Dietary Habits and Physical Activity Pattern Of Rural and Urban School Going Children (10-12 years)

Karthika, U

(12PFN006)

Thesis submitted to

Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore- 641 043

In Partial Fulfilment of the Requirement

for the Degree of

Master of Science in Food Science and Nutrition

March, 2014

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"No one who achieves success does so without acknowledging the help of others. The wise and confident acknowledge this help with gratitude".

- Alfred North Whitehead

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INTRODUCTION

I INTRODUCTION

"Physical fitness is not only one of the most important keys to a healthy body; it is the basis of dynamic and creative intellectual activity"

-- John F Kennedy

The period of childhood between the ages 4 and 13 is characterized by continued physical growth and rapid cognitive, emotional and social development. Many children especially girls, undergo their pubertal growth spurt between ages 4 and 13. This period of childhood precedes adolescence, the transitional stage of development between childhood and adulthood (Drake, 2008).

School children form an important vulnerable segment of population and constitute about 20 per cent of total population of India. School age is a dynamic period of growth and development as children undergo physical, mental, emotional and social changes during this stage (Chandna and Seghal, 2004).

The period that begins after infancy and lasts until puberty is often referred to as the latent or quiescent period of growth- a contrast to the dramatic changes that occur during infancy and adolescence. Bose et al., (2007), view that although physical growth may be less remarkable and proceed at a steady pace than it did during the first year, these preschool and middle school years are a time of significant growth in the social, cognitive and emotional areas.

School age is considered as a dynamic period of growth and development because children undergo physical, mental, emotional and social changes. In other words the foundations of good health and sound mind are laid during the school age period (Srivastava, 2012).

Nutritional status is defined as the state of the body in relation to the consumption of and utilisation of nutrients (Victor, 2013). Good nutrition throughout childhood is important not only to support normal growth and cognitive development but also to establish healthy eating patterns that are associated with decreased risk of chronic diseases in adulthood, including obesity, type II diabetes, cardio vascular diseases, metabolic syndrome and osteoporosis.

The nutritional status of school-aged children impacts their health, cognition, and subsequently their educational achievement (Best et al., 2010). Nutritional status during school age is a major determinant of nutritional and health status in adult life (Weaver, 2007). Socio economic status, environmental factors, parents occupational and educational status are the main factors associated with children's nutritional status (Sylvia Subapriya and Sujatha 2011).

Proper nutrition is essential in keeping children healthy and able to grow and develop properly. Poor eating behaviours lead to poor nutritional status and can affect growth and development of children (Butchoko, 2004).

India is home to the greatest population of severely malnourished children in the world. Childhood malnutrition is a massive crisis caused by a combination of factors including inadequate or inappropriate food intake, childhood disease, and improper care during illness. According to National Family Health Survey of India, 55 per cent of children living in rural areas suffer from malnutrition compared to 45 per cent children in urban areas. The age demographics showed that about 32.2 per cent of the population who are malnourished are less than14years of age (www.unicef.org /infoby country/ india.html).

World vision, a development and advocacy organisation, has implemented a project in collaboration with ICDS to tackle child malnutrition in Coimbatore district. The survey found that 45 per cent of children are malnourished in 26 urban slums in the district, 282 children in these slums have been identified as either severely or moderately malnourished (The Hindu, 2013). There is high prevalence of underweight among rural areas whereas rate of obesity has increased among urban population.

"To eat is a necessity, but to eat intelligently is an art."

-- La Rochefoucauld

Today obesity is one of the most serious health problems among children. Obesity is considered to be caused by an over consumption of energy rich foods and reduced energy expenditure or a combination of both. A positive energy balance is the traditional explanation of the origin of overweight and obesity. It has risk factors for cardio vascular diseases, including high cholesterol levels, high blood pressure and abnormal glucose tolerance (Rajiv, 2009).

Behaviour, genetic factors and environment play an important role in BMI, which means that family, school and community can contribute to childhood obesity (Fisher et al., 2009).The relationship between obesity and lifestyle factors is necessary for effective prevention and management of obesity in children (Hazzaa, 2012).

Over eating along with a sedentary life style, contributes to obesity. High consumption of soft drinks and junk foods with sugar, caffeine, salt, preservatives and hydrogenated fat might contribute to childhood obesity, diabetes and other ailments in adulthood (Gururaja, 2006). According to Nybelen et al. (2005), dietary patterns of high intakes of saturated fatty foods and low intakes of fruits and vegetables are linked to increased risks of Coronary Heart Disease, certain cancers, diabetes, hypertension and obesity.

A study conducted in different parts of India (Punjab, Maharashtra, Delhi and South India) reported that prevalence of childhood obesity ranged from 3 per cent to 29 per cent and also indicate that the prevalence is high in urban than in rural areas (Chhatwal, 2011).

Around 19 per cent of the children in Tamil Nadu had a higher BMI than normal or were overweight and 18 per cent were under nourished with a lower BMI than normal (Times of India, 2014). Children across the country showed an alarming lack of fitness, as the children were unfit with BMI scores of 39 per cent (East and North), 38 per cent (West), and 37 per cent (South and Central) (Times of India, 2014).A nation-wide study found that one in every five children in Tamil Nadu is either overweight or obese (Times of India, 2014).

"Those who do not find time for exercise will have to find time for illness **"**

- Edward Smith Stanley

Physical activity is defined as any bodily movement produced by skeletal muscles that require energy expenditure. It is recommended that children get at least 60 minutes and adults get at least 30 minutes of moderate activity on most days of the week. Physical inactivity has been identified as the fourth leading risk factor for global mortality causing an estimated 3.2 million deaths globally (World Health Organization, 2014).

Physical activity presents a physiological stress to the brain that when balanced with recovery promotes adaptation and growth, preserves brain function and enables the brain to respond to future challenges (Mattson, 2004). Physical movement is a medicine for creating changes in a person's physical, emotional and mental stress (Weilch, 2007).

Physical activity can regulate the appetite, help overweight people to lose fat, and help underweight to gain weight (Lenor, 2004). In childhood and adolescence physical activity improves strength and endurance, helps build healthy bones and muscles, helps control weight, reduces anxiety and stress, increases self-esteem and may improve blood pressure and cholesterol levels (Daniels, 2012).

Good nutrition and adequate physical activity both are important throughout life. The amount of exercise an individual gets influences ones nutritional status and overall health. In turn, diet and nutritional status can influence exercise performance (Smolin, 2009).

Physical inactivity is an important risk factor for many chronic diseases and contributors to obesity and poor mental well-being (Mindell *et al*., 2013). According to Stodden *et al*., (2008), children who engage in physical activity during childhood and adolescence are likely to be physically active adults. Children need to be active every day to promote their healthy growth and development. Kids who establish healthy lifestyle patterns at a young age will carry their benefits forward for the rest of their lives. Physical activity can help children cope with stress. It also promotes healthy growth and development, better self-esteem, stronger bones, muscles and joints, better posture and balance, a stronger hearts, a healthier weight range, social interaction with friends, learning new skills, better focus and concentration (http://www.healthy familiesbc.ca).

New studies have shown that when children increase their level of physical activity, they experience positive health benefits, which include less body fat, increased muscular and reduced risk factors for major diseases were diabetes, cardiovascular disease and other metabolic and life style related disorders, quickly. Children who exercised three hours in the morning and three hours in the afternoon doing a number of activities reduced 6 to 8 kilograms. Their blood pressure went down and insulin sensitivity improved and they had a reduction in total cholesterol. The overall metabolic health of these children was improved (The Times of India, 2014).

School age children should participate daily in 60 minutes or more of moderate to vigorous physical activity that involves a variety of activities (William *et al*., 2005). Physical activity levels should be higher than the current international guidelines of at least 1 hour per day of at least moderate intensity to prevent clustering of cardio vascular disease risk factors (Anderson *et al*., 2006).

School settings offer significant potentials to increase physical activity in children and several school based interventions have successfully increased physical activity in the children. Schools have the potential to increase physical activity in more than 50 million children (Howie *et al*., 2012).

Physical activity throughout the school day has also been shown to have positive benefits on academic achievement (Wechsler, 2004). Adding physical education to school curriculum has been correlated with modest improvements in academic performance (Dishman, 2008).

A positive correlation between physical activity and seven categories of cognitive performance (perceptual skills, intelligence, quotient, achievement, verbal tests, mathematics tests, developmental level/academic readiness and other) among school aged children was shown by Sibley *et al*., (2008).

Skipping breakfast can affect children’s physical and mental development (Sethi and Dangwal, 2006). Studies suggest that brain functioning is sensitive to short-term variations in nutrient availability. A short fast may impose greater stress on young children than on adults, resulting in metabolic alterations as various homeostatic mechanisms to work to maintain circulating glucose concentrations (Hoyland, 2009).

With this background the study on **"Dietary Habits and Physical Activity Pattern of Rural and Urban School Going Children (10-12 yrs)"** was framed and carried out with the following objectives:

To

- elicit information on socio economic, anthropometric and life style pattern of selected school going children in rural and urban areas
- analyse the food and nutrient intake pattern of selected subsample
- assess their Physical Activity Level (PAL) by a record of daily activities for a period of five days and
- compare the actual food intake with Physical Activity Level (PAL) of selected subsample

REVIEW OF LITERATURE

II. REVIEW OF LITERATURE

The review of literature pertaining to the present study on "**Dietary Habits and Physical Activity Pattern of Rural and Urban School Going Children (10-12 years)**" are presented under the following headings:

A. Significance of children and their nutritional requirements
B. Nutritional status and common nutritional problems among children
C. Dietary habits and eating behaviour of children and
D. Importance of physical activity among children

A. SIGNIFICANCE OF CHILDREN AND THEIR NUTRITIONAL REQUIREMENTS

The period of childhood between the ages 4 and 13 years is characterized by continued physical growth and rapid cognitive, emotional and social development (Drake, 2011).

The requirements of children are higher in proportion to body weight compared with adults due to their increased growth and metabolism (Bier, 2009).

Good nutrition throughout childhood is important not only to support normal growth and cognitive development but also to establish healthy eating patterns that are associated with decreased risk of chronic diseases in adulthood, including obesity, type II diabetes, cardio vascular diseases, metabolic syndrome and osteoporosis (Singh, 2007).

ENERGY

Energy is needed for maintaining body temperature, metabolic activity and for supporting physical work and growth. It is also needed to promote satisfactory growth in infants and children and to maintain a constant appropriate body weight and good health in adults. The factors which influence energy needs are age, body size, physical activity and to some extent climate and altered physiological status such as pregnancy and lactation (Warnock, 2007).

