REVIEW OF LITERATURE
Review of related literature is an essential aspect of research. It involves synthetic and synoptic understanding of the research works already conducted in the same field over a period of time. It provides some insight regarding strong points and limitations of the previous studies and enables the researcher to improve his own investigation (Panigrahi, 1999).

A review of literature has the following functions:

- To establish the importance of the topic;
- To provide background information needed to understand the study;
- To show readers you are familiar with significant and/or up-to-date research relevant to the topic;
- To establish your study as one link in a chain of research that is developing knowledge in your field.

It is clearly evident that review of related literature serves as a guide post not only with regard to the quantum of work done in the field but also enables one to perceive the gaps in the concerned field of research. It promotes greater understanding of the problem and its critical aspects and ensures the avoidance of an unnecessary duplication and replication.
2.1 SCHOOL AGE CHILDREN (6 TO 14 YEARS)

School age children are those of 5 to 12 years of age. This time period is a stage of continuing growth and development for young child. The child’s body continues to change as he grows older. At the start of the school age years, a child’s height may be about 43 and one-half inches. Weight may be about 43 pounds. Later, as puberty starts child’s height and weight will increase quickly. On the average, a child’s height may reach 59 inches at age 12. Girls are likely to weigh more than boys. Girls may weigh about 93 pounds while boys may weight about 89 pounds (Feigelman, 2007).

Further Feigelman (2007) stated that at school age years a child can name numbers and letter easily. As early as six years of age, child may be able to read single words and understands what he is reading. Later, he may be able to read fluently and pronounce words correctly. At this stage child begins to think logically and can make sense of what is happening around him. His ability to understand ideas and remember things improve. He can place objects in order, or sort and group and able to follow more complex directions and rules, and solve some problems better.

Jacquelynne (1999) stated that the years between 6 to 14 years – middle childhood and early adolescence are a time of important developmental advances that establish children’s sense of identity. During these years children make strides towards adulthood by becoming competent, independent, and self-aware and involved in the world beyond their families. He found that during middle childhood, there is a crucial shift in children’s cognitive skills occurs at around age six. They may develop an orientation toward achievement that will color their response
to school and other challenges for many years. Further, in early adolescence, the tumultuous physical and social changes that accompany puberty, the desire of autonomy and distance from the family can all cause problems for young people. When they are in settings (in school, in home, or in community programs) that are not attuned to their needs and emerging independence, they can lose confidence in themselves and slip into negative behavior patterns such as truancy and school dropout.

Feigelman (2007) found that the school age children typically have fairly smooth and strong motor skills. There will be significant differences in height, weight, and build among children of this age range. It is important to remember that genetic background as well as nutrition and exercise, may influence a child’s growth.

Children grow up in worst conditions are really distinguished by rates of development process. Thus in the worse conditions the share of children with outstripping in height is less and that with backwardness in height and weight and deficits of body mass is larger. Further, the children getting good nutrition were as follows 34% with excessive height, 1% with deficit of height and only 0.2% with deficit of weight in Kemervo children to those who were in worse conditions of poor family living and poor nutrition, only 16.5% were with excessive height, 8% with deficit of height and 14.8% were with deficit of weight (Maximova et al. 1992-93).

Levitsky (1999) suggests that undernourishment leads to poor motor development and lower activity level and responsiveness among young children. The lower activity level in turns reduces young children exploration of their environment and the stimulation they receive from their caretakers; as a result, they experience developmental delays.
Grantham et al. (1994) found good evidences to show that severe malnutrition in early childhood has a substantial long-term effect on child development. A land mark quasi-experimental study in Jamaica followed up children who had been hospitalized with severe malnutrition at 6-24 months of age. It was found that at 7, 8 and 9 years of age these children had lower developmental levels than a control group of children who were not malnourished and had been hospitalized for other reasons. At the 14 year follow-up the malnourished group had markedly lower overall Intelligent Quotient (IQ -1.50 SD) below the control group.

Chang et al. (2002) found that the stunted children had more behavioural difficulties at home, regardless of their social background, than non-stunted children. Their educational attainment was also poorer than non-stunted children in arithmetic, spelling and reading tests.

Seetharaman (2001) found that the relationship between educational achievement and physical development was strong. When boys and girls were compared across different age groups, the analysis revealed that better the state of physical health, the better is their educational achievement in schools.

Powell and Mathews (1998) determined that omitting breakfast interferes with cognition and learning among school children, an effect that is more pronounced in nutritionally at-risk children than in well-nourished children.

United Nation International Children Emergency Fund (UNICEF), (2005) report on the state of world’s children under the title “Childhood Under Threat”, speaking about India, states that million of Indian children are equally deprived of their rights to survival, health and nutrition, education and safe drinking water. It is reported that 63% of them go to
bed hungry and 53% suffer from chronic malnutrition. Further, the report states that 147 million children live in kuchcha houses, 77 million do not use safe drinking water from a tap, 85 million are not being immunized, 27 million are severely underweight and 33 million have never been to school. It estimates that 72 million children in India between 5 to 14 years do not have access to basic education.

School feeding program have been developed in response to concern that hunger and poor nutrition lead to behavioural problems, health problems and ultimately poor learning outcomes. Many evaluations of school breakfast programs are based on qualitative reports from teachers and parents, rather than quantitative evidences. Such reports are generally very positive, with teachers and parents attributing improvements in student’s motivation and concentration, discipline, health, attendance and educational achievement to implementation of breakfast program (Hyndmann, 2000).

2.2 MID DAY MEAL SCHEME

The School Breakfast Program (SBP) started as a pilot program to provide funding for school breakfast in poor areas and areas where children had to travel a great distance to school. The intent was to provide a nutritious breakfast to children who might otherwise not receive one. More recent research studies suggests that providing school breakfast to low-income children is associated with greater likelihood of eating a substantive breakfast and improved school attendance and decreased tardiness (Briefel et al. 1999).

Rosso (1999) notes that school feeding program can alleviate hunger and increase the attention and concentration in learners and therefore improve learning, motivate parents to send their children to
school regularly and therefore reduce absenteeism and dropouts and address micronutrients deficiencies like iron and iodine in school children. He also stated that iron deficiency, anemia and causes children to be listless, in attentive and uninterested.

