk of chronic disease as well, particularly if combined with other adverse lifestyle patterns, even if the detrimental effects may take long to show.
According to Chen (1979) and Sendrowitz (1995), Adolescent’s growth and development is closely linked to the diet they receive during childhood and adolescence. Adequate nutrition of any individual is determined by two factors. The first is the adequate availability of food in terms of quantity as well as quality which depends on socio-economic status, food practices, cultural traditions and allocation of the food. The second factor is the ability to digest, absorb and utilize the food in the body. Cultural factor play a stronger role than socio-economic conditions in determining allocations of food and nutritional adequacy. Even where food resources are adequate, the mean caloric intake of individual family members can fall below requirements.

Adolescence is a key time from a nutritional standpoint. For many adolescents both boys and girls the lack of adequate quality and quantity of food is a prime cause of nutrition problems. Chronic undernutrition that causes stunting among young people delays growth and physical maturation, increases risk to pregnant mothers and their newborns, and decreases the capacity to work. Folate and iron deficiency are of particular concern in adolescence, along with other micronutrient deficiencies (Piwoz and Greble, 2000). On the other end of the spectrum, in developing countries, over nutrition and obesity in adolescents is on the rise as a result of changes in diet and physical activity. Many harmful eating habits begin in adolescence and can lead to diet-related chronic illness later in life.

Singh (1999) revealed that health problems of adolescents are very different from those of younger children and older adults. Due to lack of accurate information and in the absence of proper guidance, adolescents are prone to various behavioral and nutritional health problems. Adolescent health issues can be further complicated by factors associated with rapid social and economic development, increased urbanization, the widening gap between rich and poor, youth unemployment and rural poverty put adolescents at greater risk for sexually transmitted infections, pregnancy, malnutrition and over nutrition, and substance abuse.
According to Manford and Picciano (2000), in India, poor nutrition, early bearing and reproductive health complications compound the difficulties of physical development in adolescents. During adolescence, nutritional problems originating earlier in life can potentially be corrected in addition to addressing new ones. Thus it is regarded as a timely period to shape and consolidate healthy eating and lifestyle behaviors, thereby preventing or postponing the onset of nutrition related chronic diseases in adulthood.

National nutrition monitoring bureau (NNMB, 2002), Socio-cultural factors, peer influences, craze for trendy foods; mood; body image; and extreme changes in the lifestyle, and food habits of adolescents in recent past have affected both their nutrient intake and needs.

Nutritional status is now recognized to be a prime indicator of the health of individuals. The World Health Organization stated that the ultimate objective of nutritional assessments is the improvement of human health. Adolescence is extremely important period of life cycle which is a transition time between childhood and adulthood. During adolescent human are body demands for more nutrients to cope with rapid growth. In case of girls adolescent period nutrition is very much important as they are the future mother. A well-nourished mother after adolescent period can give birth of a healthy baby. Nutrition during adolescent can improve the nutritional status of the community. Adolescence is a right period of intervention for the future mothers (PHGAN, 2003; Kurz KM, 1996).

FACTORS INFLUENCING ADOLESCENT MALNUTRITION

Malnutrition is associated with multiple risk factors operating at different levels, from the individual level to household and community levels. At the individual level, malnutrition is caused independently or jointly by inadequate dietary intake and illnesses (Psaki S, et al., 2012). At the community level, malnutrition may be associated with the unavailability and lack of access to nutritious food (Arimond M and Ruel MT, 2004), poor hygiene and sanitation (Merchant A, et al., 2003), and insufficient health care
(Macassa G, et al., 2012). While individual nutritional status may be influenced by the interaction between food consumption and the overall state of health, the physical environment also plays a significant role in regulating access to resources and opportunities for individuals. Studies have shown that poor nutritional status is prevalent in individuals of low socioeconomic status, and those at risk are clustered in dry, underdeveloped regions and within communities with poor environmental status (Macassa G, et al., 2012; Nikoi E and Anthamatten P, 2012).

Other studies have shown that nutritional challenges are more likely to occur in families with the least resources, especially low access to food (Cordeiro L et al., 2012), cash income (Masibo PK and Makoka D, 2012), potable water (Psaki S, et al. 2012), sanitation facilities (Mickey C, 2003), and health care services (Smith L, et al. 2005). These findings raise concerns for adolescents in developing countries where malnutrition in this age group is a significant but often overlooked problem (Delisle H, 2005).

**Environmental Factors:** Based on available information, it may be asserted that approximately half of all nutritional problems occur in rural homes located in areas that are exposed to environmental risks. The highest levels of malnutrition and infant mortality are found in countries where agriculture is often affected by natural disasters. Frequent hurricanes, droughts, earthquakes and frosts create “direct” risks that obstruct access to foodstuffs, as well as “indirect” risks brought about by the economic and social problems caused by these events. In addition, malnourished children often live in homes without potable water and basic sanitation. This increases the risk of contracting infectious illnesses, mainly parasite-borne and diarrheal diseases, creating a vicious circle in which environmental factors lead to the development of malnutrition. In the Andean countries, for example, the prevalence of undernutrition in homes with water from unsafe sources (rivers, lakes or wells) is 11-15 percent, approximately twice as high as in homes with access to “tap water” (6%).

**Social, Cultural and Economic Factors:** undernutrition is closely related to extreme poverty. However, they both present specific characteristics and cannot be dealt with as a
single phenomenon. The numerous poverty-related factors leading to undernutrition include the following: Low incomes limit access to food in terms of quantity, quality or both. The lack of access to land limits access to credit and other resources, with repercussions on income. Replacing traditional crops with more profitable cash crops tends to increase nutritional vulnerability and reduce access to food when prices drop, or in times of economic crisis. Low levels of parental education – especially in mothers and lack of knowledge on reproductive health, nutrition and child development have a negative impact on nutrition. For example, the prevalence of undernutrition is 30%-40% lower among children whose mothers completed primary education. The lack of access to and deficient quality of primary health care services and specific health and nutrition interventions are another major obstacle. The situation of indigenous peoples, characterized by extreme poverty, discrimination and geographic isolation is closely linked to the high prevalence of undernutrition among indigenous children. In countries with large indigenous populations, undernutrition is up to 140 percent higher among children from indigenous homes. The loss of social capital and the dismantling of support networks for the poorest people, as a consequence of migratory processes and social conflicts, limit the collective response capacity to natural or economic disasters, which obstruct access to food.

**Age at Menarche**

In undernourished populations, growth rate during adolescence is slower (Eveleth and Tanner, 1990). Using maximum growth spurt or menarche as an indicator, maturation may be delayed in malnourished girls by an average of two years (Dreizen, et al., 1967). There are differences according to socioeconomic level, and there may also be ethnic differences that are not fully accounted for by environmental conditions. For instance, in Guatemala, median age at menarche is significantly higher in Indian adolescents living in rural areas than in non-Indians; lowest age is among the urban, non-Indian Guatemalans. Age at menarche is also inversely associated with weight, arm circumference, height, and BMI (Delgado and Hurtado, 1990). In Nigeria, it was found that schoolgirls from the upper socioeconomic class reached menarche 11 months earlier than the lower
socioeconomic counterparts (Abioye K. et al., 1997). In India, it was observed that peak weight and height velocities were delayed by 18 months for children who were stunted at 10 years of age (Kanade, 1994).

**Early Marriage**

Early marriage is a common occurrence in many low- and middle-income countries, but particularly in India. Over one-third of women aged 20-24 in developing countries were married or in a union before the age of 18 (Cappa et al., 2012) and an estimated 10 million adolescent marriages each year (Partnership for MNCH, 2012). One in three girls in developing countries are married before the age of 18 and a startling one in nine before the age of 15 (UNFPA, 2012). About 16 million adolescent girls give birth each year, roughly 11 percent of all births worldwide, with almost 95 percent of these births occurring in low- and middle-income countries (WHO, 2014a). The average age of marriage for women has a significant effect on the teenage birth rate. In rural areas of some countries of this Region, tradition is strongly in favour of early marriage for females. Often, the stress is on marriage soon after the onset of menstruation. About 60 percent of marriages in Nepal involve adolescent brides (UNFPA, 1998). Majority of women marry as adolescents in Bangladesh, India and Nepal. Large surveys have found that almost half of all women aged 20-24 are married by the age of 15 in Bangladesh, as are nearly one-fourth in India (24%) and one-fifth (19%) in Nepal.

**Adolescent Pregnancy**

As per WHO statistic (http://www.who.int/mediacentre/factsheets/fs364/en/), About 16 million girls aged 15 to 19 and 1 million girls under 15 give birth every year most in low- and middle-income countries. Complications during pregnancy and childbirth are the second cause of death for 15-19 year-old girls globally. Every year, 3 million girls aged 15 to 19 undergo unsafe abortions. Babies born to adolescent mothers face a substantially higher risk of dying than those born to women aged 20 to 24. Teenage
mothers bear a double (physiological) burden: one involving their own growth and development, and another involving the intra-uterine growth and development of their offspring. Teenage mothers in India, on the other hand, carry a triple burden the added (pathological) burden of their under-nutrition and underdevelopment with its inevitable mutually aggravating effect on the other two burdens (Gopalan, 1989).

Short stature is often associated with small pelvises in women, and this is an important risk factor for obstructed labour. The risk rises sharply when the stature is below 1.45 m, which is the case of 16-18 percent of women in Asia, 11-15 percent of women in Latin America and 3 percent in Africa (ACC/SCN, 1992a). So maternal stunting is a factor of increased obstetric risk, and it can be attributed to chronic malnutrition, at least in part. In addition, delayed growth and maturation in girls as a result of malnutrition further increases the risks associated with adolescent pregnancy, as biological age lags behind chronological age. Prematurity, short maternal stature, infections, cigarette smoking, alcohol and drug use, very young maternal age, indoor air pollution, domestic violence, closely spaced pregnancies, hypertension, stress, and malaria are all important predictors for the intergenerational effect of undernutrition (ACC/SCN, 2000).

Eating Patterns

Adolescent eating is conceptualized as a function of individual and environmental influences. Four levels of influence are described: Individual or intrapersonal (psychosocial, biological); social environmental or interpersonal (e.g., family and peer); physical environmental or community settings (e.g., schools, fast food outlets) and macro system or societal (e.g., mass media, marketing and advertising, social and cultural norms). The search for identity, the struggle for independence and acceptance, and concern about appearance, tend to have a great impact on lifestyle, eating patterns and food intake among adolescents). The meal pattern of adolescents becomes more disorganized, and they tend to miss their meals at home as they get older, often skipping breakfast. Some dietary patterns like snacking, usually on energy dense foods, wide use of fast foods that are low in iron, calcium, riboflavin, vitamin A, folic acid and fibers, low
consumption of fruits and vegetables and faulty dieting are more common among the adolescents of industrialized countries (Dennison et al., 1995, Spear, 2000). In developing countries also, particularly in cities, some of these patterns are also common, and yet very little has been documented. A study in Nepalese schoolchildren showed that fast foods (ready to eat snacks, chips etc) were preferred by more than two-third of adolescents. Advertising, probably TV and magazines, influenced preferences in 80 percent of these Nepalese adolescents (Sharma, 1998).

**Gender Inequality**

It is plausible that parents allocate food and other resources differently depending on whether the child is a boy or a girl. Studies on gender discrimination in relation to nutrition have primarily focused on children, and there is more evidence of such discrimination against girls in Asia than in Africa (Walker, 1997). Adolescent girls and women may be at a disadvantage with respect to household food distribution, as observed, in Nepal (Gittelsohn, 1991). It was observed that in poor households, adolescent boys and girls make major contributions to their family’s welfare, and that they work about equal amounts of time in a combination of household chores, farm work, and wage employment. But girls put an extra 12 hours per week in school. Surprisingly, it is not gender, but the demand for education by the adolescents themselves that is the key factor influencing the amount of education they receive, and girls are keener than boys. Boys spend relatively more time in farm work and relatively less in household chores. The study finds no inequality associated with gender in the households surveyed. Both boys and girls in these poor families do hard work, have inadequate diets, particularly in nutrients provided by nonstable foods, receive poor medical care, and their education is cut short because of insufficient resources. Even though there is no gender inequality, girl adolescents may be more affected by dietary inadequacies than boys, particularly in iron, and the author advocates iron supplementation as a short-term solution, for only large increments in household income could allow a higher intake of non-staples to meet iron requirements.
Skipping Meals and Snacking

With his/her often-busy schedule, an adolescent may rush off to school without eating breakfast. In the evening rather than waiting for dinner he may grab or snack so he can spend the evening with friends. Consequently he eats fewer meals at home where parents can provide him with nutritious foods. When away from home an adolescent often eats meals that are readily available, inexpensive and acceptable to his peer groups. This may mean snacks in the form of ‘fast foods’. Fast foods and ready to eat foods obtained from vending machines or from the grocery store are frequently referred as junk foods. To most people junk food means food that is very salty, sugary or has a high fat content e.g. chips and candy bars. However, other foods sometimes classified as ‘junk’ such as pizza, hamburgers and french-fries do supply needed nutrients. In fact some studies have shown that adolescent often obtain many of the nutrients they need from the ‘fast’ food they consume. Eating low nutrient density food in moderation does not pose a serious threat to the nutritional status of an adolescent whose basic food habits are nutritionally sound. However, when carried to extremes, as when practiced by the adolescent who does not and or has not have good food habits, these practices may compromise growth and maintenance of body functions. Looking at the adolescent, intake of specific nutrients as well as comparing his food intake to the basic food gives an indication of the diets adequacy. Nutrients to be checked include iron, Vitamin A, C, B1, B2 and calcium. Parents can encourage open discussion on nutrition and food habits and make constructive suggestion rather than criticize ways to promote sound eating habits including setting a good example keeping nourishing ready to eat foods or involving a teen in meal planning and making nutrition information available. The adolescent needs the opportunity to apply nutrition knowledge himself. He is more likely to respond positively when allowed to make his own decisions than when told what to do (Adamson, 1996; Drummond, 1996; Gregary, 2000).
Food Faddism

Food fads are usually short-term crazes but in some cases may become permanent ways of eating.

Slimming Regimens

Adolescents are tempted to buy various slimming aids and gimmicks. Apart from being very expensive many of these are undesired in nutritional terms and are of no help in achieving long-term weight loss.

Athletic Training

Many teenagers involved in extensive training schedule adopt bazaar eating patterns. Eating times are limited and there are temptations to use products like expensive and in appropriate foods (Starz, 1983).

Mass Media

Seeing advertisements of food on mass media is tempting adolescents. Besides being high calorie they are not substitute for homemade foods.

Food Allergens

Most adolescents are allergic towards some protein and nutrient foods, so they get deficiencies in the long run.
REVIEW OF LITERATURE

Review of related literature implies, locating, studying and evaluating reports of relevant researches, published articles, related portions of encyclopedia and research abstracts. For any worthwhile study in field of knowledge the research worker needs an adequate familiarity with the work that has already been done in the area of his chosen field. Review of related literature is an important research effort as it provides comprehensive understanding of what is already known about the topic. The main function of citing review of literature is to provide a basis for developing a frame work. Familiarity with research work of others provide up-to-date knowledge of the latest developments, findings, recommendations, tools and loop holes of already done works. It helps to avoid duplication of what has already been done, and provides useful directions and helpful suggestions for research work. Thus, an attempt has been made in this chapter to review the studies related to this investigation. Review of Literature is integral part of entire research process and makes valuable contribution to every operational step. An in depth review of literature helps and guides the researcher to select a methodology that is capable of providing valid answer to your research questions. According to Polit & Hungler (1995), “The task of reviewing literature involves identification, selection, critical analysis and reporting of existing information on the topic. It helps information or clarification of research problem and acquaints the researcher with what has been done in the field”. This chapter contains the review of existing literature on the topic of stated.