Energy requirements for boys and girls aged 10 to 12 years are 2190 k.cal/ day and 2090 k.cal/ day respectively (ICMR, 2010). The increased need for energy is due to gradual increase in need because reserves are being laid down for the demands of the approaching adolescent period (Robert, 2009).

Children's growth spurt is sensitive to energy and nutrient deprivation. Chronically low energy intakes can lead to delayed puberty or growth retardation. According to Puglise, (2009) insufficient energy intake may occur because of restrictive dieting, inadequate monetary resources to purchase food or secondary factors such as chronic illness.

PROTEIN

Protein needs of children are influenced by the amount of protein required for maintenance of existing lean body mass and accrual of additional lean body mass during the growth spurt. Protein requirements per unit of height are greater for females of 10-12 years of age and for boys of 13-17 years of age. When protein intakes are consistently inadequate, reductions in linear growth, delays in sexual maturation and reduced accumulation of lean body mass is seen (Gleason and Suitor, 2001).The RDA for proteins is 39.9 g/d and 40.4 g/d for boys and girls respectively. (ICMR, 2010)

CARBOHYDRATES

Dietary recommendations suggest that 50 per cent or more of total daily calories should be consumed from carbohydrate, with no more than 10 to 25 per cent of calories from sweeteners, such as sucrose and high fructose corn syrup (Flodmark, 2008).Children consume approximately 53 per cent of their calories as carbohydrate (Osrin, 2005). Foods that contribute the most carbohydrate to the diet of children include soft drinks, ready to eat cereals, sugars, bread, syrups and jams. Sweeteners and added sugars provide approximately 20 per cent of the total calories.

FAT

The human body requires dietary fat and essential fatty acids for normal growth and development. High intakes of saturated fat have been associated with increased plasma total and low density lipo protein cholesterol in childhood and can ultimately increase the risk of cardiovascular disease (Wilson, 2008).

According to Timperio *et al*., (2009) 62.4 per cent of children often ate take away or fast food at least once in a week and 18.7 per cent are taken to fast food restaurants by parents at least once in a week. Robert (2009) warns that higher consumption of saturated fats among children will result in obesity thus causing cardio vascular disease and type II diabetes in adult life.

VITAMIN- A

Besides being important for normal vision, vitamin A plays a vital role in reproduction, growth and immune function. To ensure adequate body stores of vitamin-A, boys and girls aged 7-12 years should consume 600 µg/d (ICMR, 2010).According to continuing Survey of Food Intake by Individuals, about 0.04 per cent of total blindness in India are attributed to nutritional deficiency of vitamin-A (Sharma, 2013).

Vitamin – A deficiency also places the children at a higher risk for infectious disease. Even children who are only mildly deficient in vitamin-A have higher incidence of respiratory disease and diarrhoea and a higher mortality from infectious disease, compared to children who consume sufficient vitamin-A (Chhatwal, 2008)

According to UNICEF (2014) vitamin A supplementation twice in a year reduce the risk of blindness, infection, under nutrition and death associated with vitamin-A deficiency particularly among the most vulnerable children. The low intakes of fruits, vegetables, milk and dairy products contribute to their less than optimal intake of vitamin-A.

VITAMIN- E

Vitamin-E is well known for its antioxidant properties, which become increasingly important as body expands during childhood (Gleason and Suitor, 2003).Vitamin-E deficiency is rare and has been observed only in cases of severe malnutrition, genetic defects affecting the alpha-tocopherol protein and fat mal absorption syndrome in children (Singh *et al.,* 2007). According to National Health and Nutrition Examination survey (2006) the average intake of vitamin E for boys and girls aged 9 to 13 years were 6 mg/d and 5.3 mg/d respectively.

VITAMIN C

Vitamin C is a highly effective antioxidant and is important for immunity. It enhances the absorption of iron. This has special relevance to child health, considering the fact that iron deficiency is the most common nutrient deficiency in the world (Coleman, 2008). Vitamin C has important roles during growth and development involved in the synthesis of collagen and other connective tissues. The RDA for vitamin C is 40 mg/d for 1-17 years (ICMR, 2010).

Almost 90 per cent of vitamin C in the typical diet comes from fruits and vegetables, with citrus fruits, tomatoes and potato being major contributors (Laxmaiah, 2012).

VITAMIN D

It plays an essential role in maintaining normal calcium metabolism and is thus necessary for bone health. Severe vitamin D deficiency in infants and children results in failure of bone to mineralize, leading to rickets (Mittal *et al.*, 2003).It was believed that, in the presence of adequate sunshine in tropical environments, vitamin D deficiency was unlikely. However, several studies done in India showed that the prevalence of vitamin D deficiency across all age groups of 22-26 ranged from 40 to 90 per cent (Puri *et al.*, 2008). The FAO and the WHO (2002) recommend an RDA of 200 IU/day of vitamin D for all age groups except 400 IU/day for elderly. The RDA recommendation for Indians currently is 400 IU for all age groups wherever exposure to sunlight is likely to be inadequate (ICMR, 2010).

CALCIUM

Calcium requirements increase dramatically from about the age of 11 years known as the pre-pubertal growth spurt (Coleman, 2011).About 99 per cent of calcium in the body is found in bones and teeth. Adequate intake of calcium throughout childhood is important for proper mineralization of growing bones, attainment of peak bone mass and reduction of risk for osteoporosis in adulthood (American Academy of paediatrics, 2006).

ICMR recommends that children should take 600 mg/d as their calcium intake (ICMR, 2010).

Calcium fortified foods are widely available (eg: Fruit juices, Soy milk) many of these foods are fortified to the same level as milk (300 mg/serving) (Megan, 2007).Soft drink consumption by children may displace the consumption of more nutrient dense beverages, such as milk and juices. A study by Porter, (2009) shows that 87 per cent of girls and 64 per cent of boys between the ages of 9 – 13 years did not get enough calcium in their diet.

IRON

Iron is an essential component of hundreds of proteins and enzymes involved in various aspects of metabolism, including oxygen transport and storage, energy metabolism, antioxidant and beneficial pro-oxidant functions, oxygen sensing and DNA synthesis (Muthaiya *et al.,* 2007).

The RDA for children of 10 to 12 years is 21mg/d of iron (ICMR, 2010). Iron is stored in the body as ferritin, and serum level of ferritin is a good clinical indicator of iron status in children (Anderson, 2012).

Most observational studies have found relationships between iron deficiency anaemia in children and poor cognitive development, poor school achievement and behavioural problems. Anaemia is known to compromise all work performance, both physical and mental, but recent studies have suggested that even low iron stores without anaemia can negatively affect brain function (Russell, 2007).

The latest National Diet and Nutrition Survey (2008-2009) found that 46 per cent of 10 to 18 years children had extremely low iron intakes.

India has probably the highest prevalence of nutritional anaemia in women and children. Prevalence of anaemia among children in urban slums of Delhi was found to be 41.8 per cent. Iron deficiency anaemia was the commonest type of anaemia found in 68.42 per cent (65 of 95) children followed by B12 deficiency noticed in 28.42 per cent (27 of 95) in children (Gomber *et al.,* 2005). Anaemia is most common in vegetarians when compared to meat eaters where the bio availability is maximum (Russell, 2001).

ZINC

Zinc is essential for growth and development, immune function, neurological function and reproduction. Children are at increased risk for zinc deficiency, which can lead to delayed physical growth, impaired immunity and possibly to delayed mental development (Nissenberg, 2010).

Adequate zinc intake in children is essential in maintaining the integrity of the immune system and zinc deficiency is associated with increased susceptibility to a variety of infectious agents. Adverse effects of zinc deficiency on immune system are likely to increase the susceptibility of children to infectious diarrhoea and persistent diarrhoea (Peterson, 2010).

Zinc and iron compete for absorption, so elevated intakes of one can reduce the absorption of the other. Vegetarians who do not consume many animal derived products are at highest risk for low intakes of zinc (Drake, 2011). The RDA for children of 10-12 years should be about 9 mg/d of zinc (ICMR, 2010).

IODINE

Iodine is a critical nutrient for the proper functioning of the thyroid gland which regulates growth and metabolism. Iodine deficiency is the primary cause of preventable learning disabilities and brain damage, having the most devastating impact on the brain of the developing foetus. The spectrum of iodine deficiency disorders includes mental retardation, hypothyroidism, goitre and varying degrees of other growth and developmental abnormalities (Zimmermann, 2005).

Global estimates indicate that 31.5 per cent of children between the ages of 6 - 12 years have insufficient iodine intake. One teaspoon of iodine consumed in tiny amounts on a regular basis over a lifetime is sufficient to prevent the conditions known collectively as Iodine Deficiency Disorders (IDD) (Carter *et al., 2007*).

SODIUM

The 2010 dietary guidelines for Americans recommend that children should limit their sodium intake to 1500 mg/d to lower blood pressure and thus reduce their risk of cardiovascular and kidney diseases in adulthood (Stevent *et al*., 2003).

FLUORIDE

Fluoride is important for the prevention of dental caries. Children are more susceptible to dental caries due to their higher intake of chocolates, sweets etc (Richardson, 2007).The Food and Nutrition Board set an adequate intake recommendation of fluoride (0.5 mg/kg of body weight) to reduce the occurrence of dental caries in children. The adequate intake for boys and girls aged 9 to 13 years is 2mg/d (American Academy of Paediatrics, 2000).

B. NUTRITIONAL STATUS AND COMMON NUTRITIONAL PROBLEMS AMONG CHILDREN

Preschool and middle school years are a time of significant growth in the social, cognitive and emotional areas (Krause, 2008).The nutritional status of school age children affects their health, cognition and subsequently their educational achievement (Best et al., 2010).

Nineteen per cent of world's children live in India. India is a home to more than one billion people of which 42 per cent are children (Indian Educational Review, 2011).

i) Malnutrition in children

India stands 25th on the Global Hunger Index with 46 per cent of underweight children below 5 yrs of age (State of World Children, 2008).The present status of malnutrition in India is that all the new borns are malnourished and 30 per cent are born underweight (Onis et al., 2009).

Chronic childhood malnutrition remains common in India (Osrin et al., 2012). Socio economic status was a clear determinant for malnutrition. Nutritional deficiency signs and symptoms were more among rural children whereas nutrient intake and consumption and frequency of all the food groups were more among the urban children compared to the rural children (Monika, 2011).