Dreze and Khera (2008) found evidence on the value of mid day meal as a means of nutrition supplementation while mid day meals certainly help to protect children from classroom hunger, that may or may not lead to a sustained improvement in their nutritional status. They stated that a poor mid day meal (say rice and salt) can even be counter productive, if it ‘kills’ children’s appetite and reduces their intake of richer food at home. The improved MDMs reduces the daily calorie deficiency of the average primary school going children by almost 35%, the daily iron deficiency by 25% and meets almost their entire daily protein deficiency.

The Centre for Equity Studies Survey, New Delhi (2003) has shown that how vital it is to make the free mid day meal scheme a national priority. This study points out that the classroom hunger declined dramatically satiating their hunger in school has improved their concentration and the study also found that earlier most children slept in the afternoon due to hunger and exhaustion.

School feeding was introduced to alleviate short-term hunger by providing 25% of the energy requirement of the child per day; micronutrients requirements are, however, not always met and studies have shown that micronutrients deficiency persists in some South African school children, despite this program school age children are often a neglected group in terms of micronutrients interventions (Stuijvinberg, 2003-04).
The mid day meal program aims to improve school enrolment and attendance, to reduce dropout rate, to better the child’s performance and to improve nutritional status of primary school children. A study was conducted by Sharma et al. (1995) in the state of Andhra Pradesh to assess the impact of the MDMP on the above parameters. The results of the study on the educational component indicated improved attendance, increased retention rate with reduced dropout rate, and a marginal improvement in the scholastic performance. The nutritional component revealed better growth performance among the regular beneficiaries in the program.

De, Anuradha et al. (2005) found in their study that the quality of rajma and vegetable pulao has not been up to the mark. Parents were never allowed to taste the noon-meal distributed among the children. Further, a few school children found mid day meal very unattractive and felt that the food served was not sufficient for them.

Padmalatha (2010) reported the tale of loopholes in mid day meal scheme. She stated that this school, with a thousand students, does not have a kitchen for the meals to be cooked. To overcome this difficulty, one of the classrooms has been converted into a kitchen and the students are crammed into smaller classroom. The teachers even have to spend considerable amount of time i.e. 80 minutes in overseeing the preparations and even serving the meal on a daily basis. Further, the teacher faced a lot of trouble to find the cooks, source vessels and oversees every day’s cooking.

On contrary to this study Centre for Consumer Action Research and Training (CART) (2007) found that the boiled wheat supplementation with groundnut and jaggery (gur) is more than 90%
liked by the students under MDMS. 97% of the teachers reported receiving good quality food grains where only 23% of the schools were able to receive food grains after getting them weighed before delivery, and teachers are spending close to 20% of their time or more on managing mid day meal instead of teaching.

Gangadharan (2006) found that the physical facilities for mid day meal scheme are available only in 50% schools, 94% schools depend on firewood for cooking; separate buildings for kitchen outside classroom are rare; adequate space not there in 50% schools and the school verandah is the main menu for serving food. The teachers demand that the menu for mid day meal should be improved and made attractive and must in be adequate quantity so that the children feel full. It was identified that some children highlighted the need for a change in the monotonous menu of khichiri (made of boiled rice, pulses, tumeric, little oil and local vegetables) everyday. It was also found the inadequate salaries were paid to cooks that make them uninterested in the preparation of noon-meal and the scope for involving the parents in the process of implementation of the program was very limited.

According to a recently released annual report of Comptroller and Auditor General (CAG) of India (2009) around 76% of schools in Uttar Pradesh use low quality food grains for mid day meals. Inspection of food grains used revealed that broken grains in excess of permissible limits, foreign matter and damaged grain were used in most of the schools. The report also highlights served irregularities in the scheme’s implementation.

Pratap (2003) mentioned that the MDMP in Tamil Nadu districts of Kancheepuram, Nagapattinam and Dharamapuri is an outstanding
example of what can be achieved when quality safeguards in place. The mid day meals had been served on time everyday and meal did not interfere with teaching duties, and the most teachers appreciate the positive aspects of providing school lunches. Each school had a cooking shed and a paid staff of three women-a cook, a helper and an organiser who look after the logistics accounts.

Singh (2008) showed that the school meal scheme deliver non-trivial gains in both nutrition and learning which are highly significant. The program act as a security for children, there are large and significant gains for children who suffered from the impact of drought. In cognitive skills, it was found that school meals boost Peabody Picture Vocabulary Test (PPVT) scores by over 0.6 S.D.

The School Nutrition Dietary Assessment Study II (1998-99) reveals that for all key nutrients, such as calcium, school meals met or exceeded program standard. Both the National School Lunch Program (NSLP) and School Breakfast Program (SBP) provide more calcium than required. Those children participated in NSLP are likely to consume more milk and milk products, vegetables and meat and other protein foods as compared to non-participants. Further, the nutritional quality of school meal has been found to be superior and found to reduce students hunger, improves their nutrients intake and supports learning and academic achievement (Dairy Council Report, 2002).

Toward the negative aspect of school meal, Menon (2003) reported that mid day meals are a health hazards, because they are not prepared in hygienic conditions. The survey evidences points that the pupil do feel unwell from time to time after consuming mid day meal. About 10% parents said that this had happened to their children at least once during
the preceding 12 months. The problem is especially common in those schools where ghoogri is served day after day. Ghoogri needs to be boiled for several times, and is often hard to digest when it is under-cooked.

On the positive side, 90% of the children never had any problem and the indispositions experienced by the other 10% were not serious in most cases. The study pointed that MDMS should not be discontinued but greater attention should be given to the quality aspects.

Pottertion and Dawjee (2004) found that 22.41% schools receives food deliveries everyday, 6.89% once a week, 8.62% twice a week, 16.37% receives three times a week, 24.13% once a month and only 8.62% sometimes for school feeding meals. Some of the schools indicated that the amount of food given to children was not enough for the learners. The study also showed that the quality of food received was not always good. Furthermore, a few of the respondents complained about the lack of space in schools to store the food that was purchased in bulk and the lack of proper kitchen space to prepare food.

Comptroller and Auditor General (CAG) of India (2009) report that the improvement in the nutritional status of the children was not ensured by providing micronutrient supplementation and deworming medicines. The study also showed that there is no periodical health check up of the children was conducted in the schools.

Laxmaiah et al. (1999) observed that the average energy and protein supplied to a child in a day through mid day meal was 303 Kcal and 7.2 gm, respectively.