Good nutrition is thus essential to good health throughout life, beginning with prenatal life and extending through old age. A lifetime of good nutrition is evidenced by a well-developed body, the ideal weight for body composition and height and good muscle development (Staci, 2005). Bamji et al, (2003) opine that nutrition during adolescence is of paramount importance because it is a foundation of life time health, strength and intellectual vitality.

Adolescent’s growth and development is closely linked to the diet they receive during childhood and adolescence. Adequate nutrition of any individual is determined by two
The first is the adequate availability of food in terms of quantity as well as quality which depends on socio-economic status, food practices, cultural traditions and allocation of the food. The second factor is the ability to digest, absorb and utilize the food in the body. Cultural factor play a stronger role than socio-economic conditions in determining allocations of food and nutritional adequacy (Sendrowitz, 1995). Even where food resources are adequate, the mean caloric intake of individual family members can fall below requirements. Similarly the study found that burden of diseases, poor knowledge about long term consequences of under-nutrition of adolescents, quantity and quality of food, access of health and nutritional services (Kamble R.M., 2003). Izharul Hasan et al (2013) found in his study that socioeconomic status was one of the important factors for nutritional deficiency among children.

Studies in India have shown deficiencies in the intake of all nutrients, particularly iron, calcium, vitamin A and vitamin C. The reported reasons are mainly the low educational level of parents and low family income. The nutritional deprivation affects almost all growth parameters and final adult body size resulting in thinness and stunting. However, nutritional status of both boys and girls improved with age, showing that the effect of malnutrition is more pronounced at the time of peak growth. The prevalence of protein energy malnutrition (PEM) is high in most countries of the SEA region (FAO, 2005). In developing countries, factors associated with undernutrition of adolescents such as poor household economic condition, periodic food-shortage, child labour burden of disease, poor knowledge about long-term consequences of undernutrition of adolescents, quantity and quality of food, and access to health and nutrition services (Kurz K.M et al., 1998). Some of the studies in Bangladesh shown that, low family income, education, and periodic food-shortage were associated with inadequate dietary intake which might have led to undernutrition (Abdullah M, Wheeler E.F, 1985; Ahmed F, 2000; Helen Keller, 1999).

The State of Food Insecurity in the World 2012 (SOFI) show that an estimated 870 million people, or 12.5 percent of the world’s population, were undernourished in 2010-
2012. Of these people, 852 million were reported to be citizens of developing countries. Between 2005 and 2011, one of four African countries reported a stunting rate of at least 40 percent, which is considered very high prevalence by the World Health Organization. Countries with high stunting rates are concentrated mainly in Middle and South eastern Africa and the Horn of Africa, but pockets are also found in parts of Western Africa. Over the 2005-2011 period, stunting rates also exceeded 40 percent in South and South East Asia, with peaks in Timor-Leste, Nepal, India and Lao People’s Democratic Republic (FAO, 2013).

The global number of child deaths under the age of five, recorded in 2006 by UNICEF, WHO, United Nations Population Division (UNPD) and United Nations Statistics Division (UNSD) (UNICEF, 2007a), was just below 10 million, which is a 60 percent decrease since the 1960s. During 2007, UNICEF recorded 9.2 million child deaths under the age of five, globally. Child mortality and poverty are linked with one third of child deaths caused by malnutrition (UNICEF, 2009). Globally, per region, 4.8 million child deaths were recorded in Sub-Saharan Africa; 900 000 in East Asia and the Pacific; 3.1 million in South Asia; 400 000 thousand in the Middle East and North Africa; and 300 000 in Latin America and the Caribbean. According to the United Nations Children’s Fund (UNICEF, 2007b), 26 000 children die daily from preventable causes.

Pongou et al., (2006) studied the association between household and community level socioeconomic status (SES), environmental factors, and the nutritional status of children in Cameroon. They found a positive association between nutritional status, improved SES, and the area of residence. In the study, low weight-for-age z-scores were observed among children residing in communities with dry climatic conditions, limited food crops, low socioeconomic status, poor water and sanitation facilities, and limited access to healthcare. Overall, these studies suggest that the characteristic of the environment in which an individual lives has the potential to mediate the individual- and household level influences on health.
Srilakshmi (2004) emphasizes that proper nutrition at the growing stages of life not only helps to promote health but also prevent the occurrence of deficiency diseases and other health hazards. Ingesting too much or too little of a nutrient can interfere with health and wellbeing. Thus, malnutrition occurs when body cells receive too much or too little of one or more nutrients. Malnutrition includes undernutrition, which may be related to an individual’s inability to obtain foods that contain essential nutrients, failure to consume essential nutrients, body’s inability to use the nutrients, disease condition that increase the body’s need for nutrients and a disease process that causes nutrients to be excreted too rapidly from the body.

The number of calories an adolescent need to consume is dependent on body size, the growth rate, gender and activity level. The average 14-18 years old female needs between 1,800 and 2,400 calories a day to meet her needs for growth and activity. As activity levels increase, the number of calories needed should also be adjusted (Chapman P et al., 1997).

The literature pertaining to the study on the “Prevalence of Malnutrition among Adolescents: A caste study of Raichur district Karnataka State”, is presented under the following heads:

- Poverty and Nutritional Status
- Employment status of Parent
- Place of Residence
- Women’s Education
- Educational Achievement and Nutritional Status
- Availability of Potable water and Toilet Facility
- Gender and Nutritional Status
- Stages of Adolescents and Nutritional Status
- Birth Order and Nutritional Status
- Family Structure and Nutritional Status
- Type of House and Nutritional Status
- Caste and Nutritional Status
- Religion and Nutritional Status
- Awareness and Knowledge about Nutrition
Poverty and Malnutrition

It is widely held belief that poverty is one of the pertinent causes of Malnutrition. Following research study proved and substantiates the common belief. Reducing undernutrition and micronutrient malnutrition directly reduces poverty, in the broad definition that includes human development and human capital formation. But undernutrition is also strongly linked to income poverty. The prevalence of malnutrition is often two or three times sometimes many times higher among the poorest income quintile than among the highest quintile. This means that improving nutrition is a proper strategy, disproportionately increasing the income-earning potential of the poor. Malnutrition slows economic growth and perpetuates poverty through three routes direct losses in productivity from poor physical status; indirect losses from poor cognitive function and deficits in schooling; and losses owing to increased health care costs. Malnutrition of economic costs are substantial: productivity losses to individuals are estimated at more than 10 percent of lifetime earnings, and gross domestic product as much-or more-of an issue of economics as one of welfare, social protection, and human rights (World Bank, 2006).

The United Nations Standing Committee on Nutrition (UN-SCN) asserts that hunger poses the gravest single threat to the world’s public health (The Economist, 2008). According to Jean Ziegler, former United Nations (UN) Special Rapporteur on the Right to Food, the number of people suffering from hunger has increased every year since 1996: “Every five seconds, a child under 10 dies from hunger and malnutrition-related diseases” (Ziegler, 2008). At the November 2009 World Summit on Food Security, UN Secretary General Ban Ki-moon stated, “…more than 1 billion people are hungry; six million children die of hunger every year - 17,000 every day” (Ban Ki-moon, 2009).

The World Bank estimates that India is one of the highest ranking countries in the world for the number of children suffering from malnutrition. The prevalence of underweight children in India is among the highest in the world, and is nearly double that of Sub Saharan Africa with dire consequences for mobility, mortality, productivity and

Children in low-income families are more malnourished than those in high-income families. Whether children are of the appropriate weight and height is highly dependent on the socio-economic status of the population (HUNGAMA, 2012). Children of families with lower socio-economic standing are faced with sub-optimal growth. While children in similar communities have shown to share similar levels of nutrition, child nutrition is also differential from family to family depending on the mother's characteristic, household ethnicity and place of residence. It is expected that with improvements in socio-economic welfare, child nutrition will also improve (Kanjilal B et al., 2010).

Malnutrition in children is the consequence of much food insecurity, which stems from poor food quality and quantity, severe repeated infections or combinations of all three. These conditions are linked to the standard of living and whether basic needs can be met (UNICEF, 2007a; WHO, 2001a). The extent of hunger has also been associated with low energy intake, low micronutrient intake and poor income levels. This affects growth patterns negatively (Labadarios, 2005). Malnutrition can cause physical, cognitive and psychological impairment, which over time causes permanent learning disabilities (Pelletier et al., 1995).

The economic status of a household is an indicator of access to adequate food supplies, use of health services, availability of improved water sources, and sanitation facilities, which are prime determinants of child nutritional status (UNICEF, 1990).

As argued by Deaton and Dreze (2008) it is difficult to find a tight link between calorie intake and nutrition or health status in India: states like Orissa and Bihar have higher calorie consumption than states like Kerala and Tamil Nadu but also higher malnutrition
due to the absence of proteins in their diet. Thus, these food intake estimates are often supplemented with anthropometric measures of the body mass and weight which are strongly correlated to ‘hunger’ or systematic under-nutrition. The relationships between socioeconomic status (SES) of individuals and their health are well documented in the international epidemiological, economic and sociological literature and from a variety of perspectives (Coted; Jean-Christophe Fotso et al., 2005).

There is consistent evidence that the socioeconomically better-off individuals do better on most measures of health status including mortality, morbidity, malnutrition and health care utilization. This Poor environmental factors and low socio-economic status and inadequate nutrition of the child are responsible for low anthropometric measurements than the standards (Shashi Singh and Indira Bishnoi, 2005).

Study conducted in Ethiopia by Getaneh et al (1998) of children living in Jimma town was randomly selected and assessed their nutritional status. Risk factors for protein-energy malnutrition were also studied. About half (48%) of the children were found to be malnourished. The prevalence of underweight, wasting and stunting were 36 percent, 9 percent and 36 percent, respectively, it may be due to poor economic condition of the households. Researcher suggests that, Intervention measures should take the multifactorial causation of malnutrition into consideration.

A study conducted in Mumbai by Sanjay Rode (2015), among adolescents age group 13-19 years, covering 767 samples in eight slums in Mumbai Metropolitan Region Maharashtra India found that, the BMI of adolescent is positively correlated with per capita daily income in slums. It shows that at low per capita daily income (Rs.0-50), the body mass index is very low. As the per capita daily income increases from Rs. 50 to 100, the BMI of the adolescent also increases. As the per capita daily income increase from the Rs.200 to 250, the malnourishment among adolescent declines fast. Therefore Rs. 200 per capita daily income is must to overcome with the adolescent malnutrition in slums of region.
Bhattacharyya H. et al (2013) in her study conducted in urban slums of Dibrugarh Assam. The study population comprised of adolescent girls in the age group of 10-19 years. The data was collected using pre-tested and pre-designed proforma. It was found in the study that, prevalence of stunting (36%) thinness (27%) was highest in socio-economic class IV. It was concluded by researcher that, health and nutrition education especially of the mothers can play a vital role in improving the nutritional status of the adolescent girls.

Deshmukh PR et al (2006) conducted study with main objective was to assess nutritional status of adolescents in rural area of Wardha. The cross-sectional 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 with CDC 2000 reference. Overall result shows that, 53.8 percent of the adolescents were thin, 44 percent were normal and 2.2 percent were overweight. The mean body mass index (BMI) for boys and girls was 16.9 and 15.5 respectively. The significantly higher prevalence of thinness among adolescents from lower family income group (63.2 percent with <5th percentiles) was observed.

A community based, cross-sectional study was conducted by Das and Biswas (2005) during June to December 1999 in Amdanga block of North 24 Pargana district, West Bengal. Sample of 143 adolescent girls (10-19 years) were selected through multistage sampling procedure. Data was collected by interviewing the adolescent girls and their parent. 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 percent and 37.8 percent respectively. There was no significant association (p>0.05) of thinness or stunting with per capita monthly family income of parents.
Anaemia is still one of India’s major public health problems, especially among adolescent girls. Study conducted by Premanand Bharati et al., (2009) to investigate the severity and distribution of anaemia among adolescent girls aged 10-19 years and its association with socioeconomic and sociodemographic factors. The study used data from the District Level Household Survey, round II, 2002-04, conducted under the Reproductive and Child Health Project. Data were collected on haemoglobin along with socioeconomic and sociodemographic factors of the households. The survey covered rural and urban areas of 35 states or union territories. Data from 177,670 adolescent girls were analysed. The results shown that, highest prevalence rates were observed among older girls (15-19 years), those belong to low and medium standard of living (SLI) families with more anaemic (89.1% and 89.6%) respectively.

The study by Parasuraman et al., (2009), using data from the National Family health Survey round-III data (NFHS-III, 2005-06) conducted under the Reproductive and Child Health Project. Data were collected on haemoglobin along with socioeconomic and sociodemographic factors of the households. The survey covered rural and urban areas of 34 states or union territories. Data of adolescent girls were analysed. The results shows that, Poverty is important factor in poor nutritional status and Anaemia 22 percent of young women and 18 percent of young men belonging to the poorest households, compared to 13 percent and 6 percent from the richest households were found to be anaemic.

The study by Venkaiah K, et al (2002) concentrated on the current diet and nutritional status of rural adolescents in India using data of National Nutrition Monitoring Bureau (NNMB) of nine states and cross-sectional study with household as the unit of randomization by. In each State, 120 villages were selected from eight districts. From each of the selected villages, 20 households were selected from five clusters. The information on socio-demographic profile was collected in all the 20 HHs, while anthropometric data such as weight, height and clinical signs of nutritional deficiency was collected on all the available adolescents in the selected households. Anthropometric information on 12124 adolescent boys and girls were collected. The prevalence of
underweight (49.7%) and stunting (42.9%) was significantly higher among children belonging to lower per capita income families.

A cross sectional community based study was conducted among 272 adolescent girls in an urban slum area under Urban Health Training centre, department of Community Medicine, NKP Salve Institute of Medical science, Nagpur of Maharashtra state from June 2009 to February 2010. Out of five areas one area was selected by simple random sampling. Information regarding socio-demographic and menstrual factors was recorded in pre-designed, pre -tested proforma. Haemoglobin estimation was done by Sahli’s haemoglobinometer. Study found that, prevalence of anaemia was found to be very high (90.1%) among adolescent girls. Majority of the girls were having mild or moderate anaemia (88.6%). Significant relationship of Anaemia was observed with low SLI of the family with 86.4 percent were anaemic (Kulkarni M V et al., 2012).

Utilizing the nationwide data of Bangladesh Demographic and Health Survey (BDHS-2004) Hong et al. (2006) found strong significant association between household wealth inequality and chronic undernutrition in Bangladesh. The findings of the study showed that children of poorest household had highest risk of being chronically malnourished than the children of wealthiest households. The unadjusted odds of suffering from growth-stunting are 3.6 times higher among children living in the poorest (lowest wealth index quintile) households than among children in the wealthiest (highest wealth index quintile) households. The odds of suffering from childhood growth-stunting declines consistently as wealth index increases.

Subramanian et al. (2009) conducted cross-sectional analyses in nationally representative samples of 76,514 and 80,054 women aged 15-49 drawn from the 1998-1999 and 2005-2006 Indian National Family Health Survey, respectively. Results suggested a strong positive relationship between socioeconomic status and BMI at both time points and across urban and rural areas.
A cross sectional descriptive study was carried out involving 300 children in the age group 11 to 14 years from urban, semi-urban and rural areas Chennai Tamil Nadu. Study found that, prevalence of underweight children was 84.6 percent among socio-economic status class 4 and 5 and only 54.1 percent among socio-economic status class 1, 2 and 3. It is evident that there is a significant statistical difference in the prevalence of underweight children in Class 4 and 5 as compared to Class 1, 2 and 3 (Caroline Priya et al., 2014).