Uttar Pradesh is home to about one-sixth of country's population, every sixth malnourished children in India lives in Uttar Pradesh. 72 per cent of children are underweight in Orissa and 44 per cent of children undernourished in Chhattisgarh (Alberto, 2007).The high prevalence of under nutrition and micronutrient deficiency disorders could be the important factors contributing to the high childhood mortality (Rao et al., 2008).

ii) Micronutrient deficiencies among children

Bhan et al., (2007) reported that malnutrition increases morbidity and mortality and affects physical growth and development due to specific nutrient deficiencies. WHO (2012) also pointed out that micronutrient deficiencies of iodine, vitamin A and iron are the greatest concern worldwide.

Anaemia and micronutrient deficiencies are widespread among both undernourished and over nourished children. (Fernandez, 2012).Prevalence of anaemia in 6 to12 years old in urban school children of Punjab was 36 per cent compared to 5 to 15 years old which was 77 per cent. The prevalence was as high as 93 per cent in children from Varanasi. Prevalence of anaemia among children of Delhi was 69 per cent (Gomber *et al*., 2003).

Iron deficiency anaemia affects physical growth. There is a clinical evidence for reduced immuno- competence in children with iron deficiency but it is less clear whether this leads to increased severity of infection (Edgerton et al., 2005).Vitamin A deficiency was reported to account for 0.6 million death globally and constituted the largest disease burden among micronutrient deficiencies (WHO, 2009).

Goitre, hypothyroidism, impaired mental function, retarded mental and physical development and diminished school performance was seen during childhood. Thirty two countries reported a significant proportion of their population being affected and classified as iodine deficient in 2012. Excessive iodine intake was found in twenty nine countries, potentially leading to iodine-induced thyroid function (Zimmerman et al., 2012).

Zinc deficiency was prevalent in children in developing countries where diets were low in animal products and phytates (Brown et al., 2007).Vitamin B12 deficiency was more prevalent than folate deficiency among children in Delhi (Bondevik et al., 2009).Iron deficiency anaemia was the commonest followed by vitamin B_{12} and folic acid deficiencies (Sachdev, 2005).

In linear growth faltering, energy and micronutrient intake of children were usually low. Even when energy intake was adequate, diets were often vegetarian and were low in content and poor in bio availability of nutrients like iron, calcium, zinc and vitamin A (Verbeck, 2008).

iii) OTHER NUTRITIONAL PROBLEMS AMONG CHILDREN

Obesity has become a public health concern with an ever increasing prevalence in adult and childhood populations (James and Keer, 2005).Studies have shown that 80 per cent of obese children were most likely to become obese in adulthood (Chatterji, 2006).Prevalence of obesity and overweight was higher in high income groups as compared to low and middle income groups (Kaur*et al*., 2008).

Rapid urbanization, better health care facilities, improved economic scenario and increase in the number of nuclear families with both spouses working have brought about phenomenal changes in the diet. Food habits and activity patterns resulted in the increased prevalence of overweight and obesity across the globe and across all the stages in life particularly in children and adolescents (Speiser, 2005).

Increasing obesity rates in children are attributable mainly to the substantial reduction in physical activity, methods of commuting and methods of recreation

(Fernandez, 2012).Overweight in children is associated with increased risk of hypertension, sleep apnea, dyslipidaemia, negative psychologic outcomes such as body mass disparagement and depression (Christina and Myles, 2004).

A nation-wide study found that one in every five children in Tamil Nadu is either overweight or obese (Times of India, 2014).

Food allergy was an immunologically mediated adverse reaction to food protein (Warner, 2003). Children with food allergies often have concurrent asthma. Food allergies have become a significant medical and legal concern for children worldwide as there is a rising incidence of potentially fatal hypersensitivity reactions (Husain and Schwartz, 2013). A study conducted among Swedish children showed that fruit and vegetable consumption reduced the risk of allergic disease in children (Kull *et al*., 2011).

Dental caries develops from a complex process of demineralization of the tooth and acid destruction. Acid is formed from the fermentation of carbohydrate by oral bacteria (Eastwood, 2002). A child’s diet influences dental health by affecting both tooth formation and oral environment to which teeth are subjected (Krause, 2008).

C. DIETARY HABITS AND EATING BEHAVIOUR OF CHILDREN

In nutrition, diet is the sum of food consumed by a person and dietary habits are the habitual decisions an individual or culture makes when choosing what foods to eat.

Skipping breakfast

The term “nutritionally adequate breakfast” refers to breakfast that provides at least 25 per cent of the RDA for energy (Kamath*et al*., 2012).Skipping breakfast has become the norm in modern day, because of changes in family lifestyle. When this happens largely among children, it can result in their suboptimal growth and development. Skipping breakfast can affect children’s physical and mental development (Bellisle,2004). Studies suggest that breakfast skipping is associated with increased snacking and larger meal portions for the rest of the day (Gross, 2004).

According to Sivaramakrishnan (2012), the most frequently stated reasons for breakfast skipping included not being hungry and lack of time for consuming breakfast. Other reasons stated were stress, being tired and necessity for travel.

Breakfast enhances cognition and academic performance. Missing breakfast has adverse effects on cognition. Skipping breakfast reduces the learning capacity of children (Reddy, 2005).Behavioural problems in children including decreased attentiveness, irritability and hyperactivity have been reported to be associated with the transient hunger resulting from missing breakfast. Providing breakfast to students at school has been reported to improve some cognitive functions, particularly in undernourished children (Gross, 2004).

Added sugar

Soft drink consumption by children may displace the consumption of more nutrient dense beverages such as milk and juices. A study revealed that 87 per cent of girls and 64 per cent of boys between the ages of 9-13 yrs did not get enough calcium in their diet (Hu, 2010). Displacement of milk by high sugar beverage reduces consumption of protein, calcium and vitamin B_2, B_{12} and vitamin D (Keller and Heymsfield, 2003). According to Raithel, (2002), children who drank soda and other sugar sweetened drinks were more often obese and this risk increased with each additional beverage consumed.

Serving size

Average serving sizes for foods eaten at home and away from home have increased during the past 30 years. The average serving sizes for foods frequently consumed by children like salty snacks, French fries, ready to eat cereals and soft drinks have significantly increased (Shroff *et al.,* 2012).

Foods with low nutrient density, such as soft drinks, candy, desserts and salty snacks, added sugar and fats account for 30 per cent of daily energy intake in children aged 8 to 18 years. Consumption of these low nutrient density foods is associated with higher energy intakes and lower consumption of vitamin A, folate, calcium, magnesium, iron and zinc (Briefel and Johnson, 2004).

Junk food consumption among children and its impact on health

Junk food is a slang word for foods with limited nutritional value. Salted snack foods, candy, gum, most sweetened drinks, desserts; fried fast foods are some of the major junk foods which offer little in terms of protein, vitamin or mineral and lots of calories from sugar or fat (Eddeling, 2004).

Meals and snacks based on foods prepared away from home contained more calories per eating and it was higher in total fat and saturated fat (Rockell, 2010). According to Atwood *et al*.,(2002) nutritional problems of junk food consumption included overweight, sedentary lifestyle, high intakes of energy, dietary fat, saturated fat, sugars and sodium with low intakes of calcium, fibre, fruits, vegetables and whole grains.

Among 14355 children surveyed over three years, researches from the Department of Ambulatory Care and Prevention found that 9 to 14 yrs old who increased their consumption of fried food away from home over the course of a year gained weight above the normal rate (www.consumeraffairs.com/ news04/ 2005).

Studies have found that food colourings can cause hyperactivity and lapse of concentration in children (Anuradha, 2004).A study of 120 subjects aged 6 to 12 years in Delhi indicated that the frequency of eating at the school canteen was reported to be daily by more than 50 per cent of the subjects and other outlets was reported by 62.5 per cent of the subjects (James, 2005).

A significant proportion of children’s daily energy intake is consumed during television viewing and eating highly advertised foods are two of the hypothesized mechanisms thought to affect children’s weight (Matheson et al., 2010).Candy, cookies, cakes, pies, breads, muffins, potato chips, French fries contain large amounts of sugar or carbohydrate and consumption of these lead to obesity, anaemia and poor dental caries among young children (Coon I 2002).

D. IMPORTANCE OF PHYSICAL ACTIVITY AMONG CHILDREN

Physical activity is defined as any bodily movement produced by skeletal muscles that require energy expenditure (WHO, 2014).Participation in regular physical activity helps children build and maintain healthy bones and muscles, reduces the risk of developing obesity and chronic diseases and reduce the feelings of depression and anxiety (Schneider *et al*., 2008).

Physical inactivity is an important risk factor for many chronic diseases and contributors to obesity and poor mental well-being (Parizkova, 2007).

Benefits of physical activity

- Helps in controlling weight
- Reduce the risk of cardio vascular disease
- Reduce the risk of type 2 diabetes and metabolic syndrome
- Reduce the risk of some cancers
- Strengthens the bones and muscles
- Improves mental health and mood and
- Increase the chance of living longer (www.cdc.gov)

A team from the Centre for Disease Control and Prevention (CDCP) reported that physical inactivity was associated with more than 9 million cases of cardio vascular diseases in 2001 (Patel *et al*., 2006).The prevalence of obesity in children and adolescents has become a concern over the last 20 years worldwide (Centre for Disease Control and Prevention, 2010). Freedman, (2001), warned that the potential consequences of obesity and physical inactivity are risks of coronary diseases, type II diabetes and several other chronic diseases. Children from minority backgrounds, those living closer to the poverty line are at greater risk for obesity.

School age children should participate daily in 60 minutes or more of moderate to vigorous physical activity that involves a variety of activities (William *et al*., 2005).Physical activity levels should be higher than the current international guidelines of at least 1 hour per day of at least moderate intensity to prevent clustering of cardio vascular disease risk factors (Anderson *et al*., 2006).

Metabolic syndrome as a clustering of risk factors is based on abdominal obesity, (waist circumference > 90^{th} percentile), triglycerides (≥110 mg/dl), blood pressure (> 90^{th} percentile for age, sex, height), fasting glucose (≥110 mg/dl), and reduced high density lipoprotein (≤ 40 mg/dl). Several studies showed improvements in elements of the metabolic syndrome in association with physical activity in obese and non-obese children (William *et al*., 2005).

Middle school students and elementary age students received the most cognitive benefit from physical activity (Sibley *et al*., 2003).According to Etnier (2006), adding physical education to school curriculum has been correlated with modest improvements in academic performance.