Anna Adhikar Abhiyan Maharashtra (2006) under took a study in a total of 91 villages from 8 districts of Maharashtra. It was found that only in 12% of villages cooked food was being given. Out of 11 villages where
there is MDMS is being implemented only 3 villages had 100% coverage of the scheme. However in none of these 11 villages children were getting food equivalent to 300 calories and 8-12 grams of protein. In majority of villages the quality of food being provided was average. However, the quality of food was reported poor in one fourth of the villages and in only one village good quality food was given. In the majority of village the food grains were stored in the school premises. There was no separate storage space available.

Centre for Equity Studies Survey, New Delhi (2003) revealed that in 76 of the 81 sample schools, the mid day meals were being served regularly. But, in Rajasthan the menu is same every day: ghoogri. In case of Chattisgarh, lunch usually consist of rice with dal or vegetables with some variation over the week. Karnataka provides the most convincing menu. Aside from rice with sambhar, school children often enjoys other items such as vegetables, pongal, lemon rice and even sweets like kshira and sajjitha. Thus the menu needs to be reviewed in Rajasthan and Chattisgarh so that the children took interest in eating mid day meal rather become non-participants.

School feeding programs are likely to improve the nutrient intake of participating children. A study in Huaraz, Peru shows that for children who received breakfast at schools, dietary intake of energy increased by 2%, protein by 28%, and iron by 4% compared to the control group (Jacoby et al.1996). An evaluation of a school feeding program in Jamaica assessed the dietary impact of school breakfast consisting of a bun and half pint of milk. Results show that the program provided 32% and 45% of daily energy and protein requirements, respectively (Chamber, 1991). In Brazil, a study of a large school lunch program examined the impact of program on consumption of calories and protein
by school children in Sao Paulo. Participation in the program was associated with an increased availability of 357 calories and 8.5 grams of protein.

To counter the harmful effects of micronutrients malnutrition among school children, some school feeding programs provide fortified food. The provision of such food was shown to increase the dietary intake of micronutrients. The program significantly increased dietary intakes of iron by 46%, besides increasing energy and protein by 25% and 28%, respectively (Dall’Acqua, 1991).

2.3 NUTRITIONAL STATUS OF SCHOOL CHILDREN

Good Nutrition is the fundamental basic requirement for positive health, functional efficiency and productivity. Nutrition science provides abundant evidences of the importance of nutrition in not only promoting proper physical growth and development, but also in ensuring adequate immunocompetence and cognitive development. Recent advances point to the far reaching effects of good nutrition in early life on prevention of degenerative diseases in late adult life. For a nation to be healthy, strong and productive, the nutritional status of its people must be good (Nutrition Foundation of India (NFI), 2004).

Sunita and Jain (2005) defined nutritional status or nurture is the condition of health of an individual as influenced by nutrient intake and utilization in the body. It can be determined with the help of clinical examination of symptoms of nutritional deficiencies, dietary intake, and anthropometry and laboratory investigation.

Around 27.28% of all children in developing countries are estimated to be underweighted and stunted. The two regions that account for the bulk of the deficit are South Asia and Sub-Saharan Africa. If
current trends continue, the Millennium Development Goals Target (MDGT) of halving the proportion of underweight children will be missed by 30 million children, largely because of slow progress in Southern Asia and Sub-Saharan Africa (Shah, 2010).

Nutrition plays an important role in children’s development from before birth through infancy, early childhood, and adulthood. However, the environmental factors such as poverty, family structure and support, and access to care, also affect children’s nutritional and health status. Diet has been shown to have both short-term and long-term effects on behavior (Briefel et al. 1999).

School children often face health and nutritional problems that affect their intellectual and physical development and their capacity to attend school and their ability to learn. The effect of under nutrition on young children can be devastating and enduring. It can impede behavioral and cognitive development, educability, and reproductive health, thereby undermining future work productivity (Martorell, 1996).

Gopaldas (2003) stated that the average Indian schooler is undernourished and underweight suffers from iron deficiency anemia, and is vitamin A, riboflavin, vitamin C and iodine deficient. She/he is very often suffers from diarrhoea, skin infections like scabies that negate her/him being an “Actively Learning Child.” Further stated that a schooler has to have a minimal level of nutrition and health in order to imbibe what is taught to her/him in school.

Awate et al. (1997) found that the prevalence of nutritional disorders in rural primary school children (5-15 years) were as follows: anemia 32.47%, vitamin A deficiency 9.8%, vitamin B complexes deficiency 2.57%, protein energy malnutrition 2.38% and vitamin D
deficiency 0.19%. 69.52% of the school children had perceived morbidity at the time of the initial visits of the schools 68% were assessed as having poor personal hygiene, 30.47% was infested with worms and 10.66% has acute respiratory infections.

Singh and West (2004) conducted a study on children age group 5-15 years and found that the estimated prevalence of vitamin A deficiency among school children is 23.4%, suggesting that there are approximately 83 million vitamin A deficient school aged children in the Southeastern Asia, of whom 10.9% (9 million at an overall prevalence of 2.6%) have mild xerophthalmia (night blindness or bitot's spot) potentially blinding corneal xerophthalmia appears to be negligible at this age.

Khalil and Khan (2004) revealed that the mean height and weight increased monotonically with age along with high degree of positive correlation between height and weight in both boys and girls (except for 14 years of age for girls). They found that the over all increase in a mean height is more in boys (40.52 cm) than girls (37.35 cm) but increase in mean weight was more for girls (19.76 kg) than boys (16.92 kg). It can be conclude that boys are taller than girls, but girls are heavier than boys at pre-puberty and puberty (14 years of age). Further, they stated that the prevalence of wasting of boys and girls were 32.76% and 28.12% respectively, stunting was observed as 79.73% of boys and 81.80% for girls. It was concluded that age has play no significance role in stunting of boys and girls and wasting for girls, but age was significantly associated with wasting of boys only.

Abou-Zeid et al. (2005) reported that the anemia is highly prevalent among school children living at Saudi high altitude area, which is seriously affecting the growth of 6 to 14 years old children. Similarly,
malnutrition seems to be a significant health problem among those children as estimated by anthropometric measurement. In this study, 513 students from 5 schools were recruited. They found that the mean haemoglobin concentration was 1.34±0.9 g/dl, while the prevalence of anemia was 11.6% and 15.5% based on haemoglobin and haematocrit values. At the same time, underweight affected 14.2% of the students and 13.8% suffered from wasting. Most of the victims of anemia and erroneous anthropometric measurements were females, except for wasting which was more prevalent among males.