Studies in India and Bangladesh have shown deficiencies in the intake of all nutrients, particularly iron, calcium, vitamin A and vitamin C. The reported reasons are mainly the low family income. There may be socio-cultural factors or change of lifestyle and food habits of adolescents that can affect both nutrient intake and needs (Spear, 2002; Jeyaseelan L & Lakshman M., 1997).

Alessandra Marini & Michele Gragnolati (2003) in their study conducted in Guatemala found the relationship between child, maternal, household and community characteristics and children's nutritional status. Study shows very large differentials in the prevalence of malnutrition among children of different socioeconomic and geographic groups. Only 16 percent of children in the richest quintile of households are chronically malnourished. The corresponding proportion is 62 percent among children in the poorest quintile.

A cross sectional survey was conducted in selected Anganwadi centres of rural area of Hassan district of Haryana. The study was conducted to estimate the prevalence of anaemia among adolescent girls with sociodemographic factors associated with anaemia. A sample of 314 adolescent’s girls (10-19 years age) was included in the study. The study was conducted from February to April 2011. The study result shows that the prevalence of anaemia was found to be 45.2 percent. A statically significant association was found with iron deficiency anaemia, weight loss and anaemia, pallor and anaemia. In the present study it was also seen that, among 45.2 percent of anaemic adolescent girls 40.1 percent had mild Anaemia, 54.92 percent had moderate anaemia and 4.92 percent had severe
anaemia. The study was concluded that, prevalence of anaemia was higher among adolescents and which was higher in low economic strata (Siddharam S.M et al., 2011).

Food insecurity has been defined as a condition that exists ‘when people do not have adequate physical, social or economic access to food, (FAO, 2010). Food security has major impacts on hunger and undernutrition (Rahman and Karim, 2013). Food and its access and availability are cited as one of the most important long-term factors that could prevent undernutrition. The quantity and nutritional quality of food can determine the intake of energy, protein and vitamins, which affects growth, development and resistance to disease and infection. A lack of nutrients can lead to a vicious cycle of illness and undernutrition (Das and Hossain, 2008; Ahmed and Ahmed, 2009). Studies have looked at the relationship between food prices and undernutrition. As poor households spend a relatively high proportion of income to purchase food, food prices can directly affect the amount and type of food consumed and will subsequently impact nutrient intake. Previous studies have shown that increases in food prices lead to greater levels of stunting among children, decreased maternal micronutrient status, and impaired growth of infants (Gitau, R, et al., 2005).

A study conducted in Cameroon, Africa by Léonie Nzefa Dapi (2010) for both adolescent girls and boys. The aim of this study was to assess dietary intake, anthropometry and physical activity of adolescents according to sex and socioeconomic status (SES) and to investigate food perceptions of adolescents living in urban and rural areas of Cameroon. Girls and boys, 12-16 years of age, were randomly selected from schools in urban and rural areas. Food frequency questionnaire, 24-hour dietary and physical activity recalls, anthropometric measurements, qualitative interviews and a background questionnaire were used for data collection. The prevalence of stunting was two times higher among the urban adolescents with low SES (12%) compared to those with high SES (5%). The rural adolescents had more muscle that the urban adolescents. The rural adolescents ate in order to live and to maintain health. Urban adolescents with low SES ate in order to maintain health, while those with high SES ate for pleasure.
Marinda (2006) argues that there is a strong link between malnutrition and poor health in children and women and poverty interventions should focus on reducing male-female inequalities in society. Family income has an adverse effect on child’s health especially in the early childhood since it is a crucial stage of development, where a deficiency or any health problem that occurs is carried on to adulthood. Children from low income families suffer from worse health with different nutritional deficiencies and metabolic dysfunctions than children from high income families.

It is well accepted that a reduction in income poverty will lead to a reduction in malnutrition (Strauss and Thomas, 1998). Greater incomes at the household level mean that families can invest more in food consumption, access to clean water and good hygiene, and effective health care. They can also afford more effective child care arrangements. At the community level greater income will eventually lead to better access to and better quality of health care centres and water and sanitation systems (Allen and Gillespie, 2001).

Employment Status of Parents

Employment status of parents especially women play a pivotal role in nutritional status of adolescents. Women’s employment status increases household income, with consequent benefit to household nutrition in general and the woman’s nutritional status in particular. Employment may increase women’s status and power, and may bolster a woman’s preference to spend her earnings on health and nutrition. Though employed, women without control over their income and decision making authority within the household are deprived of economic and social power and the ability to take actions that will benefit their own well-being (Kennedy and Haddad, 1991).

Although women’s employment enhances the household's accessibility to income, it may also have negative effects on the nutritional status of children, as it reduces a mother’s time for childcare. Some studies have revealed that mothers of the most malnourished children work outside their home (Popkin, 1980; Abbi et al., 1991).
A cross-sectional study was conducted to assess nutritional status in school-age slum children and analyse factors associated with malnutrition with the help of a pre-designed and pre-tested questionnaire, anthropometric measurements and standard clinical examination procedures were followed in urban slums of Bareilly, Uttar-Pradesh (UP) India. The result shows mean height and weight of boys and girls in the study group was lower than the CDC-2000 standards. One of the strongest predictors of malnutrition in the study was mother’s working status. Children of nonworking mothers have better nutritional status than children of working mothers, possibly due to more time for caring of children. Hence the busy time schedule of working mothers adversely affects the nutritional status of children (Srivastava Anurag et al., 2012). Another study argued that there is no association between maternal employment and children's nutritional status (Leslie, 1988).

A cross-sectional sample survey of 556 adolescent girls (10-18 years) was covered by house-to-house visit in an urban area of Meerut which is the field practice area of Department of Community Medicine, L.L.R.M. Medical College, Meerut Uttar-Pradesh (UP) India. The prevalence of anaemia was found to be maximum 48.1 percent in adolescent girls whose father's worked as laborers while it was 41.8 percent in private service, 27.5 percent in business, 38.4 percent in government service and minimum 17.8 percent in professionals. Fathers who were professionals had least prevalence of anaemia in their adolescent daughters (Singh Rita, 2008).

A cross sectional study conducted by Sunil Pal Singh (2014) among primary schools children in urban slums of Hyderabad (2014) including 384 children age group 6-11 years found that, the prevalence of underweight (35.9%), stunted height (26.0%), were significantly higher in children of unskilled worker fathers than children of skilled worker fathers. The prevalence of underweight (68.7%), stunted height (31.4%), was significantly higher in children of unemployed mothers than children of skilled worker mothers.
To study the current diet and nutritional status of rural adolescents in India using data of National Nutrition Monitoring Bureau (NNMB) of nine states and cross-sectional study with household as the unit of randomization by Venkaiah K, et al (2002). In each State, 120 villages were selected from eight districts. From each of the selected villages, 20 households (HHs) were selected from five clusters. The information on socio-demographic profile was collected in all the 20 HHs, while anthropometric data such as weight, height and clinical signs of nutritional deficiency was collected on all the available adolescents in the selected households. Anthropometric information on 12124 adolescent boys and girls were collected. The prevalence of underweight (47.4%) and stunting (40.3%) was significantly higher among children belonging fathers were engaged in labour work.

Place of Residence

Ruel et al, (1999) argue that the nutritional difference between urban and rural areas is due primarily to a number of phenomena that are unique to or are exacerbated by urban living. Urban areas in relation to rural areas have a unique set of characteristics which are detrimental to child nutrition such as; greater dependence on cash income, the greater exposure to environmental contamination; greater involvement of women in income-generating activities outside the home; smaller family size and weaker social and family networks which may affect the availability of childcare. The beneficial characteristics include; greater availability of food, housing arrangements, health services and greater availability of employment opportunities. In addition, services such as electricity, water, and sanitation are on average more readily available than in rural areas.

India is the largest democracy with consistent economic growth rate since independence. India is also third largest scientific and technological workforce. In agriculture India produces sugar, groundnut, tea, fruits, rice, wheat, vegetables and milk in a large scale. With regard to demographic profile more than 720 million i.e. one third of its population live in rural areas. Despite these developments, there is a wide gap between rural and urban India with respect to technology, living condition, economic empowerment etc.
Many in rural India lack access to education, nutrition, health care, sanitation, land and other assets and they are trapped into poverty. In rural India there is high number of infant mortality with low life expectancy at birth rate. Rural India mostly depends on agricultural sector. The rural populations, who are the prime victims of the policies, work in the most hazardous atmosphere and live in abysmal living conditions.

Unsafe and unhygienic birth practices, unclean water, poor nutrition, subhuman habitats, and degraded and unsanitary environments are challenges to the public health system in rural areas. The majority of the rural population is smallholders, artisans and laborers, with limited resources that they spend chiefly on food and necessities such as clothing and shelter. They have no money left to spend on health. The rural peasant worker, who strives hard under adverse weather conditions to produce food for others, is often the first victim of epidemics (Patil A et al., 2002). In sub-Saharan Africa, regional variations are pronounced for both child malnutrition rates and access to adequate water and sanitation. Rates of child malnutrition tend to be higher in rural areas, while access to improved water and sanitation is much lower in rural areas than in urban areas (UNICEF, 2010).

Using National Family Health Survey-III data by Kanjilal B et al., (2010) found that, undernutrition is more prevalent in rural areas, again mainly due to low socio-economic status. Anaemia for both men and women is only slightly higher in rural areas than in urban areas. 40 percent of women in rural areas, and 36 percent of women in urban areas were found to have mild anaemia. In urban areas, overweight status and obesity are over three times as high as rural areas.

A national cross-sectional household demographic and expenditure survey carried out by the Government of Mozambique from February 1996 to March 1997. Data from 8,274 households were collected to be representative at the level of each of the 10 provinces and the capital, Maputo. Study revealed that, there were differences in rural-urban gap in malnutrition. Urban children generally have better nutritional status than rural children (Garret and Ruel, 1999).
The study was conducted to assess the nutritional status and levels of body mass index (BMI) and to evaluate the geographical distribution of male youths of the Han nationality in China. In total, 60,773 male youths, aged 18-20 years, of the Han nationality, were categorized into underweight, normal-weight, overweight, and obesity according to the international adult BMI cut-offs. Study found that the BMI of adolescents living in rural areas was significantly lower than those living in urban areas (Shang L et al., 2007).

Caroline P et al (2014) in her study among adolescents conducted in Chennai, Tamil Nadu reveals that, 67.3 percent were found to be underweight, of which 29.7 percent were from rural area; 6 percent were found to be overweight or obese, of which 4.7 percent were from urban area. The percentage of under-weight children was 65 percent in semi urban area and 48 percent in urban area in contrast to 89 percent in rural area.

Alessandra Marini & Michele Gragnolati (2003) in their study conducted in Guatemala found the relationship between child, maternal, household and community characteristics and children's nutritional status. Study shows very large differentials in the prevalence of child malnutrition among children of different socioeconomic and geographic groups. The prevalence of stunting is 31 percent and 50 percent in urban and rural areas respectively.

Another study entitled “Prevalence of Anaemia and its Correlation to Body Mass Index: Study among Unmarried Girls conducted in Bhodia, Fatehabad district of Haryana, India by Peter R et al. (2012) among adolescents. Study found that, 83.7 percent of the adolescent girls were anaemic. 40.6 percent girls were underweight in urban areas and 43.2 percent girls were underweight in rural area.

The 2008-09 Kenya Demographic and Health Survey (KDHS), (KNBS and Macro, 2010) Rural children are more likely to be underweight (17%) than urban children (10%). North Eastern province has the highest proportion of moderate and severely underweight children (25 %), while Nairobi province has the lowest proportion (8%). Children living
in rural areas are moderately and severely stunted to a greater extent (37%), when compared with rural children (26%).

A study was carried out in Sudan reveals that, nutritional status of urban school children was found to differ significantly from that of rural school children. The prevalence of underweight was higher for rural girls (59.1%) compared to that of urban girls (39%). The median weight was lower among rural groups in the study population compared to their WHO-NCHS growth standard, while the median weight was better among urban school girls (Soeikerman et al., 2002; Oninla et al., 2007).

The study by Parasuraman, et al., (2009), using data from the National Family health Survey round III data (NFHS-III, 2005-06) conducted under the Reproductive and Child Health Project. Data were collected on haemoglobin along with socioeconomic and sociodemographic factors of the households. The survey covered rural and urban areas of 34 states or union territories. Data of adolescent girls were analysed. The results shown that, Anaemia among young women cuts across place of residence- 18 percent of rural women and 16 percent of urban women are anaemic.

**Women’s Education**

The relationship of nutritional status women’s education in creatures continues to intrigue the researchers. Parents illiteracy particularly mother’s illiteracy will be used as the measure of maternal ability to care well for children. There are at least four reasons for expecting maternal illiteracy to impair the nutritional status of their children. One is that illiterate mothers are in a disadvantaged position to acquire and apply knowledge about appropriate health-care. A second is that uneducated women are likely to be less able to care well for themselves in terms of nutrition and health and therefore less apt to care for their own children. A third is that uneducated women marry earlier and have higher fertility (Abadian, 1996; Smith et al., 2003; Smith et al., 2005a). A fourth reason is, as we will see, that illiterate women abstain from exercising their right to vote in state election more often than their literate peers and this affects the public provision of child health care. Thus, a mother’s literacy level is a better determinant than socioeconomic
status as it affects the type of food prepared, distributed including the type of care received by the girls in a particular family. Parental educational level, in particular the mothers, showed the highest impact on the adolescents’ health related dietary habits since they cook family meal. Majority of the educated mothers are cautious of what the family eats than uneducated mothers (Adamu Abiba et al., 2012).

Education is one of the most important resources that enable parents to provide appropriate care for their children, which is an important determinant of children’s growth and development (Engle and Menon, 1996). Studies in the Philippines (Aguillion et al, 1982), Libya (Popkin and Bisgrove, 1988), Uganda (Statistics Department and Macro International Inc., 1996), and Ethiopia (Yimer, 2000; Genebo et al., 1999) show a decreased incidence of malnutrition among young children with an increase in the level of mothers’ education.

A cross-sectional study was conducted to assess nutritional status in school-age slum children and analyse factors associated with malnutrition with the help of a pre-designed and pre-tested questionnaire, anthropometric measurements and standard clinical examination procedures were followed in urban slums of Bareilly, Uttar-Pradesh (UP) India. The result shows mean height and weight of boys and girls in the study group was lower than the CDC-2000 standards. Regarding nutritional status, the risk of malnutrition was significantly higher among less educated mother (Srivastava Anurag et al., 2012). Alessandra Marini & Michele Gragnolati (2003) in their study conducted in Guatemala found that, mother has no education 56.5 percent and 30.4 percent were stunted and underweight. Mother education was more than primary 22.6 percent were stunted and 10.6 percent were underweight. Similarly, father has no education 58.1 percent were stunted and 31.6 percent were underweight. Father education was more than primary, 23.3 percent were stunted and 7 percent were underweight.

Bhattacharyya H. et al (2013) in her study conducted in urban slums of Dibrugarh Assam. Study population comprised of adolescent girls in the age group of 10-19 years. The data was collected using pre-tested and pre-designed proforma. Study did not find
any association between the nutritional statuses of adolescent girl with the father’s literacy status. However, adolescent girls whose mothers did not have formal education were more likely to be thin (44.3%) and stunted growth (41.8%) as compared to those whose mothers have completed college (31.4% Vs 38.7%) and higher education.

A study conducted in Mumbai by **Sanjay Rode (2015)**, among adolescents age group 13-19 years, covering 767 samples in eight slums in Mumbai Metropolitan Region Maharashtra India found that, 28 percent male and 41 percent female were severely malnourished but both the parents were illiterate. Illiterate parents do not understand the nutrition and its value for good health. 27 percent male were mild malnourished but the parents were primary studied. Half of females were malnourished but the parents were primary studied. 37 percent male and 49 percent female were malnourished but the parents were secondary school studied. All the high school studied parents were severe malnourished adolescent male. All the college studied parents were severe malnourished female.