Optimal physical education programs in schools engage students on a daily basis in cognitively, socially and aerobically demanding physical activity and provide opportunities for physically strenuous play in order to inspire and instil lasting healthy behavioural patterns (Mora *et al*., 2007).Leisure time physical activity has even been to shown to offer some protection against Alzheimer disease (Kramer, 2008).

Consequences of physical inactivity

Overweight and obesity, influenced by physical inactivity and poor diet are significantly associated with an increased risk of diabetes, high blood pressure, high cholesterol, asthma, arthritis and poor health status.

Physical inactivity increases the risk of dying prematurely, dying of heart disease and developing diabetes, colon cancer and high blood pressure (National Centre for Chronic Disease Prevention and health promotion, 2008).

Physical activity and cognitive function and academic performance

Cognition is a general term that reflecting a number of underlying mental processes (Kramer, 2003).Best (2010), explained that cognitive function and specifically executive functioning was enhanced through aerobic physical activity.

Hillman *et al.,* (2007), found that 20 minutes of walking at 60 per cent of maximum heart rate which improves cognitive processes central to problem solving and goal oriented action, including response speed and accuracy.

Coe (2006), reported that boys of 7 to 10 years who participated in 30 minutes of aerobic exercise at moderate intensities showed significant improvement in cognitive function, compared to those who watched television.

Davis *et al*., (2012), found that the "dose" of physical activity influenced the effect on cognitive function. Higher doses of physical activity (40 minutes) was associated with significantly better cognitive performance than lower doses (20 minutes) as measured by a test of executive functioning.

Physical activity throughout the school day has also been shown to have positive benefits on academic achievement. Sibley *et al*., (2008) showed a positive correlation between physical activity and seven categories of cognitive performance (perceptual skills, intelligence, quotient, achievement, verbal tests, mathematics tests, developmental level/academic readiness and other) among school aged children.

A study conducted by Hillman (2007) very least time spent in physical education does not hinder academic performance and may even lead to an improvement.

METHODOLOGY

III.METHODOLOGY

The methodology pertaining to the present study on the **Dietary Habits and Physical Activity Pattern of Rural and Urban School Going Children (10-12 yrs)** is presented under the following headings:

A. Selection of the area
B. Selection of the sample
C. Selection of the tool for data collection
D. Conduct of the survey
E. Assessment of nutritional status of the school going children
F. Screening of physical activity level
G. Determination of the physical activity level and calculation of energy balance and
H. Analysis of the data

A. SELECTION OF THE AREA

The investigator selected Coimbatore city also known as Kovai, which is located in the state of Tamil Nadu in India. It is the second largest city in the state, being a major commercial hub; it is popularly called as the “Manchester of India” (www.mapsofindia.com).

The investigator selected schools in both rural and urban areas to identify the differences in socio economic, anthropometric measurements, life style, dietary pattern, health problems faced and physical activity level of school going children.

The children were selected from the rural and urban areas for the study due to the easy availability and approachability of schools. Necessary permission was obtained from the Chief Educational Officer for schools and school authorities to conduct the survey among school children.

The following two schools each from rural and urban areas were selected by the investigator.

Rural: 1. Government Higher Secondary School, Irugur

2. Government High School, Peedampalli

3. Government Higher Secondary School, Pattanam

Urban: 1. Corporation Higher Secondary School, Udayampalayam

2. Corporation Higher Secondary School, North Coimbatore

3. Corporation High School, Ramalingam Colony

B. SELECTION OF THE SAMPLE

Sampling indicates the selection of a part of a group or an aggregate with a view to obtain information about the whole (Murthy, 2009). The main aim of sampling is to obtain maximum information about the phenomenon under study with the least expenditure of money, time and energy(Sharma, 2007)

Purposive sampling is the one where the individual members of the sample are chosen in accordance with a certain principle (Rao, 2008).

The investigator selected all the students of sixth and seventh standard between the age group of 10-12 years from both urban and rural schools. A total of 513 children comprised of124 boys and 168 girls from rural schools and93 boys and 128 girls from urban schools were included for the study.

C. SELECTION OF THE TOOL FOR DATA COLLECTION

The tool selected for the study was an interview schedule which was designed by the investigator. Interview has been defined differently by different social scientists andin the words of Good and Halt an interview is fundamentally a process of social interaction (Sharma, 2007)

A detailed interview schedule was formulated to elicit information from the parents of the children regarding socio economic status such as type and size of family, income and the food expenditure. From the monthly food expenditure data the percentage was found out using the formula,

$$\text{Percentage of food expenditure} = \frac{\text{Food expenditure (Rs)}}{\text{Total income of the family (Rs)}} \times 100$$

Information from the children regarding dietary habits such as skipping of meals, food consumption pattern, consumption of fats and oils, consumption of snacks and processed foods, consumption of beverages was collected.

Details about life style pattern such as sleep pattern, exercise, yoga, study time and physical activity pattern were also obtained. Information on the health of the students in terms of ailments such as cold, cough, fever, head ache, diarrhoea, vomiting, abdominal pain, constipation, sleep disorders in the last one year was also obtained. Data on prevalence of chronic diseases such as diabetes mellitus, heart disease, hypertension, etc among family members were also collected. The interview schedule was pretested and finalised and used (Appendix I).

D. CONDUCT OF THE SURVEY

Prior permission was obtained from the authorities of the schools where the study was conducted. The investigator explained the nature of the study and adequate efforts were taken to create rapport with the children and parents. By using the interview schedule information on socio- economic, anthropometric, dietary habits, life style pattern, health problems and physical activity pattern were collected from the parents and children during the convenient times indicated by the school authorities (Plate 1).

E. ASSESSMENT OF NUTRITIONAL STATUS OF THE SCHOOL GOING CHILDREN

The state of the body with respect to each nutrient and to the overall state of the body is known as nutritional status and the assessment of the state of nourishment is termed as assessment of nutritional status (Trivedi, 2006).Nutritional status is the condition of health of the individual as influenced by the utilisation of nutrients (Monika *et al., 2011*).

According to Sharma (2006) nutritional status of an individual is defined as the state of his health as affected by the intake and utilization of nutrients and is a reflection of the balance between their dietary intake and expenditure. It can be assessed by a variety of techniques like anthropometry, biochemical, clinical and dietary assessment.

1. Anthropometric Assessment:

Anthropometric measurement involves obtaining physical measurements of an individual and relating them to standards that reflect the growth and development of the individual. Anthropometric data are most valuable when they reflect accurate measurements and are recorded over a period of time (Lee and Nieman, 2003)

The most widely used anthropometric measurements include height and weight, waist hip ratio and body mass index.

Height

The height of an individual is principally a measure of skeletal bone tissues (Williams, 2000). The height of children aged 10-12 years was measured by using fibre glass tape fixed on wall. The students were asked to stand erect, without slippers and looking ahead. The heels, buttocks, shoulders and head were touching the vertical measuring surface and the readings were recorded to the nearest 0.1 cm (Plate-2).

Weight

Body weight is the most widely used and the simplest reproducible anthropometric measurement for the evaluation of nutritional status. It indicates the body mass and is a composite of all body constituents like water, fat, protein, minerals, bone etc (Byrom, 2002). Body weight is obtained and interpreted using various methods, including BMI, usual weight and actual weight. In children it is a more sensitive measure of nutritional adequacy than height, and it reflects recent nutrient intake. The children were asked to keep the feet parallel, hands straight and looking ahead and to remove their footwear while taking their weights. Weights were recorded to the nearest 0.1 kg (Plate-3).

Waist circumference

Waist circumference is obtained by measuring the distance around the smallest area below the rib cage and above the umbilicus with the use of a non-stretchable tape measure (Plate-4). Waist circumference measurements assess abdominal fat content. A measurement of greater than 40 inches for men and greater than 35 inches for women is an independent risk factor for disease (Centre for Disease Control and Prevention, 2002).

Waist to Height ratio

Waist-to-Height ratio (WHtR) is a relatively constant anthropometric index of abdominal obesity across different age, sex or racial groups. However, information is scanty on the utility of waist-to-height ratio in assessing the status of abdominal obesity and related cardio metabolic risk profile among normal weight and overweight/ obese, categorized according to the accepted body mass index threshold values (Jasmeet, 2010). According to Schender *et al*., (2010) Waist-to-Height ratio may be more useful as a global clinical screening tool than waist circumference and Body Mass Index, with a weighted mean boundary value of 0.5 which essentially means that the waist circumference needs to be less than half of height.

It is calculated by dividing waist size by height. It may give a more accurate assessment of health. A Waist-to-Height ratio of 0.5 is considered to be healthy in children. Children who have a waist to height ratio of more than 0.5 are likely to be overweight – and the larger the number, the greater the potential weight problem (Browning *et al., 2010*).

PLATE -1

COLLECTION OF DATA

PLATE-2

MEASUREMENT OF HEIGHT

PLATE-3

MEASUREMENT OF WEIGHT

PLATE -4

MEASUREMENT OF WAIST CIRCUMFERENCE

PLATE-5

CLINICAL EXAMINATION

2. Food and nutrient intake

The 24 hour recall method of data collection requires individuals to remember the specific foods and amounts of foods they consumed in the past 24 hours (Kant, 2002).

To determine the food intake 24 hour recall method for a sub sample of 50 students was followed for three days. From the recall method the average food intake was found out and using the ICMR (2010) Food Composition Tables nutritive values were calculated. The food and nutrient intakes were compared with ICMR (2010) Recommended Dietary Allowances.

3. Clinical examination

Clinical assessment is an essential feature of all nutritional survey. It is the simplest and the most practical method of ascertaining the nutritional status of individuals. Clinical examination provides a number of clues about general nutritional status of the person and specific deficiency states (Kenneth, 2008).

Clinical assessment is based on observation of physical signs, it is relatively inexpensive and does not require any elaborate field equipment or even a laboratory (Joshi, 2004).

Clinical examination was done by the investigator using a simple proforma for all the children and the overall prevalence of clinical symptoms was interpreted (Plate V).

F. SCREENING OF PHYSICAL ACTIVITY LEVEL

Physical activity is defined as any bodily movement produced by skeletal muscles that require energy expenditure. It is recommended that children get at least 60 minutes and adults get at least 30 minutes of moderate activity on most days of the week. Physical inactivity has been identified as the fourth leading risk factor for global mortality causing an estimated 3.2 million deaths globally (World Health Organization, 2014).