The majority of infants and children in developing country are in a nutritionally inadequate status. For them, the primary food problem is that of quantity, not quality. The diets are deficit not only in micronutrients but in energy as well. What children require is food of good nutritive value, to meet their requirement of micronutrients and not just a capsule containing single/multiple micronutrients. The food besides providing, the vitamins and minerals (which can be administered by a capsule), supplies a whole range of bioactive photochemical (Kapil, 2004).

National Nutrition Monitoring Bureau (NNMB) (2002) showed that there was a relatively steeper decline in the prevalence of moderate and severe under nutrition as assessed by weight-for-age and height-for-age. In spite of the steep decline in the prevalence of stunting, the change in the mean height of the children is very low. There has been a decline in underweight children over the last three decades but even now nearly 50% of the children are underweight as compared to the NCHS norms. The data also revealed that 94.5% children in the age group of 6 to 9 years and 96.1% children in the age group of 10 to 13 years were suffering across mild, moderate and severe levels of malnutrition.
Analysis of data from District Level Household Survey (DLHS), (2002-04) show that under nutrition rates (as assessed by weight-for-age WHO 2007 standard) varies between 20-50% in different age groups.

Nutrition Foundation of India (NFI), (2004) carried out a study to access under nutrition and over nutrition in children of low income group studying in government schools and high income group children studying in public schools. Data were analyzed to assess prevalence of under nutrition and over nutrition using height, weight and BMI-for-age (as compared to CDC norms) as indices for assessment in nutritional status. It was reported that the prevalence of under nutrition in low income group was higher and over nutrition was higher in high income group schools. Even in public schools there are some children who are underweight, stunted and undernourished.

Khor (2003-04) stated that the prevalence of under nutrition and micronutrient deficiency problems is markedly low in Malaysian children. Underweight and stunting in children from urban primary school is generally below 10%. However, the magnitude is significantly higher from 20 to 50% in children from rural schools and low income household in urban schools. Beside Protein Energy Malnutrition (PEM), iron deficiency anemia and a sub-clinical form of vitamin A deficiency have been reported in young children.

Osci et al. (2010) conducted a study in twenty public primary schools over 499 children between 6 to 10 years of age and found that underweight, stunting and wasting were present in 60.9%, 56.1% and 12.2% of school children, respectively. Anemia, iron deficiency and vitamin B₁₂ deficiency were found in 36.7% and 17.4% of the children, respectively.
To improve school performances through improved health and nutritional status, Sembene (2003-04) conducted an operational study to control iron deficiency and parasitic infections in 2,245 school children. Children were randomly assigned to one of the following groups- weekly Fe-30 mg, weekly Fe-60 mg, weekly multiple micronutrients supplement including 30 mg of iron or a placebo. The impact of the intervention was assessed on health and micronutrient status, parasitic loads and school performance. Preliminary results showed that the prevalence of anemia reduced to 46%. The proportion of children who successfully passed the mathematics and French tests was higher in the groups which received Fe-60 mg.

Medhi et al. (2006) study revealed a high prevalence of malnutrition among school age children and malnutrition was both chronic and recent in nature. Prevalence of wasting, stunting and underweight was 21.2%, 47.4% and 51.7%, respectively, among the children in the age group of 6 to 8 years. Prevalence of stunting and thinness was 53.6% and 53.9%, respectively, among the children in the age group of 9 to 14 years of age group.

Chowdhury et al. (2008) studied 216 boys and 226 girls from randomly selected primary schools and found that the prevalence of undernutrition among school children were as follows: stunting 17.9%, underweight 33.7% and wasting 29.4%. Severe stunting, underweight and wasting were found in 4.98%, 7.92% and 9.51% of school children, respectively. It was found that the prevalence of stunting (21.7%) and wasting in girls (35.8%) was higher in comparison to boys (13.8%) stunting and 22.7% wasting.
Under nutrition, both Protein Energy Malnutrition (PEM) and micronutrients deficiencies, directly affects many aspects of children’s development. In particular it retards their physical and cognitive growth and increases susceptibility to infection, further increasing the probability of malnutrition (Panda, 2008).

Hall et al. (2001) stated that Iron Deficiency Anemia (IDA) is one of the world’s most widespread health problems, especially among school children. He found that iron deficiency is caused by poor diets and lose of blood due to warm infestations. Vitamin A is needed for the full absorption of iron and deficiency exacerbates anemia. Anemia leads to weakness, poor physical growth and a compromised immune system—decreasing the ability to fight infection and increasing mobility.

Deb et al. (2010) revealed that the mean personal hygiene score of the girls was significantly higher than that of boys. Most of the girls and boys were normally nourished as per the CDC growth chart. Over 70% of the children were suffering from one or more morbidities, the most common morbidity in both the sexes being pallor, followed by worm infestation.

Nutrition Foundation of India (NFI) (2004) survey indicates that the daily intake of most foods in Indian households except for cereals and millets (470 gm) is much below the Recommended Dietary Allowance (RDA). The diets provide negligible amounts of protective foods like pulses (29 gm) and vegetables consumption of green leafy vegetables (<10 gm) and other vegetables (70-80 gm), which are rich sources of micronutrients like beta-carotene, folate, calcium, riboflavin and iron, is woefully inadequate. Intake of visible fat is less than 60% of the RDA.
Several studies show that food alone does not guarantee improved nutritional status. A study in Ethiopia found that differences in food availability and access had limited effect on the differences observed in child nutritional status (Pelletier et al. 1995). This could be because a child's nutritional status is a function of not only the quality and quantity of the dietary intake but also a function of morbidity, child caring and feeding practices, and household variables such as income and parental education. Further in developing countries, poor health status of children is exacerbated by poor and inadequate: health facilities and services, immunization, safe water and sanitation, and health education programs (Clay and Stokke, 2000).

According to Guthrie (1979) the techniques by which attempts are made to assess the nutritional status include physical or anthropometric measurement, dietary evaluation, clinical observation and biochemical analysis. Davidson and Passmore (1963) have also listed the above methods for the evaluation of nutritional status of children.

Anthropometric Measurement

According to Sachdev and Choudhary (1995) for practical purposes, anthropometry is the useful parameter for assessing nutritional status of children. As the nutritional intake and environmental factors influence the body size and growth, the classical use of anthropometry serve as the most readily available method of nutritional assessment and therefore is logical. Anthropometric measurements such as height, weight, mid-arm circumference, skin fold thickness are valuable indicator of nutritional status (Guthrie, 1979).