A community based, cross-sectional study was conducted by **Das and Biswas (2005)** during June to December 1999 in Amdanga block of North 24 Parganas district, West Bengal, India. A sample of 143 adolescent girls (10-19 years), selected through multistage sampling procedure. Data was collected by interviewing the adolescent girls and their parent. 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 percent and 37.8 percent respectively. There was no significant association (p>0.05) of thinness or stunting with literacy status of parents.

**Deshmukh PR et al (2006)** conducted study with main objective was to access the nutritional status of adolescents in rural area of Wardha, Maharashtra. The cross-sectional 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 with CDC 2000 reference. Overall result shows that, 53.8 percent of the adolescents were thin, 44 percent were normal and 2.2 percent were overweight. The mean body mass index (BMI) for boys and girls was 16.9 and 15.5 respectively. Prevalence of thinness was significantly higher in those having education less than 8th standard than those educated at least up to 8th standard. The prevalence of thinness was significantly (p<0.05) higher (60.3%) in those having education less than 8th standard than those educated at least up to the 8th standard (49.6%).

A cross-sectional sample survey of 556 adolescent girls (10-18 years) was covered by house-to-house visit in an urban area of Meerut which is the field practice area of Department of Community Medicine, L.L.R.M. Medical College, Meerut Uttar-Pradesh (UP) India. The prevalence of anaemia was maximum in adolescent girls whose mothers were educated up to primary level (53.6%) and prevalence progressively decreased with an increase in educational status of mother, being minimum, in adolescent girls whose mothers were graduate and above prevalence was 25.2 percent (Rita Singh, 2008).

Researches which reveal the relationship between level of physical development in children and the level of education of their parents can be found in the literature. In Baksi’s study (1982), it has been found that the blood lead levels are higher in children with father education of less than eight years and children with height and weight percentile lower than the tenth percentile. These three variables can be explained with the nutrition of the child. Especially consumption of calcium, zinc, iron and diets poor in protein increases lead absorption. Lack of such nutritive materials may cause acute and chronic nutrition disorders and therefore low height and weight percentiles. Household income is as important as the mother’s education for a balanced diet.

A cross sectional study conducted by Sunil Pal Singh (2014) among primary schools children in urban slums of Hyderabad (2014) including 384 children age group 6-11
years found that, the prevalence of underweight (39.5%), stunted height (58.8%), were higher in children of illiterate fathers than children of literate fathers. This was found statistically significant. The prevalence of underweight (29.6%) stunted height (33.3%), were statistically significantly higher in children of illiterate mothers than children of literate mothers.

A cross-sectional study was conducted to assess nutritional status in school-age slum children and analyse factors associated with malnutrition with the help of a pre-designed and pre-tested questionnaire, anthropometric measurements and standard clinical examination procedures were followed in urban slums of Bareilly, Uttar-Pradesh (UP) India. The result shows mean height and weight of boys and girls in the study group was lower than the CDC-2000 standards. Study found that, risk of malnutrition was significantly higher in children of illiterate mothers (Anurag Srivastava et al., 2012).

Protein energy malnutrition is a major health problem in India and it affects the growth and development of young children. Study investigated the impact of hygiene, housing and sociodemographic variables on acute malnutrition in children aged 5-7, living in urban and rural areas. Ordinal logistic regression analysis showed that the overall prevalence of severe malnutrition was 8.2 percent. Malnutrition is more among uneducated mother (Jeyaseelan L & Lakshman M, 1997).

Verma et al. (2003) conducted a study on school going girls (N-1295) from the slum of Ahmedabad city and found that 81.8 percent of girls were anaemic, out of which, 55.2 percent were mildly anaemic, 0.6 percent were severely anaemic. Prevalence of anaemia was highest whose fathers were working as semi-skilled or skilled workers i.e.77 percent.

Richa et al., (2012) in her study found significant association between prevalence of anaemic in adolescent girls and education qualification of their fathers. Prevalence of anaemia was 72.5 percent in adolescents those fathers were illiterate and 20.7 percent in those fathers were educated beyond high school.
A cross sectional community based study was conducted among 272 adolescent girls in an urban slum area under Urban Health Training centre, department of Community Medicine, NKP Salve Institute of Medical science, Nagpur of Maharashtra state from June 2009 to February 2010. Out of five areas one area was selected by simple random sampling. Information regarding socio-demographic and menstrual factors was recorded in pre-designed, pre-tested proforma. Haemoglobin estimation was done by Sahli’s haemoglobinometer. Study found that, prevalence of anaemia was found to be very high (90.1%) among adolescent girls. Majority of the girls were having mild or moderate anaemia (88.6%). Significant relationship of anaemia was observed with illiterate mother with 89.5 percent were anaemic (Kulkarni M V. et al., 2012).

To study the current diet and nutritional status of rural adolescents in India using data of National Nutrition Monitoring Bureau (NNMB) of nine states and cross-sectional study with household as the unit of randomization by Venkaiah K, et al (2002). In each State, 120 villages were selected from eight districts. From each of the selected villages, 20 households were selected from five clusters. The information on socio-demographic profile was collected in all the 20 HHs, while anthropometric data such as weight, height and clinical signs of nutritional deficiency was collected on all the available adolescents in the selected households. Anthropometric information on 12124 adolescent boys and girls were collected. The prevalence of underweight and stunting was significantly higher among children belonging of illiterate parents (48.3% Vs 40.8%).

A cross-sectional study was carried out in urban slums of Bhubaneswar, Odisha, India, by Ansuman Panigrahi (2014) involving children of age group (13-19 years) during the year 2013-2014. Mother’s education was found to have a strong independent effect on child’s nutrition controlling the effects of other variables. Illiterate mothers and mothers with primary education were about thrice more likely to have wasted children as compared to mothers who had attained higher education (high school and above). It might be due to the reason that higher educated women can take independent decisions and have greater exposure to outside world and thus access to various resources which help them in securing proper nutrition of their children. They are more aware about
proper nutrition, maintenance of hygiene, and various health issues as compared to uneducated or less educated women.

A cross sectional community based study was conducted to estimate prevalence of anaemia among adolescent girls in an urban slum and to study socio-demographic and menstrual factors associated with it. The study was conducted among 272 adolescent girls in an urban slum area under Urban Health Training centre, department of Community Medicine, NKP Salve Institute of Medical science, Nagpur of Maharashtra state India from June 2009 to February 2010. Out of five areas one area was selected by simple random sampling. Information regarding socio-demographic and menstrual factors was recorded in pre-designed, pre-tested proforma. Haemoglobin estimation was done by Sahli’s haemoglobinometer. Data was analysed by mean, standard deviation and chi square test. The study result shows that the prevalence of anaemia was found to be very high (90.1%) among adolescent girls. Majority of the girls were having mild or moderate anaemia (88.6%). A significant association was found between adolescent girl’s education, mother’s occupation and anaemia. No association was found between menstrual factors and anaemia. The study concluded that nutrition education along with nutritional supplementation and iron folic acid tablets should be provided to all girls (Meenal VK, et al., 2012).

Educational Achievement and Nutritional Status

Children are considered the greatest national resource of any country who will build the future of the Nation. Schooling is an instrument of individual and social change, increasing the probabilities of general well-being (UNESCO, 1984). Primary education is a vital stage in the development of the consciousness and personality of the child as it is at this juncture that a whole new world of bright ideas and knowledge open up in front of their eyes. At this stage children are extremely inquisitive and elementary education must encourage this tendency among the children. Nutrition is an endogenous factor that affects the learning ability and skills before and after the child is in school (UNESCO, 1984).
The World Health Organization defines health as a “state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity”. The World Health Organization also states that the diets people eat, in all their cultural variety, define to a large extent people’s health, growth and development (Anurag, 2001).

A study conducted by Haile et al (2016) on Academic achievement of school age children and nutritional status. Study aimed to determine how nutritional status and cognitive function are associated with academic performance of school children in Goba town, South East Ethiopia. An institution based cross-sectional study was conducted among 131 school age students from primary schools in Goba town enrolled during the 2013-2014 academic year. The nutritional status of students was assessed by anthropometric measurement, while the cognitive assessment was measured by the Kaufman Assessment Battery for Children (KABC-II) and Ravens colored progressive matrices (Raven’s CPM) tests. The academic performance of the school children was measured by collecting the preceding semester academic result from the school record. Descriptive statistics, bivariate and multivariable linear regression were used in the statistical analysis. Study found that, there was a statistically significant positive correlation between height for age Z score (HAZ) and mathematics score among school aged children (p=0.026). However, both weight for age Z score (WAZ) and body mass index for age Z score (BAZ) had no statistically significant association with academic performance.

Mukudi, E. (2003) in their study entitled “Nutrition status, education participation, and school achievement among Kenyan middle-school children”, the broad objectives of the study was to intervening effects of nutrition status on school attendance rates among Kenyan middle school pupils. The study also examined the effects of nutrition status on primary school achievement scores for the eighth-grade class of 1997. Data were obtained on 851 pupils enrolled in the five indexed schools. Anthropometric measures included weight for age, height for age, and relative weight for height, and the values were derived from the raw data. Percentage of attendance rates derived from daily school
attendance and raw scores on the Kenya Certificate of Primary Education were the measures of educational participation and achievement. Statistical analysis included descriptive statistics, analyses of variance, correlation, and linear regression analyses. Findings show that, 29 percent of the children fell below the 90 percent cut-off value for acceptable relative weight for height. The percentages of the population falling below -2 SD on indices for height for age and weight for age were 16.6 and 3.8 respectively. Prevalence of nutritional stress is a significant educational problem in this population. Study suggests that, association between attendance rate and nutrition status is a function of socioeconomic status. The predictive effect of nutrition status on educational achievement is more evident for girls with poor socioeconomic status.

Studies examining the relationship between mental development and severe malnutrition concluded that school-age children who suffered from early childhood malnutrition generally have poorer IQ levels, cognitive function, school achievement and greater behavioural problems than matched controls, and to lesser extent siblings (Grantham-McGregor, 1995).

Malnutrition in early stages has been found to have a long term effect on the growth and development of children, particularly on cognitive development. Chronic malnutrition in infancy resulting in stunting, for example has been associated with poor cognitive function reflected in the reduction of 10 points on Wechsler Intelligence Scale (WISC–R) scores (Berkman et al, 2002).

Children are vulnerable to malnutrition from beginning. Pregnant women who are undernourished are more likely to have low birth weight babies who, in turn, are susceptible to developmental delays. These early deficits sustained with post-natal malnutrition often result in diminished cognitive functioning. Malnourished children are also more prone to illness. By the time they reach school-age, they have a much lower potential to learn compared to their well-nourished peers. Deficiency of micronutrients, such as iron, iodine, zinc and vitamin A, in a child’s early years may result in a lower attention span, decreased ability to concentrate and poor memory. Anaemia resulting
from deficiency of iron is known to have a severe impact on the cognitive development of children (Grantham-McGregor, 1995).

Research shows that, the period from pregnancy to 24 months is the most critical period and hence offers a window of opportunity for the delivery of nutrition interventions. If proper nutrition interventions are not delivered to children before the age of 24 months, they could suffer irreversible damage into their adult life and to subsequent generations (The Lancet, 2008).

Another study was to determine the effects of nutritional status on educational performance of the primary school children in the plantation sector in Nuwara Eliya educational zone Srilanka. A cross-sectional study involving 802 Grade-4 children was conducted on a randomly selected 21 plantation schools in Nuwara Eliya zone. By measuring height and weight using standard methods, indicators such as height-for-age, weight-for-age and body mass index-for-age were computed and used to define stunting, underweight and thinness to indicate nutritional status. The educational performance of children was assessed by using end-term examination marks obtained for Tamil and Mathematics subjects and for the overall subject average. The prevalence of stunting, underweight and thinness in the study group was 32 percent, 50 percent and 34 percent, respectively. All indicators were significantly higher in males than in females. The educational performance of females was higher than males, the differences being statistically significant except in Mathematics. The low level of educational performance (marks<40%) in Tamil, Mathematics and overall subject average was significantly higher among the underweight and stunted children than that of the normal children. The height-for-age and weight-for-age Z-scores showed significant positive associations with Tamil, Mathematics and overall subject average marks while BMI-for-age Z-score showed significant positive associations with only Mathematics and overall subject average. It appears that undernutrition in the primary school children of the plantation sector has led to a low level of educational performance, which could affect their quality of life in the long-term (Sarma Gajapathy et al., 2013).
Cueto S. (2005) in their study was conducted in Peru. Present study used cross-sectional and longitudinal analysis to determine the relationship between height-for-age z-scores (HAZ), weight-for-age z-scores (WAZ), body-mass index (BMI), and education outcomes of the children. The sample was composed of students from 20 elementary public schools in two rural zones in Peru. Findings showed a positive association between anthropometric variables (HAZ) and education achievement. It could be because of study was carried out at very poor sites, at altitudes between 3000 and 3500 meters above sea level. The scarce studies about development in high altitudes suggest that the patterns for height and weight for children and adolescents are different than at sea level. Another possible explanation has to do with the fact that in the contexts studied, children who are perceived as relatively heavier (BMI) or taller (HAZ) might be expected to be out of school and start working.

Anaemia has a serious negative impact on growth and development during adolescence, and decreases the ability to concentrate and learn. Iron deficiency was shown to be associated with impaired cognitive processes in adolescents, as suggested by improved performance following supplementation in South-East Asia (Nelson, 1996). Similarly, anaemia was independently associated with lower school achievements in adolescent girls (Walker et al., 1996).

The relationship between nutrition, health and educational achievement of school-age population in less developed countries has been of interest to many researchers due to the frequent observation that many children did not complete primary school and those who completed, did not do as well as children in the developed countries. Nevertheless, nutritional and health status by itself is not the only variable affecting educational achievement, since biological, psychological, socioeconomic and cultural factors could directly or indirectly affect both nutrition, health status and educational achievement. The mechanism by which health and nutrition influence educational achievement is not well established, but poor health and malnutrition in early childhood may affect cognitive abilities, necessary for learning process and consequently educational achievement. A study was conducted in Kuala Lumpur, Malaysia, to investigate the relationship between
nutritional status and educational achievement among primary schoolchildren from low income households (N-399). A high percentage of them were underweight (52%), stunted (47%) and wasted (36%) and increasingly overweight (6%). Educational achievement was measured based on test scores for Malay language (ML), English language (EL) and mathematics (MT). While a majority of the schoolchildren obtained optimum scores (>75) for ML and MT, the majority of them had insufficient scores (<50) for EL. Children's total score (TS) for the three subjects was significantly associated with household socioeconomic status, gender, birth order and height-for-age. Even after controlling for household socioeconomic status, significant association between TS and height-for-age persisted. In this sample of schoolchildren, household income, gender, birth order and height-for-age were significant predictors of TS. The finding which have reported that height-for-age, compared to weight-for-height or weight-for-age is linked to educational achievement. Height-for-age reflects the accumulation of nutritional deprivation throughout the years, which may consequently affect the cognitive development of the children (Shariff ZM et al., 2000).

A Ugandan study (Acham et al., 2008) reported that all nutritional indicators (HAZ, WAZ and BMIZ) had significant associations with learning achievement of children. Associations were positive particularly for Mathematics and English, but negative for life skills and oral comprehension. In China, children with lower height-for-age were consistently far behind in their expected school grade (Jamison, 1986). In a Sri Lankan study of Grade-4 children, Aturupane et al. (2006) reported that height-for-age has a sizeable impact of examination scores, which was also consistent with results from Pakistan (Alderman et al., 2001) and the Philippines (Glewwe et al., 2001).