Physical activity pattern of school children was assessed to determine the level of physical activity and compare with parameters like energy balance and academic performance. The investigator developed forms (Appendix II) and gave to a subsample of 50 students and they were asked to record their activities for 24 hours for five days which included holidays as well as working days.

According to Wardlaw (2000), based on the muscular activity, physical activity levels are categorized as follows;

Sedentary activity : Mostly sitting

Light activity : Clerk involved in a daily program

Moderate activity : A teacher involved in daily exercise

Heavy activity : A mail carrier who walks the route

On the basis of activities of the students they were grouped as sedentary, moderate and heavy.

G. DETERMINATION OF PHYSICAL ACTIVITY LEVEL AND CALCULATION OF ENERGY BALANCE

Physical activity level (PAL) is the way to express a person's daily activity as a single number. According to Kroll (2013) "a person's physical activity level is defined as that person's total energy use over a 24 hour period divided by his (or) her basal metabolic rate." PAL value can be calculated by using the following formula:

$$\text{PAL} = \frac{\text{TOTAL DAILY ENERGY EXPENDITURE (TDEE)}}{\text{BASAL METABOLIC RATE (BMR)}}$$

Total Daily Energy Expenditure (TDEE)

The investigator selected both boys and girls from both rural and urban areas to determine the physical activity level. They were given a questionnaire to record the time spent in activities like sitting, standing, walking, playing, running, sports and tournaments etc. for a period of five days. The investigator calculated the energy values of five days energy expenditure for the subsample and taken as Total Daily Energy Expenditure.

Basal Metabolic Rate (BMR)

The amount of energy needed by the body for maintenance of life when the person is at digestive, physical and emotional rest. The amount of oxygen consumed at rest is used as a measure of the basal energy requirements and is expressed as Kilocalories per square meter of body surface per hour. This rate is reported as the per cent of variation in the person above or below the normal number of kilocalories, required for a person of like height, weight and sex (Williams, 1989)

An accurate calculation of BMR can only be done through specifically designed tests conducted when the digestive system is inactive (after 8 hours of sleep, 12 hours without food).

The investigator used Harris Benedict equation, for calculating BMR, which is one of the standards for BMR measurements formulated in 1919 by Harris and Benedict. It has been proven to estimate by five per cent or more considering the number of factors which are involved in proper BMR calculation, including body surface area, body temperature and health, external temperature and gland function. Completely precise BMR results cannot be done in simple equation. The equation used the variables of weight (w) in kilograms, height (h) in centimetres and age (a). The equation for calculating the BMR is as follows:

For men: $BMR = (13.75 \times w) + (5 \times h) - (6.76 \times a) + 66$

For women: $BMR = (9.56 \times w) + (1.85 \times h) - (4.68 \times a) + 655$

From the TDEE and BMR values the PAL values were determined for the subsample.

The reference range of general activity levels are expressed as:

PAL values	Activity level
1.0- 1.4	Sedentary
1.4- 1.6	Low active
1.6- 1.9	Active
1.9- 2.5	Very active

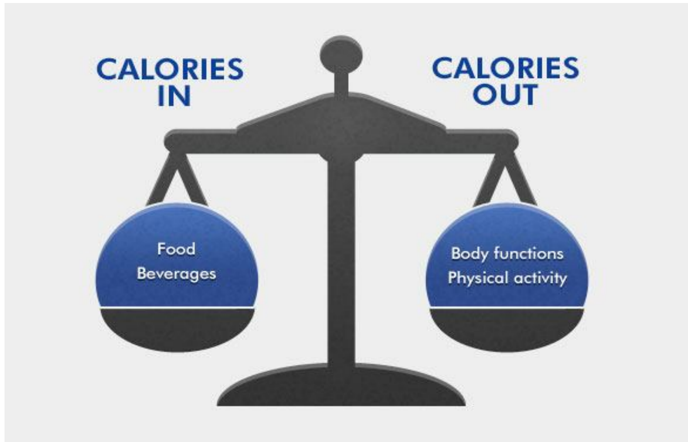
Energy balance

Energy balance is the relationship between energy intake and energy output (Michel, 2004). According to Wardlaw (2004), the state in which energy intake in the form of food and beverages, matches the energy expended, primarily through the basal metabolism and physical activity (Figure 1). The energy balance is written as equation by Wardlaw.

Energy input = Energy output

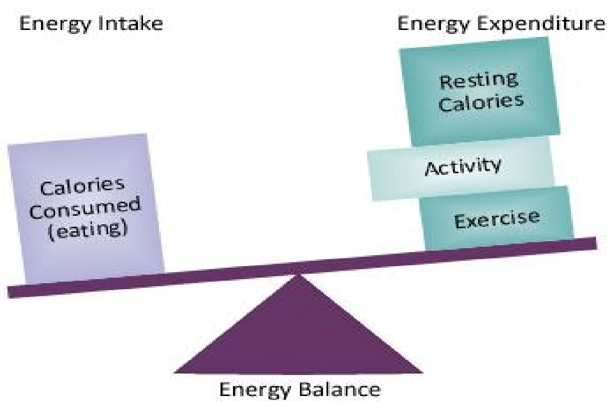
(Calories from food intake) (Metabolism, Digestion, Absorption)
and physical activity)

A. **Positive Energy Balance:** The state in which energy intake is greater than energy expended, generally resulting in weight gainas shown in Figure 2.
B. **Negative Energy Balance:**The state in which energy intake is less than energy expended resulting in weight loss. Negative energy balance is depicted in Figure 3.



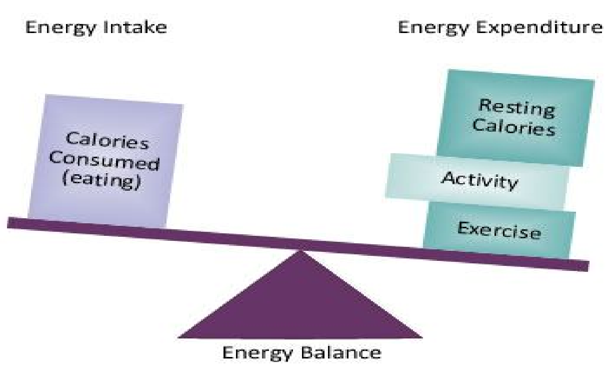
ENERGY BALANCE

FIGURE -1



POSITIVE ENERGY BALANCE

FIGURE -2



NEGATIVE ENERGY BALANCE

FIGURE-3

Comparison of physical activity and energy balance

Physical activity allows people to eat enough food to obtain the nutrients they need without weight gain. In fact, some threshold of physical activity seems to protect against weight gain. This activity must be theactive kind, not passive motion such as being jiggled by machine act as a health spa or being massaged. The threshold for weight maintenance appears near the moderate level of activity (Sizer, 2004).

Physical activity can regulate the appetite, help overweight people to lose fat, and help underweight to gain weight (Lenor, 2004).

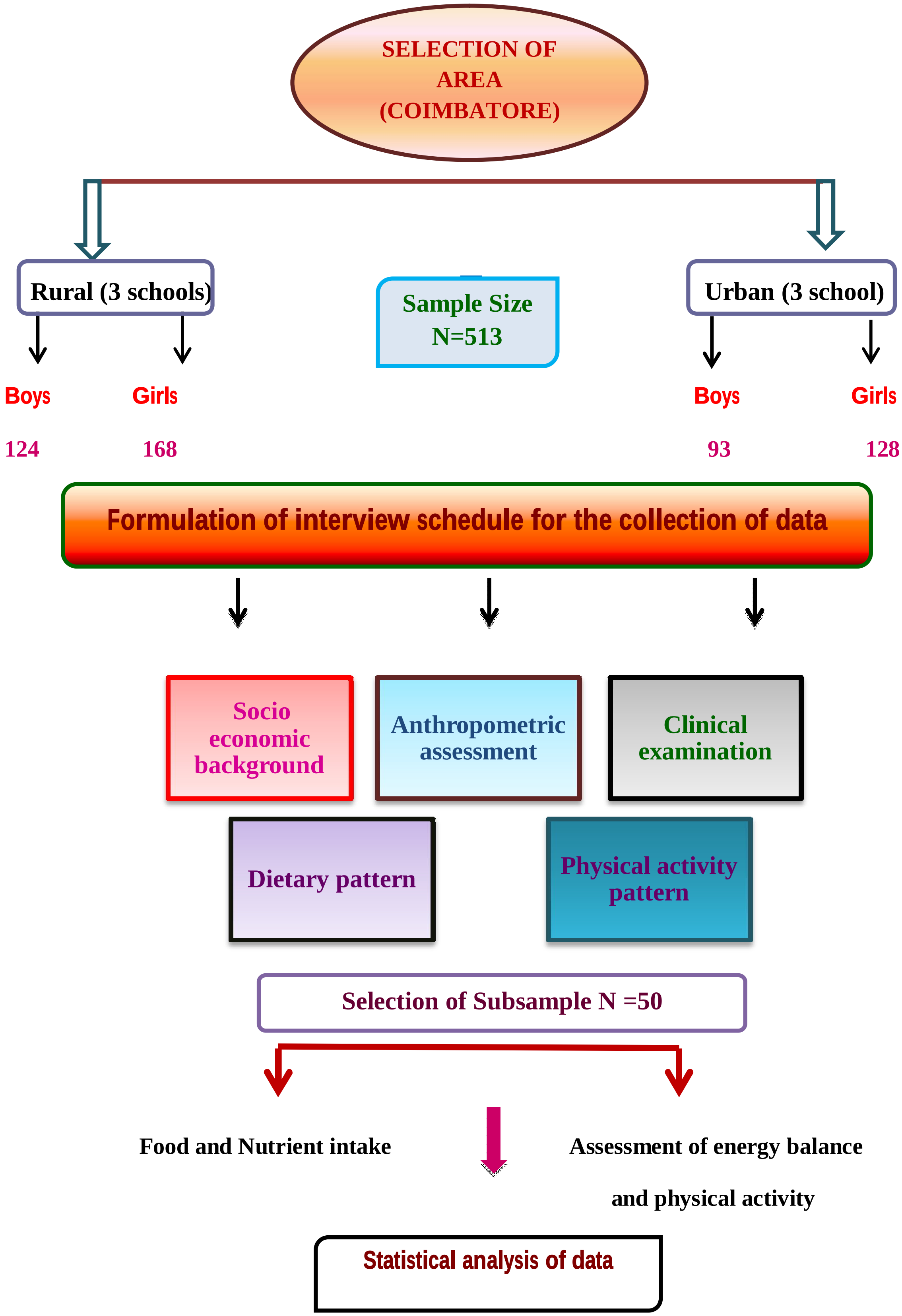
The investigator compared the physical activity level and energy balance for a subsample of 50 students.