Macy et al. (1957) and Rao (1961) indicated that body measurement such as weight and height, if properly obtained and interpreted would
serve as useful physical sign in the evaluation of nutritional status. Bhasin et al. (1990) also observe that anthropometry offers a reliable method to assess the nutritional status of school children.

Frisancho (1984) stated that anthropometric measurement has become an indispensable approach for the evaluation of nutritional status of children and adults. Anthropometric variable are indicators of body composition for which inferences about nutritional status may be made. In comparison to laboratory test based on blood or urine specimen anthropometric methods offer several practical advantages, costs are minimum and initiative may be taken by a variety of professionals.

**Weight**

Weight is the anthropometric measurement most in use. In developing countries the prevalence of malnutrition appears to be best indicated by weight deficiency. Jelliffe (1966) has noted that body weight standard can best compare with locally prepared standard.

Bhasin et al. (1990) studied weight and height of 4,405 school children in the age group of 5 to 15 years both boys and girls in Haryana. In this study they found that weight of boys and girls were uniformly heavier than their counterparts in comparison to Indian Council of Medical Research (ICMR), (1989) study for all ages and the results were statistically significant (p<0.05) for all ages and for both sexes except male children in the ages of 13 and 14 years where the results were not significant (p>0.05). They found that mean weight of boys ranged from 19.13 kg to 52.8 kg and of girls from 18.12 kg to 48.52 kg.

Mohaptra et al. (1998) from Orissa conducted a cross sectional study in 4004 school children 5 to 15 years on health and nutritional profile of young children in Orissa. The mean weight and height of
respective age groups were compared with data from well to do subjects from India, NCHS standards, it was observed that the mean weight and height of Orissa school children were lower than the referred standards.

Devi and Mayuri (1999) in a study of physical development of rural school children observe that weight of girls were marginally better than that of boys. The physical measurement gradually increased from 6 to 12 year. The boys were found to be heavier than girls up to 10 years and from 10 to 12 years girls measured more than boys for weight.

**Height**

School age is a period of growth and development. It is at this time that acceleration in weight and linear growth as well as further development takes place in children. It is well established that the time of maximum growth in height is closely correlated with sexual maturation. Several studies found that the menarche always occurs after the greatest increase in height (Bhasin et al. 1990; Rao et al. 1998; Anand et al. 1999).

Bhasin et al. (1990) in a study on height and weight of well to do school children in Haryana, observed that the range of mean height of boys extends from 112.68 cm to 116.17 cm with total increment of 53.49 cm. In case of girls the range of mean height extended from 111.9 cm to 161.25 cm with a total increment of 49.35 cm.

Devi and Mayuri (1999) in her study of school children in Andhra Pradesh indicated that stature of boys were shorter than well to do boys of ICMR by 5.10 cm to 8.45 cm with increasing age and were measuring 93 to 95% of ICMR standard. With reference to NCHS standards the differences were between 3.12 cm to 6.45 cm with increasing age and were measuring 95 to 96%. They observed that the low weight and stature of children might be due to the low socio-economic status. The
growth performance in stature was found to be better as compared to weight. Agarwal et al. (1992) have shown that growth performance of Indian children failed to catch up like that of western counterparts even under the best of economic and environmental conditions.

Rita and Singh (2001) in a study which was carried out at nine states of India on nutritional status of Indian school children found 83% of children were malnourished based on Gomez classification, in which 35.5%, 39.5% and 8% children were suffering from grade I, grade II and grade III degree of malnutrition, respectively.

Sujatha (1997) in her comparative study of children in municipal schools in Visakhapatnam city on health status of 2938 school children found that according to weight-for-age criteria 79.04% children were undernourished and according to height-for-age 66.89% children were stunted. Devi and Mayuri (1999) in a cross sectional study on physical development of 1657 rural school children of Andhra Pradesh, calculated the growth profile by using body mass index formula. They observed that about 58.4% of boys and 48.5% of girls to be in the category of moderately malnourished. The overall prevalence of malnourished children was 53.45%, the severely malnourished children were found to be 40.5% in boys and 37.3% in girls. The overall prevalence of severely malnourished children was 38.4%. They concluded that nearly two third of sample children were in the category of moderately malnourished followed by severely malnourished and normal categories.

**Clinical Examination**

Clinical examination is an essential feature of all nutritional survey since their ultimate objective is to assess level of health of individuals or of population group in relation to food they consume. It is also simplest
and the most practical method of ascertaining the nutritional status of a group of individuals (Park, 2005).

Nutritional deficiencies were widely prevalent in rural and urban school children due to poverty, ignorance and high incidence of infection. Agarwal and Singh (1999) established that under nutrition, anemia and vitamin A deficiency were common even in higher socio-economic strata. The significant health problem at this age need prior attention as any deviation from normal health in this age group is likely to have adverse consequences in future. This may be possible, if periodical clinical examination of school children is adopted to combat it.

Mohaptra et al. (1998) in Orissa in a study on nutritional status of school children aged 5 to 15 years investigated that the prevalence of significant anemia was 32.3% in boys and 37.2% in girls.

Ingale (1985) in a study on nutritional status of school children 6 to 12 years in Nagpur noted that overall prevalence of anemia for both sexes and all ages to be 73.1%. The overall prevalence of anemia in male and female was more or less similar, 72.8% for boys and 73.4% for girls. The prevalence showed a decreasing trend with increasing age of children.

Agarwarl and Singh (1999) in a study of 1144 school children of Mumabi observed that sign of vitamin A deficiency was limited to conjunctival xerosis as bitot's spots and none had night blindness, with overall prevalence of 7.2%. In Orissa, Mohaptra et al. (1998) recorded the prevalence of vitamin A deficiency to be 10.6% in school children aged 5 to 15 years. Mukta and Singh (1998) in a study on nutritional status recorded the prevalence of vitamin A deficiency to be 5% in the urban school children aged 6 to 9 years from low socio-economic group of Jaipur city.
Again Mohaptra et al. (1998) recorded the sign of vitamin B complex deficiency like angular stomatitis, cheilosis and glossitis in 15.2% of children of age group 6 to 12 years of Nagarpur. Sujatha (1997) in a comparative study on health status of school children aged 5 to 13 years in Visakhapatnam revealed the prevalence of vitamin B complex deficiency to be 2.26%, 4.74% and 9.22% in municipal, private and rural school, respectively. The overall prevalence in boys was 4.76% and in girls 4.18%. National Nutrition Monitoring Bureau (NNMB) (2000) noticed a definite age trends in the prevalence of oral lesions of angular stomatitis, red raw tongue, cheilosis etc., indicative of vitamin B complex deficiency, with highest prevalence being in school age group.