**Availability of Potable Water and Toilet Facility**
Sanitation is very important for the health of villagers. Health is very comprehensive subject and every precaution should be taken in this direction. In the last sixty years, many studies have shown this fact that villager don’t follow sanitation guidelines and village infrastructure is not proper also. Children do face dangerous consequences due to not following sanitation guidelines. Many diseases are prevalent in rural conditions due
to unhygienic practices of villagers. The year 2014 was an exciting time for nutrition research and policy action related to water, sanitation, and hygiene, or WASH. In terms of research, during the past year, a wide range of studies began to converge on evidence that WASH can be critical in shaping key nutrition outcomes, such as child height, one of the most important measures of a population’s well-being. The evidence regarding the nutritional consequences of sanitation was particularly strong. In 2014, the issue of sanitation and nutrition also moved to the front of the development policy agenda. Sanitation now seems to be a global priority: ending open defecation is near the top of the world’s post-2015 goals for sustainable development. This is particularly true for India—a country where half of all children are stunted and a country home to half of the world’s population of the one billion people worldwide who, according to UNICEF-World Health Organization (WHO) statistics, defecate in the open. India has made the rapid elimination of open defecation a policy priority.

Could toilets help children grow tall, while disease externalities from poor sanitation keep children from reaching their height potentials? Sanitation has received little attention in economists’ recent investigations of the puzzle of Indian malnutrition (Deaton, 2007; Tarozzi, 2008; Jensen, 2012; Jayachandran and Pande, 2012; Panagariya, 2013; Shah and Steinberg, 2013). Medical research documents that chronic childhood environmental exposure to fecal germs could be an important cause of stunting. Sanitation coverage is exceptionally poor in India, where over half of households defecate in the open without using a toilet or latrine, a much larger fraction than in other countries with similar incomes. According to joint UNICEF and WHO (2012) estimates for 2010, 15 percent of people in the world, and 19 percent of people in developing countries, defecate in the open without using any toilet or latrine. The primary contribution of this paper is to document that much of the variation in child height among developing countries can be explained by differences in the prevalence of open defecation. Researcher find quantitatively similar effects of sanitation on child height that are estimated from international heterogeneity across countries; that are identified from changes over time within Indian districts; and that are associated with differences among Indian and African rural localities (Spear D, 2013).
Despite of economic growth in India, India’s hunger is still worse than North Korea or Sudan. And a child raised in India is more likely to be malnourished than Somalia. Various studies suggest that the biggest reason for India’s malnutrition is poor sanitation. Because of poor sanitation situation, more children in India than North Korea, Sudan and Somalia are exposed to bacteria. The bacteria sicken them, and make it hard for children to consume nutrients, which results in malnutrition. 620 million people in India don’t have a toilet in their house and they use public toilet or just outside. In addition, the air quality in India is among the worst in the world. As India developed, the more wastes India produce. It leads to more poor sanitation. UNICEF is recognizing the poor sanitation as one of the reasons for malnutrition. In 2012, UNICEF made a report that malnutrition is based entirely on lack of the food. But now, UNICEF and many charitable organizations are saying that poor sanitation is one of the biggest reasons of malnutrition. An estimate attributes 1.5 million child deaths each year to unclean water, inadequate hygiene, and a lack of adequate sanitation (UNICEF, 2010).

This study examines the relationship between improving household drinking water and sanitation access and the likelihood that an adolescent will be stunted, underweight or anaemic. This literature review examines and summarizes key studies on adolescent malnutrition and the health effects of improving drinking water and sanitation facility. Literature exploring the effects of clean drinking water and sanitation on adolescent malnutrition is also reviewed, although such research is rather limited. The rural-urban disparities emerge again in water and sanitation access. Globally, 84 percent of rural residents lack access to an improved drinking water source compared to 16 percent of urban residents. Access to improved sanitation eludes 32 percent of people in urban areas and 60 percent of those in rural locations (UNICEF, 2010). The World Health Organization estimates that 50 percent of malnutrition is associated with repeated diarrhea or intestinal worm infections from unsafe water or poor sanitation or hygiene (WHO, 2008).

The literature conveys the sustained negative impact of repeated infections combined with poor nutrition, and how this can create a cyclical vulnerability to undernutrition and
infection. An impaired gut caused by repeated infection can damage the ability to absorb nutrients thus perpetuating the impacts of undernutrition (Lin et al., 2013).

A study conducted by Francis M. et al., (2014) found that, stunting can stem from enteropathy, a chronic illness caused by inflammation that keeps the body from absorbing calories and nutrients. Children who are exposed to open defecation or who don't have a clean water supply may ingest bacteria, viruses, fungi, or parasites that cause intestinal infection; chronic inflammation in a child's gastrointestinal track is linked to stunting and anaemia, and puts children at risk for poor early childhood development.

Kosek et al. (2013) show that environmental enteropathy is associated with subsequent deficits in growth. The lack of access of living without safe, adequate sanitation and hygiene service holds back social and economic development through its negative impacts on health, education and livelihoods.

Esrey et al. (1985) designed a study that, separately analysed the effects of water quality, water availability, and method of excreta disposal and found that water quality does not have as large of an impact on diarrheal diseases as water availability or proper excreta disposal. In another study, by separating water and sanitation, Esrey concluded that child nutritional statuses only improved from increased water access when water was increased to the optimal level and when sanitation was also improved.

Shirisha J (2014) argued that poor environmental factors and low socio-economic status and inadequate nutrition of the child are responsible for low anthropometric measurements than the standards. Studies carried out in the slums and shantytowns of Brazil and Peru reveal that, more persistent diarrhea is in early childhood, the shorter children are in height and the lower they score on mental tests during the school years (Checkley et al., 2003; Niehaus et al., 2002).

Brown (2003) compiled various studies on diarrhea and nutrition undertaken from 1968 to 1998 documenting the impact and risk factors of diarrhea. Brown found an intertwined
relationship between diarrhea and undernutrition: Children with diarrhea eat less and are not fully able to absorb the nutrients from their food; while malnourished children are more vulnerable to diarrhea (compared to normal children) when exposed to fecal material from their environment. Brown concluded that infection adversely affects nutritional status by reducing intake of food; lowering absorption capacity of the intestine, increasing catabolism, and taking away nutrients from the body that are required for growth. Furthermore, undernutrition reduces the protection of the body against infection and alters the immune function, thereby prompting infection.

Lin et al (2013) undertook a study in rural Bangladesh suggested that “children living in clean households with good hygiene would have lower prevalence of parasites and environmental enteropathy and better growth (less stunting, wasting, and underweight conditions) compared with children living in contaminated households with poor hygiene.” A study conducted by Campbell, Elia, and Lunn (2003) in The Gambia had similar findings, estimating that environmental enteropathy explained 40-64 percent of stunted growth in a small cohort of children.

Children born into houses without access to clean water were shown to be at risk of disease, according to a study based on findings from the Bangladesh National Health Survey from 2004. Specifically, children from households without access to a toilet facility were observed as more likely to suffer from growth-stunting than in households with access to a toilet facility (Hong et al., 2006). This association with growth-stunting was not found with availability of safe drinking water and water with arsenic. Malnutrition is more among defecation within the premises were significantly associated with malnutrition (Jeyaseelan L & Lakshman M, 1997; Engle, 1992).

A comparative study in some developing countries (Sommerfelt et al., 1994) and in Jimma, Ethiopia (Getaneh et al., 1998) showed that unprotected water source and non-availability of latrine were associated with low child stature. A cross-sectional study was carried out in urban slums of Bhubaneswar, Odisha, India, by Ansuman Panigrahi (2014) involving children of age group (3-9 years) during the year 2013-2014. Found that
households having toilet facilities had significantly less number of stunted children (52.4%) as compared to 67.9 percent children in households without toilet facilities. Children residing in households without having toilet facility were 1.5 times more at risk of developing stunting as compared to children in households with toilet facility. This finding has been corroborated in other studies (G. Fink, et al. 2011; A. T. Merchant, et al, 2003; Vitolo, et al, 2008; Spears D et al., 2013).

Gender and Nutritional Status

Gender inequality can be a cause as well as an effect of malnutrition. Not surprisingly, higher levels of gender inequality are associated with higher levels of undernutrition, both acute and chronic undernutrition (Mucha N, 2012; UNDP, 2011). Gender and nutrition are not stand-alone issues; agriculture, nutrition, health and gender are interlinked and can be mutually reinforcing. Some experts consider women to be the nexus of the agriculture, health and nutrition sectors (IFPRI, 2011). Gender and nutrition are increasingly acknowledged by the development community as important cross-cutting issues.

In industrialized countries women are born with an advantage; their healthy life expectancy is two years longer and their life expectancy six years longer than those of men. This advantage is prominent in childhood; girls are more likely to survive the first five years of life than boys (WHO, World health report, 2003). From many perspectives women in South Asia find themselves in subordinate positions to men and are socially, culturally, and economically dependent on them (Narayan D, et al., 2000). Sons are perceived to have economic, social, or religious utility; daughters are often felt to be an economic liability because of the dowry system (Arnold F, et al., 1996). The probability of surviving the first five years of life for girls is equal to or smaller than that for boys.

A cross-sectional study was conducted to assess nutritional status in school-age slum children and analyse factors associated with malnutrition with the help of a pre-designed
and pre-tested questionnaire, anthropometric measurements and standard clinical examination procedures were followed in urban slums of Bareilly, Uttar-Pradesh (UP) India. The result shows mean height and weight of boys and girls in the study group was lower than the CDC-2000 standards. The mean height of girls was lower than that of the boys in all age groups except the 13-14 years old age group in which girls were taller than boys. This difference in height of boys and girls was not significant in any age group. The mean weight increased from 16.46 kg and 16.28 kg for boys and girls respectively in the 5 years age group to 49.40 kg and 46.38 kg respectively in the 15 years age group. The mean weight of girls was higher than the boys, in most of the age groups. However, there was no statistically significant difference in the mean weights of boys and girls in any of the age groups. In comparison with the CDC-2000 standard, the mean weight of boys and girls of the present study was found to be lower in all age groups (Srivastava Anurag, et al., 2012).

A cross-sectional epidemiological study, using a multistage cluster sampling technique was carried out on 942 adolescents aged 12-15 years attending 10 preparatory schools at grades 7-9 and their parents in Gaza city, Jabalia village and Jabalia refugee camp in Palestine. 46.2 percent were boys and 53.8 percent girls were interviewed. The NCHS/WHO reference data on height, weight and age were used to estimate the prevalence of underweight, overweight, obesity and stunting. Haemoglobin test by finger prick method was used to assess the prevalence of anaemia. Questionnaires were used to study the relationship between nutritional status and socio-demographic status. The prevalence of underweight was 4.9 percent, overweight was 12.8 percent, obesity was 5.5 percent and stunting was 9.6 percent, the latter being higher among boys than girls. The prevalence of anaemia was 48.1 percent. It was higher among girls than boys 51.4 percent and 44.2 percent respectively. Higher consumption in starch items was found compared to other important food items such as animal products, mainly meat, and dairy products as well as fruits and vegetables. Food frequency intake seems to be positively related to socio-economic status for all food groups (Abudayya, Abdallah Hassan, 2003).
A cross-sectional study was conducted by Joshi H.S., et al (2011) in schools of Kaski district of Western Nepal from January 2007 to June 2007. A total of 786 students were randomly selected from six schools in the study area and nutritional status of the children was assessed by anthropometric measurements. Among 786 students, 26 percent of the students were found to be undernourished and 13 percent stunted, 12 percent wasted and only 1 percent both stunted. A proportion of undernourished is more among males (51.2 percent) than females (48.8%).

The study used data from the National Family health Survey round III data (NFHS-III, 2005-06) by Parasuraman, et al., (2009), conducted under the Reproductive and Child Health Project. Data were collected on haemoglobin along with socioeconomic and sociodemographic factors of the households. The survey covered rural and urban areas of 34 states or union territories. Data of adolescent girls were analysed. The results highlight various background characteristics which play an important role in determining the prevalence of anaemia. While 22 percent of adolescent girls aged 15-19 years and 16 percent of boys aged 15-19 had moderate to severe anaemia, it is less than half (12%) among girls who had completed 12 or more years of schooling and 5 percent among boys in the same age group.

To study the current diet and nutritional status of rural adolescents in India using data of National Nutrition Monitoring Bureau (NNMB) of nine states and cross-sectional study with household as the unit of randomization by Venkaiah K, et al (2002). In each State, 120 villages were selected from eight districts. From each of the selected villages, 20 households (HHs) were selected from five clusters. The information on socio-demographic profile was collected in all the 20 HHs, while anthropometric data such as weight, height and clinical signs of nutritional deficiency was collected on all the available adolescents in the selected households. Anthropometric information on 12124 adolescent boys and girls were collected. The study found that, the prevalence of undernutrition was higher (53.1%) in boys than in girls (39.5%). In the case of girls, the extent of underweight was considerably less in each age group than boys.
Izharul Hasan et al (2011) in their study entitled “Prevalence of stunting among school children of Government Urdu Higher Primary Schools in Azad Nagar and its surrounding area, Bangalore” of Karnataka state, covering 500 children of age 5-15 years from both sexes found that, the prevalence of malnutrition was found to be 52 percent; prevalence of malnutrition among boys was 53.9 percent and among girls was 49.3 percent. The stunting was 41.7 percent and 38.8 percent in boys and girls respectively. The prevalence of stunting was more in boys as compared to girls (41.5% Vs 38.8%).

An assessment of the health status among school children of the Naporuna ethnicity was conducted in north-eastern Ecuador by Sebastian MS and, Senti S, (1999). Prevalence of protein-energy malnutrition (PEM), parasitic infections, and pathology was investigated among 511 school children.

A study conducted on Scheduled caste hostels in Tirupati of Andhra Pradesh by Srinivas K. et al (2004) found that 78.4 percent children were found to be malnourished. Malnutrition was higher in boys (82%) as compared to girls (74.5%), and statistically significant. Grade-II malnutrition had higher prevalence among both the sexes. Out of 107 (20% sub-sample) children, 86 children (80.4%) were found to be anaemic. Among the boys, the prevalence of anaemia was found to be significantly higher (87.7%) as compared to that among girls (72%).

The study was conducted to assess the growth and nutritional status of school age children (6-14 years) of tea garden workers of Assam. Compared to NCHS standard and affluent Indian children, the mean height and weight of tea garden children was inferior at all ages. Assessment of nutritional status using WHO recommended anthropometric indicators revealed a high prevalence of malnutrition among tea garden school age children and malnutrition was both chronic and recent in nature. Prevalence of stunting was found to be more among girls than boys, but prevalence of thinness was higher among boys than among girls. The mean body mass index was higher among girls of all ages than among boys. Overall, half of the adolescents were stunted and most of them were thin (Medhi et al., 2007).
In a study done with adolescents of Pimpri-Chinchwad Corporation area near Pune, Maharashtra, India by Mane S.V., et al. (2012). This study was prospective cohort study based on teenage screening questionnaire and clinical examination. Total 200 adolescents including 100 boys and 100 girls, age of 15 to 18 years were included in the study. General demographic data was collected along with family history and dietary information like intake of fast food, bakery items was taken. General examination, blood pressure, anthropometric measurements were taken by using standard techniques. Study found that, prevalence of anaemia in 51 percent of girls which was statistically highly significant compared to boys (13%).

A study conducted in Vadodara Gujarat by Surabhi S et al (2013) of adolescent boys and girls and found that, most of the adolescents were malnourished (78.9%), with only 21.1 percent of the adolescents having normal weight. adolescents belonging to private school were more underweight (53.7%) than over weight and obese (25.2%). It is also reveals that more than half (55.1%) of the adolescents were anaemic. This indicates presence of triple burden of malnutrition. No significant difference was observed in the prevalence of malnutrition between girls and boys, although boys (26.9%) were found to be more over weight (including obesity), while more (58.5%) girls were underweight. More than half of the adolescents were anaemic, with girls being more anaemic (58.2%) than boys (53.6%).