Ethical clearance: The research design of the study was presented (Figure 1) to a panel of members present in the Avinashilingam University Institutional Human Ethics Committee and the research proposal received an ethical clearance with the approval number AUW/IHEC/-13-14/XMT-01 (Appendix -2).

H. ANALYSIS OF THE DATA

The researcher classified the raw data into some purposeful and usable categories. Then the data was edited so as to improve the quality of data for coding. After that the recorded data were tabulated, which is a part of the technical procedure where the data are put in the form of a table. After tabulation, analysis work is started and this is based on various percentage coefficients by using statistical formulae, which help in statistical measurement (Saravanavel, 2004).

The data collected by the investigator in terms of physical activity level was correlated with energy intake and other associated factors affecting the nutritional status of the subjects were discussed.



RESEARCHDESIGN

FIGURE-4

RESULTS AND DISCUSSION

IV. RESULTS AND DISCUSSION

The results of the present study on the **"Dietary Habits and Physical Activity Pattern of Rural and Urban School Going Children (10-12yrs)"** are presented and discussed under the following headings.

A. Demographic profile of the selected school going children

B. Anthropometric measurements of the selected school going children

C. Clinical status of the selected school children

D. Dietary pattern of the selected school children

E. Life style pattern and

F. Physical activity pattern of the selected school children

A. DEMOGRAPHIC PROFILE OF THE SELECETD SCHOOL GOING CHILDREN

The details regarding the demographic profile such as age, sex, type and size of the family, income of the family and the food expenditure were elicited using interview schedule and the results obtained are discussed in the following tables.

1) Age and sex of the selected school going children

The age and sex distribution of the selected school going children aged 10-12 yrs in rural and urban areas is given in Table I.

TABLE I

AGE AND SEX OF SELECTED SCHOOL GOING CHILDREN (N=513)

Details	Boys		Girls		Total	
	No	**%**	**No**	**%**	**No**	**%**
Rural						
10-11 yrs	73	58.9	69	41.1	142	48.6
11-12 yrs	51	41.1	99	58.9	150	51.4
Total	**124**	**100**	**168**	**100**	**292**	**100**
Urban						
10-11 yrs	39	41.9	63	49.2	102	46.2
11-12 yrs	54	58.1	65	50.8	119	53.8
Total	**93**	**100**	**128**	**100**	**221**	**100**

From the table it is noted that 58.9 per cent and 41.9 per cent of boys were between the age of 10-11 yrs are from rural and urban areas respectively whereas 41.1 per cent and 58.1 per cent of boys were in the age group of 11-12 yrs from rural and urban areas respectively.

Similarly girls of 10-11 yrs comprised 41.1 per cent in rural areas and 49.2 per cent in urban areas, whereas 11-12 yrs girls constituted 58.9 per cent and 50.8 per cent from both rural and urban areas respectively. In the present study the percentage of girls (57.7%) was found to be more than the percentage of boys (42.3 %). In general the girls available for the study was found to be more than the boys

2) Type of family of the selected school going children

The type of family of the selected school going children aged 10-12 yrs is presented in Table II

TABLE II

TYPE OF FAMILY OF THE SELECTED CHILDREN (N=513)

Area of School	**Rural**				**Total**		**Urban**				**Total**	
	B	**%**	**G**	**%**	**No**	**%**	**B**	**%**	**G**	**%**	**No**	**%**
Nuclear	63	50.8	55	32.7	**118**	**40.4**	51	54.8	94	73.4	**145**	**65.6**
Joint	61	49.2	113	67.3	**174**	**59.6**	42	45.2	34	26.6	**76**	**34.4**

It is revealed that among rural boys an equal percentage belonged to nuclear and joint families 50.8 and 49.2 per cent respectively. In the case of families of urban boys more percentage was of nuclear type (54.8%) compared to joint families (45.2%).

Among the selected girl children 32.7 per cent in rural and 73.4 per cent in urban areas were from nuclear families. Among the remaining girls 67.3 per cent in rural and 26.6 per cent in urban areas belonged to joint families.

In general, joint families were found to be more in rural areas (33.9%) than urban areas (14.8%). In the case of nuclear families more percentage were found in urban areas (28.3%) than in rural areas (23%). This reveals the increasing trend towards nuclear families in urban areas.

3) Size of the family of the selected school children

The size of the family of the selected school going children between the ages of 10-12 years is presented in Table III.

TABLE III

SIZE OF THE FAMILY OF SELECTED SCHOOL CHILDREN (N=513)

Size	Rural				Urban				Total	
	B	%	G	%	B	%	G	%	No	%
<3	-	-	-	-	-	-	-	-	**-**	**-**
3 – 5	63	50.8	59	35.1	58	62.4	72	56.3	**252**	**49.1**
6 – 8	47	37.9	93	55.4	31	33.3	49	38.2	**220**	**42.9**
>8	14	11.3	16	9.5	4	4.3	7	5.5	**41**	**8**
Total	**124**	**100**	**168**	**100**	**93**	**100**	**128**	**100**	**513**	**100**

From the table it is observed that a maximum of 50.8 per cent of families of boys in rural areas had 3-5 members whereas 55.4 per cent families of girls had 6-8 members being the higher prevalence.

In the case of urban school going boys and girls majority of the families namely 62.4 and 56.3 per cent respectively had 3-5 members. More than 8 members were found in the families of rural boys and girls which was higher than the urban children.

More or less, equal percentage of families were having 3-5 and 6-8 members.

4) Total family income of the selected school children

The total income of the families of the selected school going children is presented in Table IV and Figure 5.

TABLE IV

TOTAL INCOME OF THE FAMILIES (N=513)

Income Rs*	Rural				Urban				Total	
	B	%	G	%	B	%	G	%	No	%
<3000	-	-	-	-	-	-	-	-	-	-
3000-7000	8	6.5	7	4.2	43	46.2	33	25.8	**91**	**17.7**
7000-10000	42	33.9	85	50.6	25	26.9	68	53.1	**220**	**42.9**
>10000	74	59.6	76	45.2	25	26.9	27	21.1	**202**	**39.4**
Total	**124**	**100**	**168**	**100**	**93**	**100**	**128**	**100**	**513**	**100**

*Source: HUDCO Classification of Income, 2010

Income is the consumption and saving opportunity gained by an entity within a specified timeframe, which is generally expressed in monetary terms (Barr, 2004). For households and individuals, income is the sum of all the wages, salaries, profits, interests on payments, rents and other forms of earnings received... in a given period of time (Case and Fair,2007).

From the study it is observed that a maximum of 59.6 per cent families of rural boys were earning more than Rs. 10,000 per month whereas 50.6 per cent of rural girls were receiving Rs. 7000-10,000 per month. Only a lesser percentage of families of rural boys and girls earned Rs. 3000-7000.

In the case of urban children a maximum of 46.2 per cent families of boys were earning Rs. 3000-7000 whereas 53.1 per cent of families of girls were receiving Rs. 7000-10,000. Among urban children only 26.9 per cent families of boys and 21.1 per cent families of girls were earning more than Rs. 10,000 per month

The findings of the study revealed that a majority of 42.9 per cent families of the selected children were earning Rs. 7000-10,000 per month followed by 39.4 per cent families with more than Rs 10,000 per month.

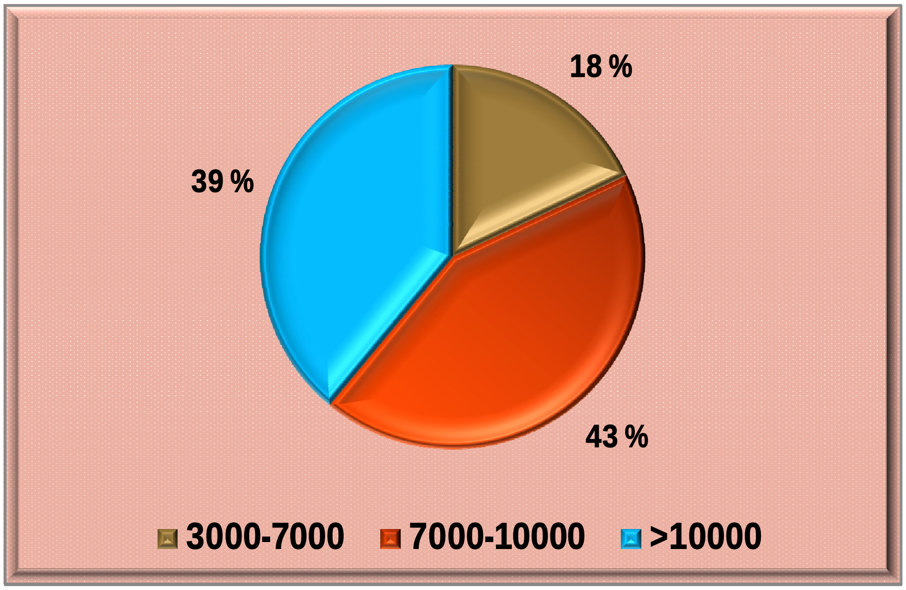


FIGURE- 5

MONTHLY INCOME OF THE FAMILIES

5) Food expenditure by the families of the selected children

The monthly food expenditure pattern by the families of the selected school children is presented in Table V and Figure 6.

TABLE V

MONTHLY FOOD EXPENDITURE BY THE SELECTED FAMILIES (N=513)

Food Expenditure (Range in percentage)	Rural				Urban				Total	
	B	(%)	G	(%)	B	(%)	G	(%)	No	%
0-25	-	-	-	-	-	-	-	-	**-**	**-**
25- 50	23	18.5	12	7.1	8	8.6	13	10.2	**56**	**10.9**
50- 75	82	66.2	107	63.7	36	38.7	89	69.5	**314**	**61.2**
>75	19	15.4	49	29.2	49	52.6	26	20.3	**143**	**27.9**
Total	**124**	**100**	**168**	**100**	**93**	**100**	**128**	**100**	**513**	**100**

In rural areas 66.2 per cent and 63.7 per cent of families of boys and girls respectively spent 50-75 per cent of the monthly income on food, followed by 18.5 per cent families of boys and 7.1 per cent families of girls spent 25-50 per cent of their income on food. On the other hand 15.4 per cent of boys and 29.2 per cent of families of girls respectively spent more than 75 per cent of their income on food.