Itoo (1994) quoted that in Orissa, the prevalence of caries was higher among children of both sex of low socio-economic status with prevalence of 75.4%. Agarwal and Singh (1999) observed dental filling in 26.1% of girls (5 to 15 years). The overall prevalence of dental caries was found to be 46.8%, with the prevalence in primary section 61%. In a comparative study Sujatha (1997) observed a reverse trend i.e. prevalence of dental caries being more in girls than boys. She reported that prevalence to be 17.56% in boys and 22.18% in case of girls. On comparison in municipal, private and rural schools she observes the prevalence of dental caries to 34.16%, 5.33% and 7.80%, respectively.

**Child and social factors**

With regard to child and family variables Devi and Mayuri (1999) observed that age, class, parental education, occupation, caste, the socio-economic status had significant relationship with physical development of children. Family size, family type and ordinal position of the children were not related to the child’s physical development. Contrary to these
findings, Sellen (1995) in a bicultural study of child growth performance in relation to diet and social and nutritional status of children in Tanzania established that nutritional status of children was directly associated with age, sex and birth order.

Zalilah et al. (2000) carried a cross sectional study in Malaysian school children and found the male children had significantly lower mean for height-for-age than female children and also children from higher income group had higher mean for height-for-age indicating that height was significantly related to household income. They found that none of the other factors like age, birth order, number of children and household size etc. show any significant relationship for nutritional status of children.

Zalilah et al. (2000) in a study in Kuala Lumpur found 52%, 47% and 36% of the school children were significantly under weight; stunted and wasted, respectively. Prevalence of underweight was 56.5% in boys and 42.6% in girls and 38.3% and 32.6% in boys and girls, respectively. Altogether more boys than girls were found to be experiencing some form of malnutrition. The findings indicate that malnutrition is still prevalent among older children although a majority of them were mildly malnourished.

**Family Size**

In a study of nutritional status of school children of Nagpur, Ingale (1985) observed that according to family size and nutritional status as per ICMR weight-for-age standard, children with family size up to six, were 58.1% normal, 20.2% were in grade I, 17.8% in grade II and 3.9% were in grade III. In families with size seven or greater, 51.2% were in normal grade, 25.6% in grade I, 18.2% in grade II and 4.9% in grade III category.
In all families with size 3 to 7 and above not a single child belonged to grade IV. In families with 3 to 4 members, only 24 to 26% were in grade I and grade II and rest about 73 to 75%, were in normal grade. While in families with family size from 2, 3 and 4, there was no child who belonged to grade III and grade IV. She concluded that family size is significantly associated with nutritional status of the children. Louise (1996) in her study also found that nutritional status was related to family size, income and ethnic origin. Whereas Devi and Mayuri (1999) established that family size was not found to be related with the child’s physical development. Zalilah (2000) in Malaysian children revealed that household size, as a factor did not have significant association with nutritional status of children.

Types of Family

Doan (1989) in a study on nutritional status and family structure in Jordan found that children in extended families were shown to have lower weight-for-age on an average than children in nuclear families, after controlling. The other factor’s effect was more intense for girls. In addition, the growth of girls was significantly lower than boys in crowded households. In his analysis he also yielded a significant interaction between nuclear families and better nutritional status.

In a study on home environment and development, Vazir et al. (1998) assessed that small family size was found to be important for positive development. He reported that nuclear families were significantly related to better nutritional status.

Income

The standard of living of the family is an important factor determining the health of the individual. Children from well to do
families have better height and weight. Gopalan (1992) compared the data collected by Nutrition Foundation of India (2003) on height and weight of children by affluent section of the population for five large cities of India viz. Ludhiana, Delhi, Varanasi, Calcutta and Bangalore, with data collected by National Nutrition Monitoring Bureau (NNMB) (2004) on height and weight of poor children in the country, showed striking difference in the growth performance. The height and weight of poor Indian children were much lower than the affluent children.

2.4 ACADEMIC ACHIEVEMENT OF SCHOOL CHILDREN

Nutritional deficiencies are a major problem in school children in India and have a variety of adverse effects on their cognitive development and growth and increases susceptibility to infections. There is strong evidence for beneficial effects of iodine, protein and energy on cognitive development in children, while evidences for vitamin B₆, vitamin B₁₂, folate, zinc and omega-3 fatty acids and in particular Docosahexanoic Acid (DHA) is limited and inconclusive. The institute further found that the children consuming products containing omega-3 fatty acids with micronutrients will have statistically significant higher scores and higher improvement in scores on cognitive tests, will grow taller and have a better immune response than children consuming control products (St. John’s Research Institute, 2007).

Grantham (2005) found evidences from his study on health and nutrition in early childhood that there is reasonably good evidence the early childhood malnutrition, moderate and severe stunting and underweight (low weight-for-age) are associated with poor cognitive development, behavior and academic achievement in later childhood.
Banerji (2000) conducted a study on the academic achievement of primary school children from Mumbai and Delhi and found that the average scores were lower than expected. The mean score for language was only a little above 75% while that in math was less than 72%. A large number of the children did not have mastery over basic language and math skills. A fourth of the children tested could not correctly read and write letters of the alphabets or simple words, 33% could not correctly recognize and numbers 1 to 100.

Zalilah et al. (2000) conducted a study in Kualalampur in Malaysia on urban primary school children to investigate the relationship between nutritional status and educational achievement and found that a majority of children obtained optimum scores (>75) for Malay language and Mathematics and >50 children had insufficient scores for English language. It was also found that the total scores of children’s were significantly associated with household socio-economic status, gender birth order and height-for-age. The height-for-age reflects the accumulation of nutritional deprivation throughout the years, which may consequently affect the cognitive development of children.

Goyal (2007) studied the learning outcomes in grades IV and V of government, private aided and private unaided schools in three tests—two language tests (reading comprehension and word meaning) and one test in mathematics. The survey results showed that overall learning levels were low absolutely and relatively in government schools. The average percentage of correct scores in government schools ranged from 40-50 points, a quarter to a fifth below the average scores in private schools.