A study conducted in Cameroon, Africa by Léonie Nzefa Dapi (2010) for both adolescent girls and boys. The aim of this thesis was to assess dietary intake, anthropometry and physical activity of adolescents according to sex and socioeconomic status (SES) and to investigate food perceptions of adolescents living in urban and rural areas of Cameroon. Girls and boys, 12-16 years of age, were randomly selected from schools in urban and rural areas. Food frequency questionnaire, 24-hour dietary and physical activity recalls, anthropometric measurements, qualitative interviews and a background questionnaire were used for data collection. The proportion of overweight was three times higher in girls (14%) compared to boys (4%). Stunting and underweight were more common among boys (15% and 6 %) than girls (5% and 1%).
Study was conducted to assess the nutritional status of school aged children (6-17 years) in Makurdi, capital of Benue State-Nigeria. Compared with NCHS/WHO standard, prevalence rate of undernutrition was (50.7%) and schools located in the slum parts of Makurdi recorded the highest rate of undernutrition with (78.3%) and (73.3%) respectively. Males recorded a relatively high rate of undernutrition 57.4 percent than females 44.7 percent. The study reveals that the average of school child in Makurdi is undernourished. Poor nutrition of children do not only affects the cognitive development of children but also likely to reduce the work capacity in future (Amuta et al., 2009).

Mohammad AR and Rezaul K in their study entitled “Prevalence of stunting and thinness among adolescents in rural areas of Bangladesh” found that there is a very high prevalence of undernutrition among rural adolescents as the prevalence of stunting was 46.6 percent and thinness was estimated to be 42.4 percent. In this study observed that the stunting was higher among girls than boys and the differences were observed to be statistically not significant. When the prevalence of stunting between boys and girls of each age was considered, the differences were statistically not significant. It is evident that the prevalence of thinness was higher among boys than girls.

The cross sectional study was carried out on 4457 primary school going children to investigate the physical growth as well as nutritional status of Darjeeling and Jalpaiguri districts of West Bengal. Standard anthropometric methods were applied to measure the height and weight of the children. Study shows that average height of the girls was more than the boys. From the view of weight for age, nutritional status shows poorer when it was compared with the nutritional status from the light of height for age. The weight of children was not increasing with the advancement of age. Physical growth as well as nutritional status of boys was affected more than the girls. Children of higher age group were more affected nutritionally (Prabir Kumar et al, 2011).

One of the study conducted by Jayasree P et al (2012) in Tiruvalla, Kerala among adolescent boys and girls found that, girls (42%) and boys (16.5%) were anaemic. The increased prevalence of anaemia in adolescent girls compared to boys was found
significant. There was an apparently increased prevalence of anaemia in early adolescence (37.06%), compared to mid (28.6%) and late adolescence (26.2%). Girls below the 3rd centile for BMI (thinness), of which 65.3 percent had anaemia, and among the girls with normal BMI was found in the study. The increased prevalence in adolescent girls with lower BMI was found to be statistically significant. In girls with stunting also, there was statistically significant increase in the prevalence of anaemia. The increased prevalence in adolescent girls with lower BMI was found to be statistically significant.

The National Pilot Programme on Control of Micronutrient Malnutrition launched in 1995 by the Ministry of Health and Family Welfare (2000) reported that, prevalence of anaemia in various age groups and found to be high in both sexes. In adolescents, the prevalence rate of mild and moderate anaemia was also very high i.e., 65.8 percent in boys and 81.3 percent in girls with severe anaemia of boys 3.8 percent and girls 6 percent.

A comparative study conducted of self-help group and non-self-help groups in Mahbubnagar district, Telangana, India by Shirisha J (2014) and it was found that 37 percent to 38 percent of children below 18 years were stunted with low height/age (<13 percentiles) in both SHG and Non-SHG, while a quarter of children were also mildly stunted (3-15 percentiles) in both the groups, and an average of 21 percent of each of SHG and Non-SHG children were in a healthy height/age percentile category of 15-85. A greater percent of girls in SHG were observed with mild to severe stunting more than boys.

Stages of Adolescents and Nutritional Status

According to WHO-UNICEF (1995), Adolescence divided into three developmental stages based on physical, psychological and social changes: Early adolescents (age 10-13 years), Middle adolescents (age 14-16 year), and Late adolescents (age 17-19 year). Children’s nutritional status is also more sensitive to factors such as feeding/weaning practices, care, and exposure to infection at specific ages. A cumulative indicator of growth retardation (height-for-age) in children is positively associated with age (Anderson, 1995).

A cross-sectional study was conducted to assess nutritional status in school-age slum children and analyse factors associated with malnutrition with the help of a pre-designed and pre-tested questionnaire, anthropometric measurements and standard clinical examination procedures were followed in urban slums of Bareilly, Uttar-Pradesh (UP) India. The result shows mean height and weight of boys and girls in the study group was lower than the CDC-2000 standards. Regarding nutritional status, prevalence of stunting and underweight was highest in age group 11 years to 13 years whereas prevalence of wasting was highest in age group 5 years to 7 years (Srivastava A et al., 2012).

National Nutrition Monitoring Bureau (NNMB, 2000) conducted survey in nine states of India with covering 12,124 samples of both sexes and result revealed that, percentage of stunting increased as age advanced in boys (34.7% at 10 years to 59.7% at 17 years). While the same increased with increasing age (32.5% to 46.7%) upto 13 years, after which it decreased to 37.2 percent at the age of 17 years. In case of height, the proportion of boys with undernutrition increased from 41.6 percent at 10 years to 68.6 percent at 17 years, while in girls, the extent of undernutrition increased (37.8% to 45.3%) till the age of 12 years and plateaued at 39.0 percent in the later age groups.

A cross-sectional study was conducted to assess the prevalence and the severity of anaemia among adolescent girls in rural areas which was conducted for a period of one year from Jan 2008 to Dec 2008 at villages which were under Vantamuri PHC, a field
practice area of J.N Medical College, Belgaum. A total of 840 adolescent girls (10-19 years of age) were included in the study. A pre-designed proforma was used to obtain the details of the socio-demographic variables. A relevant clinical examination of the participants was done. Following this, 2ml of blood was obtained by venepuncture. The blood samples were analysed by using an automated cell counter. The study results revealed that, prevalence of anaemia was 41.1 percent with that of severe anaemia being 0.6 percent, that of moderate anaemia being 6.3 percent and that of mild anaemia being 34.6 percent. It was observed that the prevalence of anaemia was high in late adolescents (15-19 years) as compared to that in the early adolescents (10-14 years). A majority of the girls had mild anaemia. The study concluded a high prevalence of anaemia was found among the adolescent girls, which was considerably high in the late adolescents (Biradar S et al., 2012).

The study was conducted to assess the growth and nutritional status of school age children (6-14 years) of tea garden workers of Assam. Compared to NCHS standard and affluent Indian children, the mean height and weight of tea garden children was inferior at all ages. Assessment of nutritional status using WHO recommended anthropometric indicators revealed a high prevalence of malnutrition among tea garden school age children and malnutrition was both chronic and recent in nature. Prevalence of wasting, stunting and underweight was 21.2 percent, 47.4 percent and 51.7 percent among the children in the age group of 6-8 years. Prevalence of stunting and thinness was 53.6 percent and 53.9 percent respectively among the children in the age group of 9-14years age group (Medhi GK, 2006).

Deshmukh PR et al (2006) conducted study with main objective of the study was to study the nutritional status of adolescents in rural area of Wardha. The cross-sectional 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 with CDC 2000 reference. Overall result shows that, 53.8 percent of the adolescents were thin, 44 percent were normal and 2.2 percent were overweight. The mean body mass index (BMI) for boys and girls was 16.9 and 15.5 respectively. Prevalence of thinness was significantly higher in those having education less than 8th standard than those educated at least up to 8th standard. The prevalence of thinness was significantly higher in early adolescence (57.0%) than in late adolescence (48.5%).

A study conducted by Misra et al (1995) found that the prevalence of anaemia in the age group of 15-18 years was 37.6 percent as compared to 35.4 percent in the age group of 10-14 years. Adolescent girls of urban poor found that moderate to severe anaemia increased from 13.8 percent to 22.7 percent as the age increased from 9 to 18 years.

Sidhu Sharda et al (2005), in their study found that prevalence of anaemia increases with age and becomes maximum (78.6%) in the age group 15+. The frequency of mild anaemia was displayed to the maximum (38.5%) by age group 11+ and the minimum (21.4%) by age group 15+. In the present study, the largest number of girls fell in the category of moderate anaemia, with maximum (35.5%) present in age group 14+ as compared to age group 11+ where the number of lowest (21.5%).

A cross sectional community based study was conducted among 272 adolescent girls in an urban slum area under Urban Health Training centre, department of Community Medicine, NKP Salve Institute of Medical science, Nagpur of Maharashtra state from June 2009 to February 2010. Out of five areas one area was selected by simple random sampling. Information regarding socio-demographic and menstrual factors was recorded in pre-designed, pre -tested proforma. Haemoglobin estimation was done by Sahli’s haemoglobinometer. Study found that, 90 percent of adolescent girls are anaemic, there was decline trend of anaemia with increase the age (5-12 95.3 %, 13-15 90.4 % & >16 87.4%).
The study was carried out to determine physical growth of children aged 10 to 13 years. 139 students both boys and girls were selected from two villages of Dharwad taluka during 2008-09. The results revealed that the mean height and weight of rural boys and girls were significantly below NCHS (50th percentile) and ICMR standards. In case of boys and girls, Greater gain in height was observed between 10-11 years as compared to 11-12 and 12-13 years and greater gain in weight was observed between 12-13 years as compared to 10-11 and 11-12 years. Further, age was significantly and positively related to height, weight and chest circumference at 0.01 levels (Saraswati C et al., 2010)

The study conducted in the rural areas of Kancheepuram district of Tamil Nadu on 245 adolescent girls aged between 10 to 19 years who were selected for the study. Pretested questionnaire applied and clinical examination done, age group, type of family, religion, monthly family income, literacy and family size. Height, weight and body mass index (BMI) were measured. The study found that prevalence of stunting is 19.2 percent and wasting is 28.2 percent. Prevalence of undernutrition was common among the girls in the late adolescent group. These studies found that majority of the Adolescent girls were undernourished (Ashok Kumar T., 2012).

**Birth Order and Nutritional Status**

Horton S, (1988) observed that the long-run outcome is far from equitable because children born later are born when per capita resources in families are smaller. The effects of birth order on nutritional status could be a result of strain on household resources, because having more children increases household size. This effect is worsened in cases where household income is also low. However, Horton (1988) detailed exploration of the impact of birth order on nutritional status shows that higher-order children are more likely to have poorer nutritional status because of competition with siblings for resources, maternal depletion, and a greater likelihood of infection. A challenge in estimation of birth order and family size effects is that birth order relates to family size.
A cross sectional survey was carried out in African countries and found that, there is no consistent pattern of stunting by birth order, although stunting is never most common in birth order 2-3. The highest level of wasting generally seen among children whose birth order is 4 and above. The largest proportion of children is usually seen among above 6 order (Sommerfelt et al., 1994).

Protein energy malnutrition is a major health problem in India and it affects the growth and development of young children. This study investigated the impact of hygiene, housing and sociodemographic variables on acute malnutrition in children aged 5-7, living in urban and rural areas. Logistic regression analysis showed that the overall prevalence of severe malnutrition was 8.2 percent. Higher birth order (5+) is positively associated with child malnutrition (Jeyaseelan L & Lakshman M, 1997).

Having a large number of siblings may well be considered a resource in many respects. Older brothers and sisters may serve as role models for younger siblings, and they are often important sources of social support. Laterborns are also heavier at birth, on average, and may thus be less prone to heart disease, diabetes and other diseases in adult life (Barker, 1994). However, despite all the possible advantages of Laterborns, a large number of studies have indicated that children of high birth order tend to end up in a disadvantaged position during upbringing with regard to both health (Kaplan, et al., 1992; Elliot, 1992) and educational achievement (Walden, 1990). Taken together, these studies suggest that children born late in the sibling order may be more vulnerable to disease and death over the life-course than their earlier-born brothers and sisters. Regarding birth order, studies show that children with more siblings were more likely to be stunted than their siblings because of the increased competition for food (Ukwuani F et al., 2003; Mishra V et al., 2000).

Another study conducted by Jonathan et al (2011) with objective was to investigate differences between firstborn and later-born individuals in early growth patterns, body composition, and blood pressure in Brazilian adolescents. The authors studied 453 adolescents aged 13.3 years from the prospective 1993 Pelotas Birth Cohort.
Anthropometry, blood pressure, physical activity by accelerometry, and body composition by deuterium were measured. Firstborns (n=143) had significantly lower birth weight than later borns (n = 310). At 4 years, firstborns had significantly greater weight and height, indicating a substantial overshoot in catch-up growth. In adolescence, firstborns had significantly greater height and blood pressure and a lower activity level. Firstborns may be more sensitive to environmental factors that promote catch-up growth, and this information could potentially be used in nutritional management to prevent catch-up “overshoot”.

Hermanussen M, (1988) study conducted in Germany found that, first-borns are smaller than later-borns at birth. We investigated adult stature of families with three or more adult children, aged between 20 and 70 (mean 32) years. There was no significant correlation between size of the family and final adult stature of the siblings. We found a mean height reduction of first-borns compared to the mean of all sibs (p<002 using conventional analysis of variance, P<005 using nonparametric prediction configural frequency analysis). Males tend to increase in height with increasing birth order, whereas females do not beyond the second-born. These observations could not be explained by decreasing age of later-born sibs or by periods of malnutrition immediately after the war (1945-1948). Thus, study concludes that birth order is a factor that contributes significantly to the variance of adult height within sibships.

This study first addresses the extent of son preference as inferred from family composition data for 772 Taiwanese first-graders born in the mid-1970s in two socioeconomically distinct communities in Taipei, Taiwan. It then uses linear regression to consider whether the model criteria help account for statural variation among children in each study area when controlling for differences in measurement age, parental education and housing. In the less affluent area, the interaction effect of male birth order and the presence of younger siblings was significantly associated with mean stature (p = 0.002). Males without brothers were 2.0 cm taller than males with either an older or a younger brother (116.3 +/- 0.5 cm vs. 114.3 +/- 0.4 cm). Males, who had both younger and older brothers, but often no sisters, were about as tall, however, as those without
brothers. A similar, but less pronounced, pattern was found among males in the more affluent area, but only among those who had sisters. These boys were also consistently shorter than boys without sisters (115.6 +/- 0.6 cm vs. 117.7 +/- 0.6 cm; p< 0.001). Patterns of mean female stature did not clearly support the hypothesis. Girls in the more affluent area were relatively tall and did not show significant variation (Floyd B, 2003).

Using data from a large cohort study of contemporary British families (ALSPAC), to test hypothesis using childhood growth trajectories as a biomarker for health status by Lawson DW et al. (2008), incorporating time varying measures of changing family structure and socio-economic environment, study represents the first true longitudinal analysis of family configuration effects on human growth. Using separate multi-variate multi-level models to estimate the effect of sibling number and sibling age and sex on height from birth to 10 years. Adjusting for family level socio-economic factors, the presence of siblings is associated with deficits in height across the study period. At the largest comparison, to estimate that compared with only children, children with four siblings have a reduced birth length by 8.7mm (14.8 to 2.6) and a reduced rate of growth by 2.3mm per year (3.8 to 0.8), leading to a deficit of 31.5mm by age 10. Older siblings are associated with larger lasting negative consequences on height than younger siblings. Study was found no difference in the height of children in relation to the sex of siblings. Even in the relatively wealthy, well-nourished conditions of modern. Western society, children are not buffered from the health costs of reduced parental investment. Later-born children appear worst affected by within family resource division.