In urban areas 52.6 per cent of families of boys and 20.3 per cent of families of girls spent more than 75 per cent of their income on food whereas 38.7 per cent families of boys and 69.5 per cent families of girls respectively spent 50-75 per cent of their income on food. Only 8.6 per cent of families of boys and 10.2 per cent families of girls spent 25-50 per cent of their income on food. In general majority (61.2%) of the families of the present study spent more than 50 per cent of their income on food.

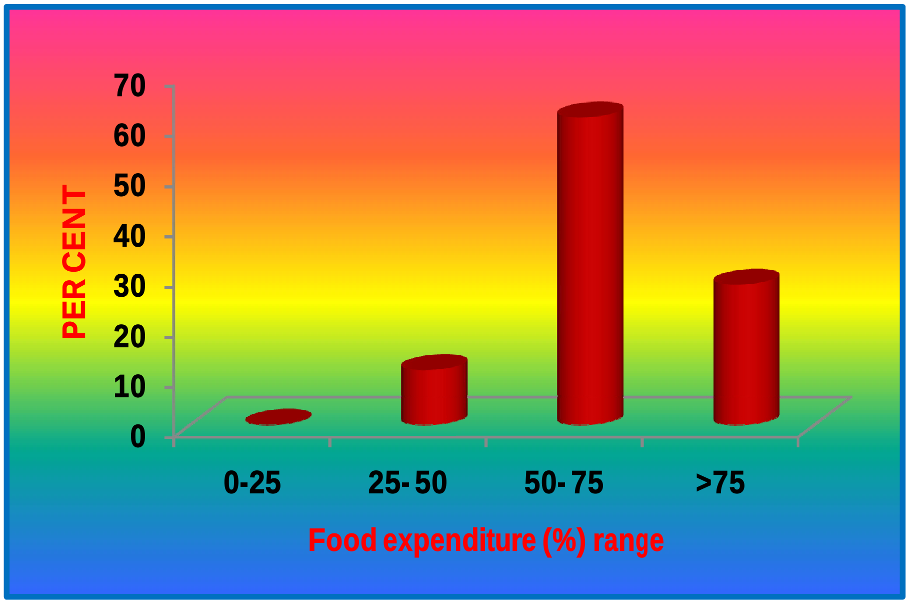


FIGURE-6

MONTHLY FOOD EXPENDITURE OF THE FAMILIES

B. ANTHROPOMETRIC MEASUREMENTS OF THE SELECTED SCHOOL GOING CHILDREN

Nutritional status of the selected school going children was evaluated by anthropometric measurements like weight (Kg), height (cm) and waist and hip circumferences and the data are presented and interpreted in the following tables.

1) Height of the selected school going children

The mean height of the selected rural and urban school boys is given in Table VI and Figure 7 and 8.

TABLE VI

MEAN HEIGHT OF THE SELECTED SCHOOL BOYS (N=217)

Rural (124)				Urban (93)			
Height (cm) Range	**No**	**%**	**Mean ± SD**	**Height (cm) Range**	**No**	**%**	**Mean ± SD**
120-130	3	4.1		120-130	6	12.2	
131-140	23	31.5		131-140	24	49	
141-150	37	50.7	139.0 ± 7.2	141-150	14	28.6	139.0 ± 4.8
151-160	4	5.5		151-160	2	4.1	
> 160	6	8.2		> 160	3	6.1	
Total	**73**	**100**		**Total**	**49**	**100**	
11 yrs standard height for boys – 144.8 cm (ICMR, 2010)							
120-130	8	15.7		120-130	16	36.4	
131-140	14	27.5		131-140	12	27.2	
141-150	13	25.5	142.7 ± 9.1	141-150	7	15.9	138.9 ± 6.3
151-160	11	21.6		151-160	5	11.4	
> 160	5	9.7		> 160	4	9.1	
Total	**51**	**100**		**Total**	**44**	**100**	
12 yrs standard height for boys-151.1 cm (ICMR, 2010)							

With regard to the height measurement, a majority of 50.7 per cent of school children in rural areas were in the range of 141-150cm whereas a maximum of 49 per cent of boys in urban areas were in the range of 131-140 cm. The mean height of 11 yrs old boys of rural and urban areas was found to be similar but compared with 144.8 cm (ICMR, 2010) reference values, they were found to be below the expected values.

The height of a maximum of 12 yrs boys from rural areas namely 27.5 per cent were in the range of 131-140 cm, whereas a maximum of 36.4 per cent boys in urban areas were in the range of 120-130 cm. It is evident from the table that rural boys of 12 yrs had a mean height of 142.7 ± 9.1 cm found to be more than the mean height of urban boys which was 138.9 ± 6.3 cm. Height of both rural and urban boys of 12 yrs was found to be less than the ICMR reference value of 151.1 cm.

In general the mean height of 11 and 12 yrs boys and girls of rural and urban areas was found to be lower than the ICMR values.

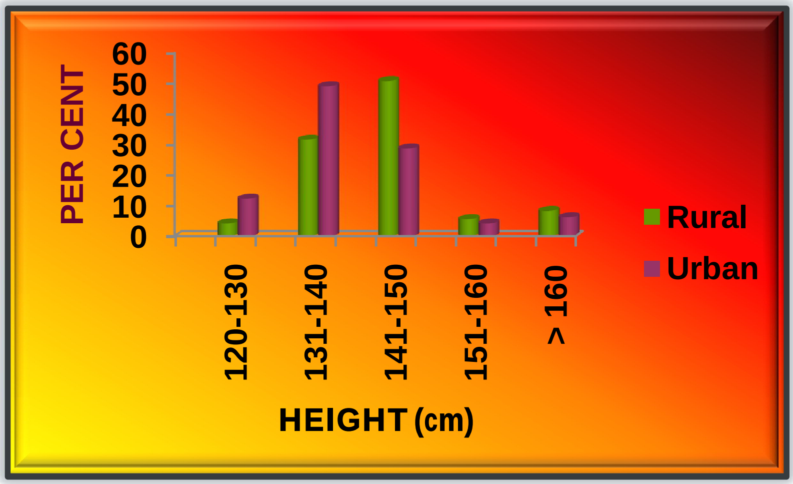


FIGURE - 7

HEIGHT OF 10-11 YRS BOYS (RURAL AND URBAN)

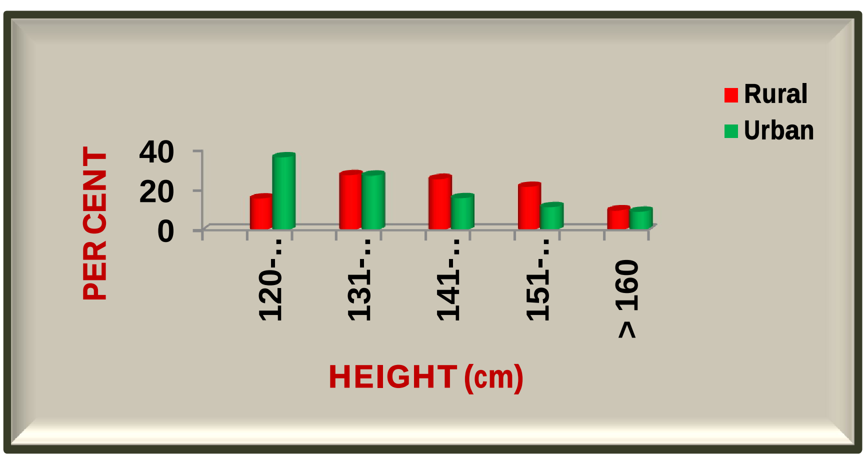


FIGURE -8, HEIGHTS OF 11-12 yrs BOYS (RURAL AND URBAN)

Table VII and Figure 9 and 10 presents the mean height of the selected school girls.

TABLE VII

MEAN HEIGHT OF THE SELECTED SCHOOL GIRLS (N= 296)

Rural (168)				**Urban (128)**			
Height (cm) Range	**No**	**%**	**Mean ± SD**	**Height (cm) Range**	**No**	**%**	**Mean ± SD**
120-130	41	43.6		120-130	24	49	
131-140	24	25.6		131-140	13	26.5	
141-150	19	20.2	143.2 ± 9.4	141-150	6	12.2	142 ± 6.3
151-160	8	8.5		151-160	4	8.2	
> 160	2	2.1		> 160	2	4.1	
Total	**94**	**100**		**Total**	**49**	**100**	
11 yrs standard height for girls – 145.3 cm (ICMR, 2010)							
120-130	24	32.4		120-130	23	29.1	
131-140	25	33.8		131-140	24	30.4	
141-150	18	24.3	144.2 ± 9.5	141-150	22	27.8	141.3 ± 7.3
151-160	5	6.8		151-160	7	8.9	
> 160	2	2.7		> 160	3	3.8	
Total	**74**	**100**		**Total**	**79**	**100**	
12 yrs standard height for girls – 150.2 cm (ICMR, 2010)							

From the table it is found that a maximum of 43.6 per cent of 11 yrs rural girls and 49 per cent of 11 yrs urban girls had a height in the range of 120-130 cm. This was followed by 25.6 per cent in rural and 26.5 per cent in urban areas 11 yrs old girls having a range of 131-140 cm. About 2 per cent rural and 4 per cent urban girls of 11 yrs had height more than 160 cm.

It is also seen that among 12 yrs girls a maximum of 33.8 per cent of rural and 30.4 per cent of urban girls had a height of 131-140 cm. Only about 4.6 per cent rural girls and 3.8 per cent urban girls were in the category of more than 160 cm height.

It is found that the mean height of the selected 11 yr old rural girls was 143.2 ± 9.4cm which was less than the standard height of 145.3cm suggested by ICMR (2010). Among the urban girls of 11 yrs the height was 142 ± 6.2 cm which was also less than the standard value of 145.3 cm.

To conclude, the mean heights of 11-12 yrs girls from rural and urban areas were less than the reference values. The findings revealed the prevalence of long term malnutrition resulting in stunting among school going children.