Singh and Shrivastava (1983) reported that the illiteracy of parents has negative effect on the achievement of younger children i.e. up to 6 to
8 years old and not on the achievement of 10 to 13 years old children. However, Sharma (1984) reported the significant positive correlation between parental education and academic achievement.

Valeski and Stipek (2001) stated that to make the most academic progress a child needs to be involved in what is going on in class. The better first graders feel about their academic skills, more engaged they tend to be; and conversely, the harder children work in school, the more self confidence they develop about their academic ability.

National Research Council (NRC) (1993) found that the socio-economic status (SES) can be a powerful factor in educational achievement—not in and of itself, but through its influence on family atmosphere, on choice of neighbourhood, on quality of available schooling and on parent’s way of rearing children.

Pungello et al. (1996) showed that the children those from low-income families tended to have lower reading and math achievement test scores, and the income gap in math achievement widened as time went on.

Pollack (2005) find out that the educational outcomes of children in stable blended families are substantially worse than of children reared in traditional nuclear families.

Considine and Zappala (2002) found a relationship between family socio-economic status (SES) and the academic achievement of children is well established.
2.5 MID DAY MEAL SCHEME AND NUTRITIONAL STATUS OF SCHOOL CHILDREN

Potterion and Dawjee (2004) found that there is little evidence to suggest that school feeding program have a positive impact on nutritional status on the participating children.

Kanani and Gopaldas (1998) conducted study on the nutritional status of underprivileged MDMP beneficiaries. It was found that the ‘stunted’ and ‘wasted’ affected more between 10 to 15 years old children where anemia was present in 73% of boys and 67% of girls. 11% boys and 4% girls were classed as “active cases of xerophthalmia (night-blindness with conjunctival lesions)”. Parasitic infestation was detected in 44% boys and 35% girls. Out of the total school enrolled children only 12% consumed mid day meal on site, the rest shared it with siblings. Thus they concluded that the beneficiaries of MDMP have a poorer nutritional status.

Gopaldas (2003) evaluated Gujarat improved MDMP (1993-1996). The implementer was commissionerate of Mid Day Meal Program, Government of Gujarat and the program involved nearly 3 million school children prior to improved Mid Day Meal Program (MDMP). It was found that the prevailing nutritional health problems of deprived school children included raw hunger, unsafe water, intestinal worms, malaria, Iron Deficiency Anemia (IDA), vitamin A Deficiency (VAD) and Iodine Deficiency Disorder (IDD). The older boys and girls (11 to 15 years) were found to more under nourish than younger children. Impediments to active learning were impaired cognition and physical work capacity, night blindness and impaired vision, absenteeism due to illness, tiredness and irritability. After the improved MDMP that consisted of deworming and
vitamin A dosing twice a school year (in ferric sulphate (60 mg elemental iron tablets) 2 times per week in the classroom and iodized salts in cooked meals. It was found that the dosed vs. undosed school children was 1.1 kg heavier and 1.1 cm taller; haemoglobin level were >12 g/dl; intestinal parasitic infection prevalence rates dropped from 71 to 39%; prevalence of night blindness and vitamin A deficiency fell from 67 to 34%. Thus, it was concluded that the improved MDMP had a positive impact on nutritional status of school children and if it continued the nutrition health problem in these children may reduced.

The impact of school feeding program on nutritional outcomes is very thin. The school feeding does indeed improve the immediate nutritional intake of children (Jacoby, 2002; Afridi, 2005) and school participation rates (Afridi, 2005; Dreze and Goyal, 2003), the effect of these program on learning cognitive skills and on longer term nutritional status, is not clear. The effect on long term nutrition is even more of a mystery. Quigly and Watts (2005) supports a relationship between regular school feeding consumption and nutritional adequacy with having a significantly healthier nutritional profile than non-recipients.

Harber and Davies (1997) note that in South African school children the school feeding program had remarkable results. However, worm infestation is a further concern and that this has an impact on nutrient absorption. Poor concentration, slowness to catch up and memory loss are the other effects of worm infestation.

Laxmaiah et al. (1999) found that about 9.5% of children in MDM schools and 9.1% in NMDM school had one or more signs of deficiency, either B-complexes and vitamin A or clinical anemia (pallor). The proportion of children with <70% of weight-for-age was marginally
lower in MDM schools than their counterparts in NMDM schools. The percentage of normal was also higher in MDM areas (3%) as compared to areas of NMDM (1.3%) also the percentage of wasted (current malnutrition), stunted (long duration malnutrition) and wasted and stunted (current and chronic malnutrition) was lower in MDM schools (3.6%, 50.8% and 4.4%, respectively) as compared to NMDM schools (4.8%, 54.1, and 4.6%, respectively). They concluded that the children who are receiving MDM have a better nutritional status than those of non-receivers.

Seetharaman (2001) carried out study to find out the impact of MDM on nutritional status of children aged 9 to 12 years in U.P. and Rajasthan. He found that the nutritional status of urban children was found to be better than that of the rural and slum children. He concluded that the MDM did not make any appreciable and significant impact on improving the nutritional status of school children. One important impact was that it reduced dropouts among the girls.

Afridi (2005) found that daily nutrient intake of program participants increases by 49 to 100%; the program reduces daily protein deficiency of participants by 100% and calorie deficiency by almost 30%. Contradictory to the above, Semeoal et al. (2006) found that the expected height-for-age as per ICMR standards was less in both boys and girls of all ages. Prevalence of wasting and stunting in MDM children was high (52.6% wasted and 26.3% stunted) than NMDM children. The 10 to 14 years old was affected most 28.4% had anemia with girls suffering more (30.2%) than the boys (26%). Thus the study reveals the poor nutritional status of school children in spite of MDMP.
Belur (2009) revealed that nearly 93,000 students in schools where MDM was given regularly are anemic and that at least 18,000 children suffer from vitamin A deficiency. The check-up revealed that at least 10% of the program participants were suffering from one or the other ailment raising fears of the quality of MDMS being provided to them.