A study conducted in rural Nigerian school children by Rufina N et al (2014) and found that the schoolchildren iron intake was inadequate for most of the children. The mean haemoglobin levels of the schoolchildren were low. Most (85.5%) of them had anaemia. Moderate anaemia was prevalent in 62.2 percent. Severe anaemia affected the 6-9 year olds more age, birth order, frequency of illness attack, household size, and frequency of skipping breakfast were factors that influenced the haemoglobin status of the children.
A cross-sectional study was carried out in urban slums of Bhubaneswar, Odisha, India, by Ansuman Panigrahi (2014) involving children of age group during the year 2013-2014. It was observed that children of birth order of 3 or more were almost three times having wasting than children of first order. Children with higher birth order might get less attention and care compared to children of first order.

**Family Structure and Nutritional Status**

For proper development and growth of an individual family size is an important causal agent, children in larger families are usually smaller, lighter and tend to get relatively lesser attention and care than in small families. The present study corroborates the family structure and Malnutrition. There is a vast literature on the importance of early life health for one’s success in life and the results have often been that children with poorer health in their early stages of life fare worse when looking at various adult outcomes. But what determines an individual’s health at an early stage of life? If one believes the Quantity-Quality model then family size may play an important role (Becker and Lewis, 1973; Becker and Tomes, 1976). The reason for this is intuitive; the cost of investing and increasing the health of children increases with family size, and this creates a trade-off between child quantity and child health.

The Quantity-Quality model would therefore suggest that family size is an important input in the health production function, and that an increase in family size would be associated with less healthy children. This is not always what the empirical evidence from the medical literature finds, however. On the contrary, some studies even find a positive relationship. Wickens et al (1999) finds that children from large families have less probability of having hay fever, skin prick positivity, and Immunoglobin E (an important class of antibody associated with allergy hypersensitivity). In accordance with this observation, a number of studies have found that a large family size is associated with a lower probability of asthma and allergies (Karmaus and Botezan, 2002) and some cancers (Bevier et al., 2011).
Alessandra Marini & Michele Gragnolati (2003) in their study conducted in Guatemala found the relationship between child, maternal, household and community characteristics and children's nutritional status. Study shows very large differentials in the prevalence of malnutrition among children of different socioeconomic and geographic groups. The prevalence of chronic malnutrition is almost twice as high among children of indigenous (joint) families (58 %) as among children of non-indigenous (nuclear) families (32 %).

Children in smaller families are less likely to be exposed to diseases spread by interaction with other children and this, in turn, results in a poorer development of the immune system and poorer health, which might be visible through stunted adult growth or increased susceptibility to diseases as an adult (Strachan, 1989). The medical literature has defined family size in various ways, such as the number of siblings/family size, the number of older siblings, the number of brothers, and birth order, which sometimes makes it difficult to know what the results capture (Karmaus and Botezan, 2002).

To study the current diet and nutritional status of rural adolescents in India using data of National Nutrition Monitoring Bureau (NNMB) of nine states and cross-sectional study with household as the unit of randomization by Venkaiah K et al (2002). In each State, 120 villages were selected from eight districts. From each of the selected villages, 20 households (HHs) were selected from five clusters. The information on socio-demographic profile was collected in all the 20 HHs, while anthropometric data such as weight, height and clinical signs of nutritional deficiency was collected on all the available adolescents in the selected households. Anthropometric information on 12124 adolescent boys and girls were collected. The study found that there is significant association found between type of family and underweight. Percentage of undernutrition was less in adolescents belonging to Nuclear families (46.9%) as compared to joint families (48.6%).

The study conducted in the rural areas of Kancheepuram district of Tamil Nadu on 245 adolescent girls aged between 10 to 19 years who were selected for the study. Pretested
questionnaire applied and clinical examination done, age group, type of family, religion, monthly family income, literacy and family size. Height, weight and body mass index (BMI) were measured. The study found that prevalence of stunting is 19.2 percent and wasting is 28.2 percent. Prevalence of undernutrition was common among the girls in those who lived joint family (Ashok Kumar T., 2012).

Rao KM et al (2006) in their study among tribal population in nine status of India and using National Nutrition Monitoring Bureau data (1998-99) found that the. About 63 percent of adolescent boys and 42 percent of girls were undernourished (<5th BMI age percentiles of NHANES). Significant association was observed between stunting and socioeconomic indicators such as type of family. The stunting was significantly higher among the children of joint families (46.8%) compared to nuclear (44.5%).

A cross sectional community based study was conducted among 272 adolescent girls in an urban slum area under Urban Health Training centre, department of Community Medicine, NKP Salve Institute of Medical science, Nagpur of Maharashtra state from June 2009 to February 2010. Out of five areas one area was selected by simple random sampling. Information regarding socio-demographic and menstrual factors was recorded in pre-designed, pre-tested proforma. Haemoglobin estimation was done by Sahli’s haemoglobinometer. Study found that, prevalence of anaemia was found to be very high (93.7%) among adolescent girls belongs to joint family and 89.6 percent among nuclear family (Kulkarni M V et al., 2012).

A cross-sectional study was conducted to assess nutritional status in school-age slum children and analyse factors associated with malnutrition with the help of a pre-designed and pre-tested questionnaire, anthropometric measurements and standard clinical examination procedures were followed in urban slums of Bareilly, Uttar-Pradesh (UP) India. The result shows mean height and weight of boys and girls in the study group was lower than the CDC-2000 standards. Regarding nutritional status, the risk of malnutrition was significantly higher among children living in joint families (Srivastava Anurag et al., 2012).
Type of House and Nutritional Status

Type of house is also key indicator in any research for assessing the health related problems of mix group of respondents. In our country large no of people lives in villages and in every part of country you found mix type of houses in the villages. To study the current diet and nutritional status of rural adolescents in India using data of National Nutrition Monitoring Bureau (NNMB) of nine states and cross-sectional study with household as the unit of randomization by Venkaiah K et al (2002). In each State, 120 villages were selected from eight districts. From each of the selected villages, 20 households (HHs) were selected from five clusters. The information on socio-demographic profile was collected in all the 20 HHs, while anthropometric data such as weight, height and clinical signs of nutritional deficiency was collected on all the available adolescents in the selected households. Anthropometric information on 12124 adolescent boys and girls were collected. Result shows that, stunting was significantly higher in those living in kutcha houses (40.5%), and underweight (48.3%) and those residing in semi-pucca 38.9 percent were stunted and 44.1 percent were underweight.

Caste and Nutritional Status

Caste structure of Indian society has been dominating factor in many social problems and even today it has its strength. This plays a major role in rural areas and spreads discrimination and violence among the society. A social determinant of health is widely recognised that the determinants of health are social and economic rather than purely medical. The poor health of people from the lower castes, their social exclusion and the steep social gradient are due to the unequal distribution of power, income, goods and services. Caste is inextricably linked to and is a proxy for socio-economic status in India. The restricted access of those from the lower castes to clean water, sanitation, nutrition, housing, education, health care and employment is due to a toxic combination of poor social policies and programmes, unfair economic arrangement and bad politics (The Hindu newspaper).
In a deeply stratified society like India with entrenched elitism, the Scheduled Caste citizens have been subject to inter-generational violence, discrimination and reprehensible practices like untouchability. Same untouchability has meant that Dalits have faced discrimination in housing and habitation, in the ownership of productive assets, in accessing the public services and in the labour markets (NCDHR, 2008). Thorat et al., (2012) mentioned dalits face various forms of discrimination in accessing public services such as schools, hospitals, nutrition feeding centres. Mamgain et al, (2012) raised their concern over multiple discriminations in public service spaces, in overt and covert forms. They questioned whether the public services meant to short circuit discrimination were perpetuating the same.

According to the Indian Constitution of 1950, under the ‘Articles 341 and 342’, some castes and tribes are scheduled as the Scheduled Castes and Scheduled Tribes respectively to get the special benefits; namely, reserved places in the legislatures and jobs to bring these oppressed persons into the mainstream of society. Poverty among socially disadvantaged groups such as scheduled castes (47% rural and 34% urban) and scheduled tribes (42% rural and 30% urban) was much higher than other groups (Planning Commission, 2012). A distorted caste system has put a very large section of our population at considerable disadvantage vis-à-vis their social and economic mobility.

The scheduled castes and scheduled tribes have been identified as two most disadvantaged Groups of Indian society needing special attention (Introduction of scheduled caste education).

The study by Gangadharan K (2011) the results shows that, the nutritional status of children belongs to the marginalized communities like SCs and STs are very deplorable compared to the OBC and Other Caste groups in Kerala. A comparison of severity of malnutrition among boys and girls reveal that in SC and STs, where malnutrition is worst, there is a high deference in the degree and severity of malnutrition between boys and girls, while in the OBC and Other Caste groups there is initially a slight but insignificant difference in the proportion nutritional deprivation between boys and girls.
The common causes of malnutrition among adolescents in the poor community are less access to food and inadequate knowledge about dietary requirements (Pereira P., Mehta S., 1983). High prevalence of anaemia has found among children of economically weaker sections and rural adolescents (Sidhu Sharda et al., 2005).

Anaemia is still one of India’s major public health problems, especially among adolescent girls. Study conducted by Premanand Bharati et al., (2009) to investigate the severity and distribution of anaemia among Indian adolescent girls aged 10-19 years and its association with socioeconomic and sociodemographic factors. The study used data from the District Level Household Survey, round II, 2002-04, conducted under the Reproductive and Child Health Project. Data were collected on haemoglobin along with socioeconomic and sociodemographic factors of the households. The survey covered rural and urban areas of 35 states or union territories. Data from 177,670 adolescent girls were analysed. The results shown that, prevalence rates were observed among older girls (15-19 years), those belong to Scheduled castes respondents with 10.9 percent were severe anaemic, 62.8 percent were moderate anaemic.

National Nutrition Monitoring Bureau (NNMB, 2000) conducted survey in nine states of India with covering 12,124 samples of both sexes and result revealed that, percentage of undernutrition was higher among those from STs (49.4%) and followed by OBCs (46.2%), SCs (45%) and less among other general caste respondents (43.1%). The NNMB (2003) revealed the anaemia status of younger adolescents (12-14 years) with respect to caste Scheduled tribes found to more anaemic (80%) followed by Schedules caste (72%) others (69.4%) and OBCs (64%). Those adolescents in 15-17 age group are more likely to be anaemic compare to younger age group with respect to caste, it is found that 83.7 percent of the STs found to be anaemic followed by SCs (72.6%) Others (69.4%) and OBCs (65.1%).

Adolescence is an intense anabolic period when requirements for all nutrients increases. Unsound food habits and lack of nutritional awareness are considered to be the main
factors in determining nutritional status in rural areas. Adolescents are more vulnerable to malnutrition (WHO, 1994). Another study conducted by Sweta Singh et al (2012) in rural areas of Varanasi Uttar-Pradesh (UP) India. The aim of the study was to assess the nutritional status of adolescent girls using weight and height measurement, using multistage random sampling method. 650 adolescent girls aged 15-19 years were selected for the study. Pertinent information was obtained on a predesigned and pretested Interview schedule. Study shows that, 26.6 percent of adolescent girls were undernourished (BMI <18.5) and 16.3 percent adolescent girls were at high risk of developing obesity in near future due to increased (BMI >25.9). Under-nutrition was significantly high among girls who belonged to Schedule Caste category (39.1%) than OBCs (26.6%) other general caste (22%) respondents respectively. This variation in under-nutrition among girls from different caste groups may be due to variation in their socioeconomic characteristics and thereby difference in availability of quality food. Therefore the study recommends the strong need of nutritional education for adolescents in the rural area. Focus will be given to adolescents who are married and belong to weaker section of society.

One of the study revealed that socio-demographic factors causing anaemia among adolescent girls, the results showed a significant difference in prevalence of anaemia in adolescent girls in relation to caste SCs (49%), among OBCs (36%) and others have (31.4%), the prevalence of anaemia was maximum in class V (47.6%) and significantly decreased with the rise in socio-economic status similarly prevalence of anaemia being minimum in class I and II (29.1% each). The extent of stunting was higher (42.7%) among adolescents belonging to the scheduled caste community (Venkiah et al., 2000). According to Gowarikar et al (2002), adolescent girls belonging to weaker section of society has very high prevalence of anaemia (97%).

A cross-sectional sample survey of 556 adolescent girls (10-18 years) was covered by house-to-house visit in an urban area of Meerut which is the field practice area of Department of Community Medicine, L.L.R.M. Medical College, Meerut Uttar-Pradesh (UP) India.. The prevalence of anaemia was 49.2 percent among the adolescent girls in
scheduled castes as against 36.7 percent in other backward class and 31.4 percent in savarna Hindus (Rita Singh, 2008).

A cross-sectional descriptive study was carried out among school going adolescent girls in rural schools of the Lucknow district, Uttar-Pradesh (UP) India, from June 2013 to September 2013. Multistage random sampling method was used to select the requisite number of girls. A total of 254 school going adolescent girls (10-19 years of age) were interviewed. Information regarding their socio-demographic characteristics was collected and the girls were also examined for presence or absence of pallor for anaemia. Statistical analyses were done using percentage, Chi-square test, and odds ratio. The prevalence of anaemia was 66.3 percent among SCs/STs followed by General category adolescents (53.7%) and OBCs with 53.5 percent (Sinha Shivani et al., 2014).

Richa et al (2012) in their study shown high prevalence of anaemia in scheduled caste community, which could be due to lack of money, either due to poverty or more number of children in the family and lack of knowledge about child care practices.

Studies in India and Bangladesh have shown deficiencies in the intake of all nutrients, particularly iron, calcium, vitamin A and vitamin C. There may be socio-cultural factors or change of lifestyle and food habits of adolescents that can affect both nutrient intake and needs (Spear, 2002). In SCs/STs and OBC households children are nearly 50 percent more likely to be underweight than children from other ethnic backgrounds Kabeer, (2010). Sen (2004) in their study found that nearly 60 percent of ST/SC was BMI less than 18.5 and anaemia is among pregnant women was more than 50 percent. Ramesh P (2006), in his study found that, underweight or suffering from Chronic Energy Deficiency was pronounced among women of scheduled caste (28%).
Religion and Nutritional Status

India is full of diversity. Many religions are spread here and their followers live with their own culture. This religious freedom is the strongest characteristic of the Indian society. The influence of religion on health is very crucial. The present review of literature examines the relationship between inequalities in Adolescent nutrition and religious identity. There is wide agreement that culture, religion and the embedded traditional knowledge are major determinants of what and how we eat (Atkins and Bowler 2001a; Counihan en Van Esterik 2013; Fieldhouse 1995; Kittler, et al., 2011; Sabaté 2004).

From an evolutionary perspective, the search for food has played a fundamental role in the evolution of human culture (Matsumoto and Juang 2012). However, the biological necessity of food has become secondary to the meaning that food has acquired in human culture and religion (McCann, 2013). Food is loaded with symbolic value in all societies. It has become a means of communication, of creating, affirming and reinforcing social relations, of expressing one’s personal or group identity (e.g. ethnicity, class, gender) and of connecting to the living or ancestral peer group (Atkins and Bowler, 2001a; Fieldhouse, 1995; Mintz and Du Bois, 2002). Most religions have dietary rules such as fasting periods and food taboos that convey religious identity and intensity. However, the importance of dietary rules and the degree to which they are observed can vary considerably over time and across religious groups, often in response to a changing environment (Sabaté, 2004).

Most societies are characterized by an interwoven set of specific beliefs and practices related to food and health, “including ways that food (and individuals) can become polluted, food classification systems, local explanatory models of illness (where food is perceived either as a causal agent or as a treatment), and normative patterns of favouring/disfavouring household members based on their age and gender” (Gittelsohn, et al., 1997).