Gopaldas (2003) stated approximately one fifth or 200 million Indians are of primary school age (6 to 14 years). Most of schoolers come from poor and under privileged home and go to free schools. The partnership for child development analysed the anthropometric data of 5 countries namely- Ghana, Tanzania, Indonesia, Vietnam and India. India’s schoolers in Gujarat had the dubious distinction of having the worst height and weight profiles. They were found to be stunted or short; and were skinny or underweight, in spite of being a regular recipient of mid day meals. Thus it was concluded that the school meal program is not fulfilling its purpose of improving nutritional status among school age children.

Agarwal et al. (1998) found that the problems of malnutrition and ill health cannot be over come by school meal program which provides less than 15% of the recommended daily allowance for calories. The nutrition status appeared to be the most important determinant of scholastic performance where the school feeding program did not contribute to it.

Dall’ Acqua (1991) examines the impact of school lunch programs on the consumption of calories and protein by school children. It was found that access to the school lunch program is associated with an increased availability of 357 calories and 8.5 grams of protein per
student. Thus the school lunch program is contributing to good nutritional status of children.

2.6 MID DAY MEAL SCHEME AND ACADEMIC ACHIEVEMENT OF SCHOOL CHILDREN

Powell and Mathews (1998) found that the participation in the Jamaican school breakfast program was positively and significantly related to arithmetic tests scores, but this study failed to find significant effect on spelling and reading test scores. Later they found that participation in Jamaican school program was not significantly related to test scores over all, although it was positively and significantly related to test scores among young children. Finally, Jacoby et al. (1996) found that participation in the Peruvian breakfast program was not significantly related to academic achievement over all, although they did find positive effects on vocabulary scores among a subset of heavier children they hypothesized to be undernourished.

Grantham (2005) suggested that missing breakfast has brief, temporary negative effects on some measures of cognitive performance and conversely providing a school breakfast has some positive acute benefits. The study also reported possible associations between school breakfast program and grades found that grades in arithmetic improved for participants in school breakfast program but benefits for other subjects were less likely and inconsistent. Study suggests that “under nourished and younger children are more likely to benefit.”

Laxmaiah et al. (1999) conducted study to find out the association between MDMP and educational attainment in children for this purpose marks obtained by each child in the preceding annual examination were collected from the school records. It was found that the majority of
children (76 to 80%) in both MDM and NMDM areas obtained marks between 40 to 70% that is grades ‘B’ and ‘C’. The proportion of students, who secured grade ‘A’, was marginally higher in MDM schools (13.1%) as compared to NMDM schools (10.3%).

Dairy Council Report (2002) study reveals that participation in school meal program such as the School Breakfast Program (SBP) is positively associated with student’s learning and academic performance. Providing free school breakfast to all students has been demonstrated to alleviate morning hunger, decrease student absenteeism and tardiness, improve children’s grades and psychosocial functioning and provide other benefits.

Ibrahim (2003-04) observed that the active children in the class are usually who receives breakfast either at home or participant of school feeding program. He found the appreciable role of school feeding program in increasing the scholastic performance of the school children, but at the same time it is not regular and does not cover the whole academic year.

Seetharaman (2001) found that mid day meal did not make any appreciable and significant impact on the educational outcomes of children. The educational achievement of the children in general was found to be strongly influenced by their nutritional intake.

Meyers et al. (1999) concluded that the school breakfast program (SBP) is giving appreciable effect on the academic achievement of school children. The improvement in low income group children’s academic functioning is found to be associated with SBP.

Simeon (1995) evaluated the impact of school meal on achievement of school children (12 to 13 years old). Children received a
school meal (milk 130 kcal, cake 25 kcal or patty 600 kcal), a syrup drink (33 kcal) or nothing. It was found that the arithmetic achievement improved but there was no change in spelling correction.

Moore and Kunze (1994) examined school feeding programs directly to determine the impact on academic performance. In 22 out of 30 schools, the success rate on a national exam for fifth grade pupils was higher for schools that had school feeding programs. Other studies conducted by World Food Program (2001) found that a school meal was positively related to children's performance on year-end tests.

The school feeding programs aims to enhance concentration span and learning capacity of school children by reducing short-term hunger in classroom, and by contributing to the alleviation of under nutrition. A standard achievement test was administered to primary school students of IV and V grades in program and control areas, and the test scores used to assess the impact of SFP on learning performance of SFP participating students. The results show that SFP has a statistically significant positive impact on learning. The participation of SFP increases test scores by 15.7% points. Interestingly, participating students do especially well in mathematics they score 28.5% higher in mathematics than do their counterpart students in control group (Akhter, 2004)

2.7 NUTRITION AND ACADEMIC ACHIEVEMENT OF SCHOOL CHILDREN

Diet (i.e. ingested foods and their nutrients and constituents) provide the energy needed for internal organs and affects metabolic pathways. The specific content of the food affects certain biochemical and hormonal function in the body and brain, thus linking diet to behavior and cognition.
Poor nutrition during time of critical brain development affects future cognitive outcomes (Levitsky and Strupp, 1995).

Nutrition during early infancy can further affect the growth and development potential of young children. A healthy child has nutritional requirements for periods of rapid growth and development. Malnutrition in early life is directly linked to poorer outcomes in school achievement and nutritional status in children. The study has shown that the children with under nutrition or stunting perform less well on cognitive tests and academic measures than well nourished children (Morely and Lucas, 1997). Iron Deficiency anemia has a negative impact on a child’s ability to learn, through poorer attention span and memory and also increases the risk of lead poisoning, thus reduces the school achievement level of children. The research studies indicate that under nutrition during any period of childhood, even for relatively short term episodes, can have negative effects on the cognitive development thus leads to poor school performance among children (Centre on Hunger, Poverty and Nutrition Policy, 1998).

Ibrahim (2003-04) suggests malnutrition disorders affect more than 30% of school children. Iron deficiency anemia is by far the most common nutritional disorders. But sub-clinical vitamin A deficiencies and other micronutrients are also present in school children that are causing a great hindrance in academic achievement of children because the malnutrition affects the cognitive and intellectual power of these children. The attitude of the school teacher was found negligible towards the nutrition as a cause of poor scholastic performance school teacher
perceives malnutrition only as low body weight. They did not correlate it with school achievement.

Iron and iodine are critical for cognitive development. Iron deficiencies may render children in attentive and uninterested in learning. Iron supplementation was shown to improve IQ (Intelligent Quotient) of previously iron deficient children (Seshadri and Gopaldas, 1989). Evidences also showed that the children who suffer from iodine deficiencies are more likely to perform poorly than those without (Rosso, 1999).