Food proscriptions are usually temporary and selective, but food taboos may have an absolute nature. Some well-known examples of absolute food taboos are religious taboos,
such as the pork taboo among Muslims and the Hindu beef taboo. In various communities
absolute food taboos apply to animals that carry a particular symbolic value, such as a
totemic animal (Chowdhury et al., 2014; Gadegbeku et al., 2013; Kideghesho, 2009;
Martínez Pérez and Pascual García, 2013; Meyer-Rochow, 2009; Onuorah and Ayo,
2003). Among some Nigerian tribes for instance, there is an absolute taboo regarding the
killing and eating of animals that are believed to have aided the tribe in wars in the past
(Meyer-Rochow, 2009).

Cultural or religious dietary rules may affect food and nutrition security and health by
affecting the quantities of food consumed dietary diversity and the intake of nutrient-rich
foods. Gender is an important factor in this context, as men and women tend to face
different dietary rules and practices (Meyer-Rochow, 2009). Some studies have argued
that food restrictions may undermine the food and nutrition security of women and
children in particular by preventing them from consuming nutrient-rich foods. Gender
may also matter in social norms regarding intra-household food distribution. Several
studies document that women are expected to give preference to their husbands in the
distribution of the quantity and/or quality of food (Community Studies Team and
Chennamaneni 2007; Ene-Obong, et al., 2001; Gittelsohn, et al., 1997; Martínez
Pérez and Pascual García, 2013; Nag, 1994; Miller 1997).

Some cultural beliefs that may lead to malnutrition is religion. Among these is the
influence of religions, especially in India are restricted from consuming meat. Also, other
Indians are strictly vegan, which means, they do not consume any sort of animal product,
including dairy and eggs. This is a serious problem when inadequate protein is consumed
because 56 percent of poor Indian household consume cereal to consume protein. But
unfortunately, the type of protein that cereal contains does not parallel to the proteins that
animal product contain. Scheduled castes or tribes also face higher rates of
malnourishment. This phenomenon is most prevalent in the rural areas of India where
more malnutrition exists on an absolute level (Gulati, 2012).
A cross-sectional descriptive study was carried out among school going adolescent girls in rural schools of the Lucknow district, Uttar-Pradesh (UP) India, from June 2013 to September 2013. Multistage random sampling was used to select the requisite number of girls. A total of 254 school going adolescent girls (10-19 years of age) were interviewed. Information regarding their socio-demographic characteristics was collected and the girls were also examined for presence or absence of pallor for anaemia. Statistical analyses were done using percentage, Chi-square test, and odds ratio. The prevalence of anaemia was found to be 55.6 percent in rural school going adolescent girls, nearly 60 percent of the Hindu adolescents found to be anaemic as compare to Muslim adolescents (37.5%) (Sinha Shivani et al., 2014).

Adolescence is an intense anabolic period when requirements for all nutrients increases. Unsound food habits and lack of nutritional awareness are considered to be the main factors in determining nutritional status in rural areas. Adolescents are more vulnerable to malnutrition (WHO, 1994). Another study conducted by Sweta Singh et al (2012) in rural areas of Varanasi Uttar-Pradesh (UP) India. The aim of this study is to assess the nutritional status of adolescent girls using weight and height measurement. For present study a cross-sectional study design using multistage random sampling method was adapted. 650 adolescent girls aged 15-19 years were selected for the study. Pertinent information was obtained on a predesigned and pretested Interview schedule. Religion was found to have a significant (p <0.05) influence on nutritional status of adolescent girls. Hindu girls were more vulnerable to undernutrition (27.7%) in comparison to Muslim girls (14.8%). This variation in the trend indirectly represents religion wise variability in food accessibility and dietary intake.

To study the current diet and nutritional status of rural adolescents in India using data of National Nutrition Monitoring Bureau (NNMB) of nine states and cross-sectional study with household as the unit of randomization by Venkaiah K, et al (2002). In each State, 120 villages were selected from eight districts. From each of the selected villages, 20 households (HHs) were selected from five clusters. The information on socio-demographic profile was collected in all the 20 HHs, while anthropometric data such as
weight, height and clinical signs of nutritional deficiency was collected on all the available adolescents in the selected households. Anthropometric information on 12124 adolescent boys and girls were collected. Result shows that, prevalence of underweight was less among Christians (34.3%) followed by Muslims (43.9%) and highest among Hindus (46.2%) respectively.

Anaemia is still one of India’s major public health problems, especially among adolescent girls. Study conducted by Premanand Bharati et al., (2009) to investigate the severity and distribution of anaemia among Indian adolescent girls aged 10-19 years and its association with socioeconomic and sociodemographic factors. The study used data from the District Level Household Survey, round II, 2002-04, conducted under the Reproductive and Child Health Project. Data were collected on haemoglobin along with socioeconomic and sociodemographic factors of the households. The survey covered rural and urban areas of 35 states or union territories. Data from 177,670 adolescent girls were analysed. The prevalence in the north-eastern states was relatively low. The highest prevalence rates were observed among older girls (15-19 years), those respondents belong to Hindu (9.6%) and Muslims (9%) religion were found to be severely anaemic

The study conducted in the rural areas of Kancheepuram district of Tamil Nadu on 245 adolescent girls aged between 10 to 19 years who were selected for the study. Pretested questionnaire applied and clinical examination done, age group, type of family, religion, monthly family income, literacy and family size. Height, weight and body mass index (BMI) were measured. Prevalence of undernutrition was common among the girls those belongs to Hindu religion followed by Muslims and Christians. Hindus are more likely to be anaemic (69.5%) compare to Muslims and Christian (66.5% and 55.7%) (Ashok Kumar T, 2012).
Awareness and Knowledge about Nutrition

The science of nutrition has been developed by using the combined knowledge of the physical and biological sciences. Its application involves the social sciences related to man’s behaviour, i.e., psychology, sociology, anthropology and economics (McDivit et al., 1973).

The environment of family which is the smallest unit of a society is quite effective on every kind of development of adolescent youngsters. One of the most important parameters which affect adolescent development is their nutrition level. It is known that adolescents with a balanced diet are advantageous in academic success as much as physiological development. Another notable parameter concerning adolescents is the attitude of their parents towards them. There is a general agreement on the matter that parent-child relationship in the adolescent period has effects on the development of the individual, relations with other people and psychological harmony. Positive approaches to the child in a family environment with balanced and good relationships are experienced, such as love, interest, trust, understanding, discipline will have positive effects on studying and success (Basar, 2004).

Healthy eating habits in childhood are important because they help prevent undernutrition, growth retardation, and acute child nutrition problems, in addition to preventing chronic, long-term health problems, such as obesity, coronary heart disease, type-2 diabetes, and stroke (Nicklas & Hayes, 2008). Nutrition and physical activity are major modifiable lifestyle factors related to the development of non-communicable diseases (Woo J, et al., 1984). The school system in India does not lay emphasis on health education or the practical application of health-related knowledge. It is often left to physicians to educate children and adults about healthy living. As many healthy or unhealthy life-long practices begin in adolescence, it is important to study the nutritional knowledge and behaviour in this age group. Also, the changes brought about by an educative intervention during these formative years are more likely to track into adulthood as healthy preferences. Moreover, children do not always choose what they
Parents are effective on their children’s eating behaviors and preferences. Especially, mothers are the role models of their children about eating behaviors. Therefore, it is important to determine mother’s eating habits to support healthy nutrition of both child and mother. Eating behaviors of the mother are affected by some factors such as socioeconomic status, educational status, age, working position, and knowledge level of nutrition of mother (McLeod et al., 2011; Variyam Blaylock et al., 1999; Vereecken & Maes, 2010). It is assumed that nutritional knowledge level of the mother could be effective on eating behaviors of their children.

Study carried out in Ankara, Turkey to determine the effects of mother’s nutritional knowledge on attitudes and behaviors children about nutrition. This study was carried out 132 boys and 170 girls, total 302 mothers of the students. The inventory was given to the mothers to determine their nutritional knowledge and attitudes and behaviors about their children’s nutrition. Results indicated that many of the mothers who have higher nutritional knowledge level and their children have normal weight. The mothers who have higher level nutritional knowledge feed their children more with vegetable, fruit, legumes, and less sugared drinks such as pops, juice and fast foods than the mothers who have lower level of nutritional knowledge. Also, higher nutritional knowledge level mothers avoid giving the foods which contains artificial to their children, and believe more the knowledge about nutrition-health. Mothers’ nutrition knowledge level affects children’s eating habits (Nurcan Yabancan et al., 2014).

It is assumed that the mothers who have true nutritional knowledge prefer right foods for themselves and for their children. Sunwoong et al. (2000) stated that there is a correlation between nutritional knowledge of the mothers and their nutrition status, nutritional habits and nutritional knowledge of their children. In other different study, it is
found that nutritional attitude and knowledge scores in mothers are positively related with diet scores of their children (Vereecken & Maes, 2010).

A study was conducted by Sunwoong et al., (2000) to investigate nutrient intake food behaviour and nutrition knowledge of 543 middle school students (13.7 years age) residing in Seoul and Kyunggi-do in Korea Republic. It was concluded that among female students, nutrient intake was lowest in subjects whose nutrition knowledge was very high or very low therefore, nutrient consumption was affected by nutrient knowledge and nutrition knowledge of male students was affected by nutrition knowledge and attitude. The results indicated that nutrition education and correct information on body image, balanced diets, regular meals and food selection for middle school students were required both at home and in schools.

Devadas et al., (1975) evaluated nutritional background of 300 malnourished pre-school children treated in the pediatric out-patient department of the Coimbatore medical, college hospital Tamil Nadu, India. The causes for malnutrition were low intake of nutrients, infection, and low income, lack of knowledge, improper selection, preparation and consumption of nutritious foods, poor weaning practices and faulty food beliefs. Malnutrition resulted in lowered height, weight and Haemoglobin level in these children.

Izharul Hasan et al (2011) study entitled “Prevalence of stunting among school children of Government Urdu Higher Primary Schools in Azad Nagar and its surrounding area, Bangalore” of Karnataka state, covering 500 children of age 5-15 years from both sexes found that, lack of nutritional knowledge was one of the important factors for anaemia and stunting among children.

Literate mothers adopt many improved behaviors related to maternal and child health care, feeding and eating practices which ultimately affect the nutritional status of children. A cross-sectional study was conducted by Joshi H S, et al (2011) in schools of Kaski district of Western Nepal from January 2007 to June 2007. Total of 786 students were randomly selected from six schools in the study area and nutritional status of the
children was assessed by anthropometric measurements. Among 786 students, 26 percent of the students were found to be undernourished and 13 percent stunted, 12 percent wasted and only 1 percent both stunted. 58 percent of mothers of malnourished children did not have adequate knowledge regarding the diet requirements of the child and the nutritional value of food items.

A study conducted in Vadodara Gujarat by **Surabhi S, et al (2013)** found that knowledge attitude and practices of parents, observed that 55 percent of the parents could correctly identify the age range of adolescents (10-19 years). 82 percent of the parents understood the importance of adequate nutrition during adolescence for growth and development. Awareness level of parents, regarding malnutrition, very few (25 %) knew about what is malnutrition while only 33.3 percent could understand the importance of addressing malnutrition during adolescence. Although 80 percent of parents agreed to the importance of assessing nutritional status of their children regularly, nobody had knowledge about how to assess their child’s nutritional status and BMI. Looking into the awareness level of parent’s regarding causes of malnutrition, very few parents could identify unhealthy dietary practices (36.7%), unhealthy home tiffin (33.3%), skipping breakfast (27%) and consumption of aerated drinks (25%).

Some studies represent that dietary deficiency are alarming among rural adolescent girls but unfortunately precise estimates of their dietary intake, dietary practices as well as nutrition related knowledge have been the least explored area (**Chaturvedi et al., 1996**). A study conducted in Malaysia by **Hafzan Yusoff et al (2012)** and revealed that, anaemia is a significant public health problem among secondary school students with an overall prevalence of 59.6 percent and more than half the adolescents (51%) possessed a poor knowledge of anaemia. Perception of adolescents about food and nutrition revealed that, adolescents do not have proper idea about nutrition food and importance of the food, moreover adolescents facing problem with lack of time, lack of self-discipline, and lack of a sense of urgency. There is a need for intervention programs for youth that focus on behavior change rather than acquisition of knowledge (**Pallavi Bharooch, Mary Story and Michael D., Resnick, 2002**).
Another study conducted by Chaudhary Seema et al (2010) in India and found that access of nutrition related knowledge was poor for adolescent girls. Their nutrition related knowledge was not up to the mark and majority of them were not aware about their nutritional needs. Research has shown that dietary habits in childhood impact directly on growth, development and the prevalence of disease throughout the life cycle.

Meral et al (2008) in her study of Turkish adolescents found that, half of the students (55.7%) reported that they had formal knowledge on nutrition. As source of their information about nutrition, media was cited by 39.2 percent, family and peers by 35.7 percent, teachers by 14.0 percent and health workers by 6.2 percent of the students. A study conducted by Elhassan MR et al (2013) the results revealed that Media was the major source of information and 42 percent of the students get their nutritional knowledge from the media.

Another study is conducted in the Hisar district of Haryana state by Jyoti Rani et al (2013) reveals that majority of the students comes under the category of underweight having low and medium level of nutritional knowledge. The comparison of nutritional knowledge of the students with Body Mass Index range of the students shows that nutritional knowledge have great impact on the health status of the adolescents. A study conducted in Malaysia by Yusuf H et al (2012) and revealed anaemia is a significant public health problem among secondary school students with an overall prevalence of 59.6 percent and more than half respondents (51%) possessed a poor knowledge of anaemia

Several factors were shown to influence the eating behaviour of adolescents and nutrition knowledge was identified as one of these factors. Because of the link between nutrition knowledge and eating behaviour as well as other risk factors in the development of nutrition-related diseases and conditions, nutrition education has been suggested as one of the strategies to address nutrition related issues for adolescents with school-based
programmes recommended as the most effective route of action (Jacoby et al., 1998; Simeon, 1998).

Undesirable dietary practices may also be determined by the adolescent’s nutritional knowledge. A number of researchers suggest that nutritional behaviour is related to nutritional knowledge and that if an individual is educated on healthy eating, they are more likely to do this in practice (Wardle et al., 2004, Pirouznia, 2001, Read et al., 1988, Saegert & Young, 1983, Cho & Fryer, 1974). Conversely, there is also research that demonstrates that nutritional knowledge is not linked to healthy eating behaviours (Stafleu et al., 1996; Shepherd & Towler 1992; Harrison et al., 1991; Halverson, 1987; Shepherd & Stockley, 1987; Story & Resnick, 1986; Axelsson et al., 1985).
Fig 1.1: Proximate determinants of Malnutrition among Adolescents

- Economic Factors
- Household Factors
- Social Factors
- Environment Factors
- Awareness
- Skipping Meal
CONCEPTUAL FRAMEWORK

Adolescents who were willing to participate in the study were interviewed for collecting the desired information. Causes of malnutrition in adolescents are complex, ranging from economic and social to environmental factors. To handle the complex hierarchical inter-relationships between these variables which are risk factors of ill health in children, particularly in less developed countries. Based on the previous research about the causes of malnutrition, here constructed a conceptual hierarchical framework of the determinants of malnutrition. Variables in this model (figure 2.1) discussed by social factors, economic factors, household factors, awareness, skipping meals and environmental factors.

According to the conceptual model, Social Factors (Religion, Caste, place of residence). Economic factors may affect directly or indirectly on all other groups of risk factors with the exception of sex and age. These include household factors (such as type of house, house structure, sources of water), Awareness factors (parent’s education, nutritional knowledge, food habits and beliefs). Environmental factors (open defecation) and skipping meal factors (Frequency of skipping meals). These variables, in turn, may affect the malnutrition among adolescents in rural areas of Raichur district.