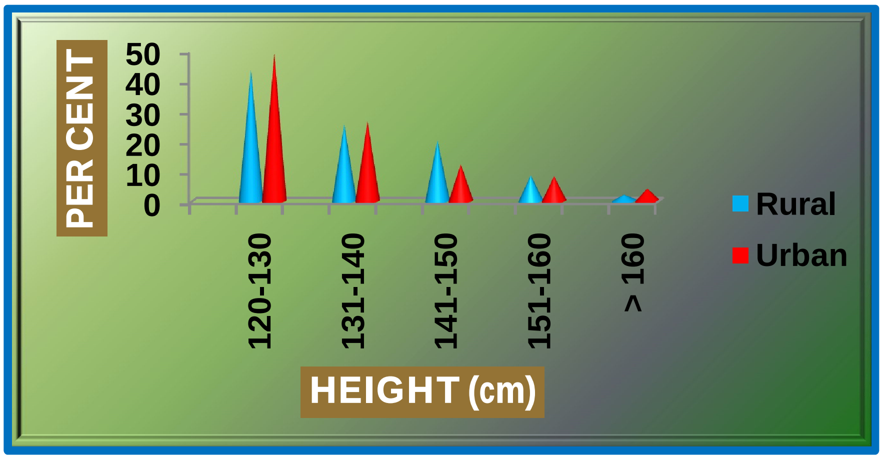


FIGURE - 9

HEIGHT OF 10-11 YRS GIRLS (RURAL AND URBAN)

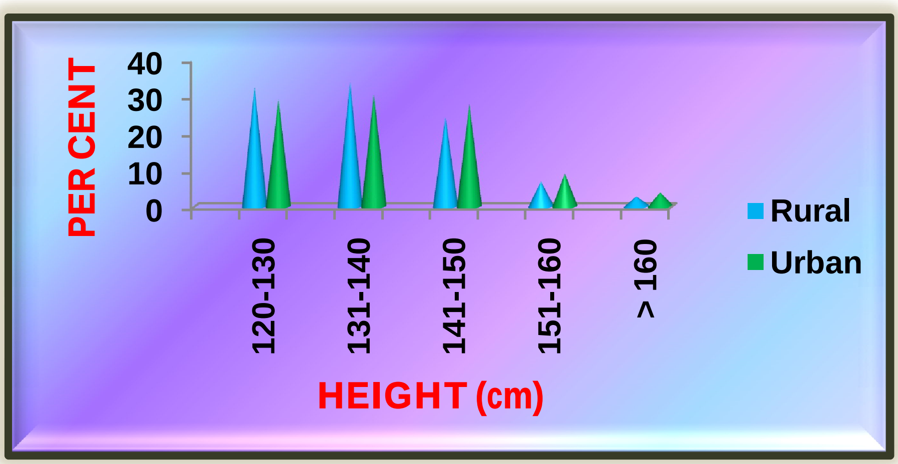


FIGURE - 10

HEIGHT OF 11-12 YRS GIRLS (RURAL AND URBAN)

2) Weight of the selected school boys

The mean weight of the selected school boys is presented in Table VIII and Figure 11.

TABLE VIII

MEAN WEIGHT OF THE SELECTED SCHOOL BOYS (N=217)

Rural (124)				**Urban (93)**			
Weight (kg) Range	**No**	**%**	**Mean ± SD**	**Weight (kg) Range**	**No**	**%**	**Mean ± SD**
20-30	18	14.5	32.5 ± 6.4	20-30	32	34.4	31.6 ± 6.4
30-40	83	66.9		30-40	46	49.5	
40-50	17	13.7		40-50	8	8.6	
> 50	6	4.8		> 50	7	7.5	
Total	**124**	**100**		**Total**	**93**	**100**	

Standard weight – 34.3 kg (ICMR, 2010)

From the Table it is found that a maximum of 66.9 per cent of 10-12 yrs rural boys and 49.5 per cent of urban boys had weights in the range of 30-40 kg. About 13.7 per cent in rural and 8.6 per cent in urban of 10-12 yrs weighed 40-50 kg and 4.8 per cent in rural and 7.5 per cent in urban areas weighed more than 50 kg weights more than 40 kg for this age group being 5.7 kg more than ICMR (2010) values which needs great concern.

It is found that the mean weight of 10-12 yrs selected rural boys was 32.5 ± 6.4 which was less than the ICMR (2010) standard weight of 34.3 kg. Similarly among the selected urban boys the mean weight was 31.6 ± 6.4kg which was also less than the standard value of 34.3 kg.

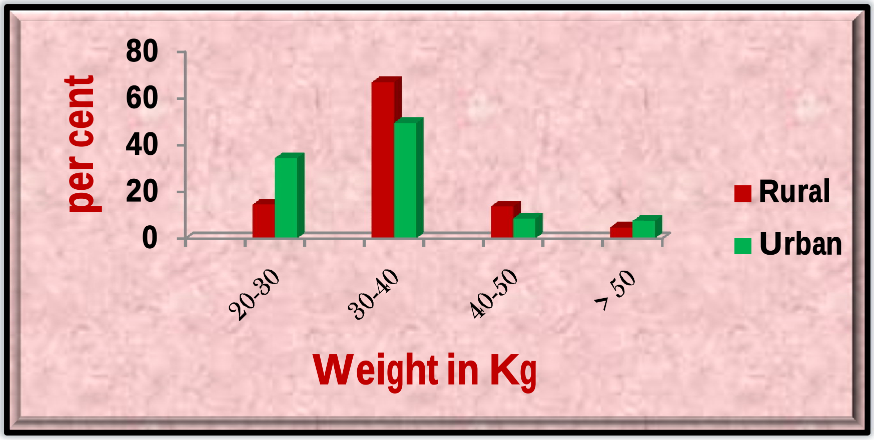


FIGURE - 11

WEIGHT OF THE RURAL AND URBAN BOYS (10-12 YRS)

Table IX and Figure 12 presents the mean weight of the selected school girls

TABLE IX

MEAN WEIGHT OF THE SELECTED SCHOOL GIRLS (N=296)

Rural				Urban			
Weight (kg) Range	**No**	**%**	**Mean ± SD**	**Weight (kg) Range**	**No**	**%**	**Mean ± SD**
20-30	26	15.5	34.2 ± 6.3	20-30	68	53.1	32.9 ± 5.7
30-40	109	64.9		30-40	37	28.9	
40-50	25	14.9		40-50	13.3	13.3	
> 50	8	4.7		> 50	4.7	4.7	
Total	**168**	**100**		**Total**	**128**	**100**	

Standard weight =35.0 (ICMR, 2010)

The above table showing the weight of 11-12 yrs girl children in rural and urban areas revealed that a maximum of 64.9 per cent girls in rural areas had a weight of 30-40 kg whereas a maximum of 53.1 per cent girls in urban areas weighed between 20-30kg. About 14.9 per cent of rural girls and 13.3 per cent of urban girls had weights within the range of 40-50 kg. Nearly 4.7 per cent girls from both areas were weighing more than 50kg which is very alarming.

It is found that the mean weight of the 10-12 yrs selected girls in rural areas was 34.2 ± 6.3 kg which was less than the standard weight of 35.0 kg suggested by ICMR (2010). Among the selected urban girls the weight was 32.9 ± 5.7 which was also less than the reference value.

In general, the mean weights of 10-12 yrs rural and urban girls were found to be less than the reference values.

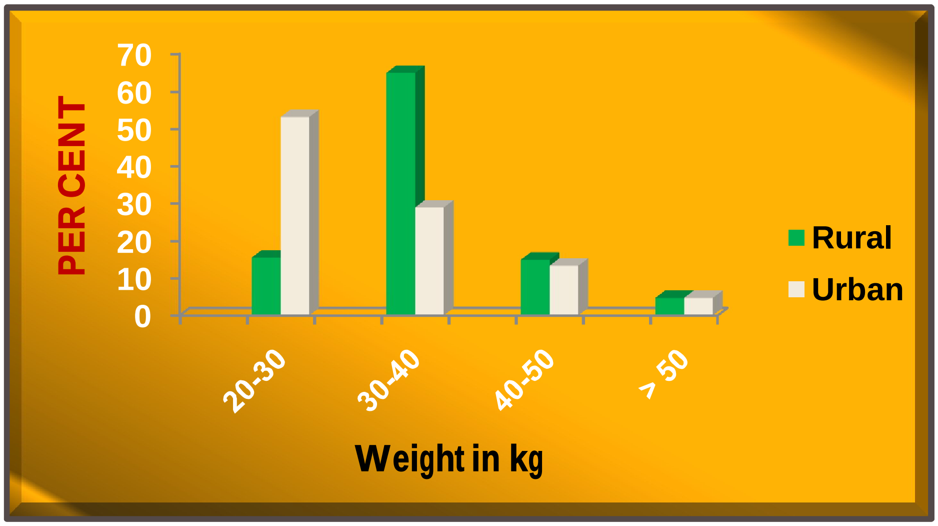


FIGURE – 12

WEIGHT OF RURAL AND URBAN GIRLS (10-12 YRS)

3) Body Mass Index of the selected school going children

The Body Mass Index of the selected school boys and girls is presented in Table X and Figure 13.

TABLE X

BODY MASS INDEX OF THE SELECTED SCHOOL BOYS AND GIRLS (N=513)

Percentile	Boys (N=217)				Girls (N=296)			
	Rural		Urban		Rural		Urban	
	No	%	No	%	No	%	No	%
<5th	34	27.4	43	46.2	56	35.2	45	33.3
10th	31	25.0	10	10.7	42	14.1	18	25
25th	27	21.8	16	17.2	34	14.8	19	20.2
50th	12	9.7	9	9.7	24	18.8	24	14.3
75th	6	4.8	2	2.2	4	10.2	13	2.4
<85th	8	6.5	4	4.3	3	3.1	4	1.8
90th	3	2.4	6	6.5	2	2.3	3	1.2
=95th	3	2.4	3	3.2	3	1.5	2	1.8
Total	**124**	**100**	**93**	**100**	**168**	**100**	**128**	**100**

From the above table it is found that a maximum of 27.4 per cent of rural boys and 46.2 per cent of urban boys were below 5th percentile which is considered as underweight. About 61.3 per cent and 37 per cent of boys in rural and urban areas respectively came under the category of healthy weight of 10th to 75th percentile. Boys in the overweight category comprised of 8.9 per cent in rural areas and 10.8 per cent in urban areas. Only about 2.4 per cent boys in rural areas and 3.2 per cent boys in urban areas were above the 95th percentile which is considered as obese.

With regard to the details of the BMI of girls a maximum of 35.2 per cent girls in rural schools and 33.3 per cent of girls in urban areas belonged to the category of less than 5th percentile being the underweight category. It is also seen that 57.9 per cent of rural girls and 61.9 per cent of urban girls were in the 10th to 75th percentile being considered as normal category. Nearly 1.5 per cent and 1.8 per cent of girls in rural and urban areas respectively came under the category of obesity. Prevalence of overweight was very less compared to underweight among urban areas.

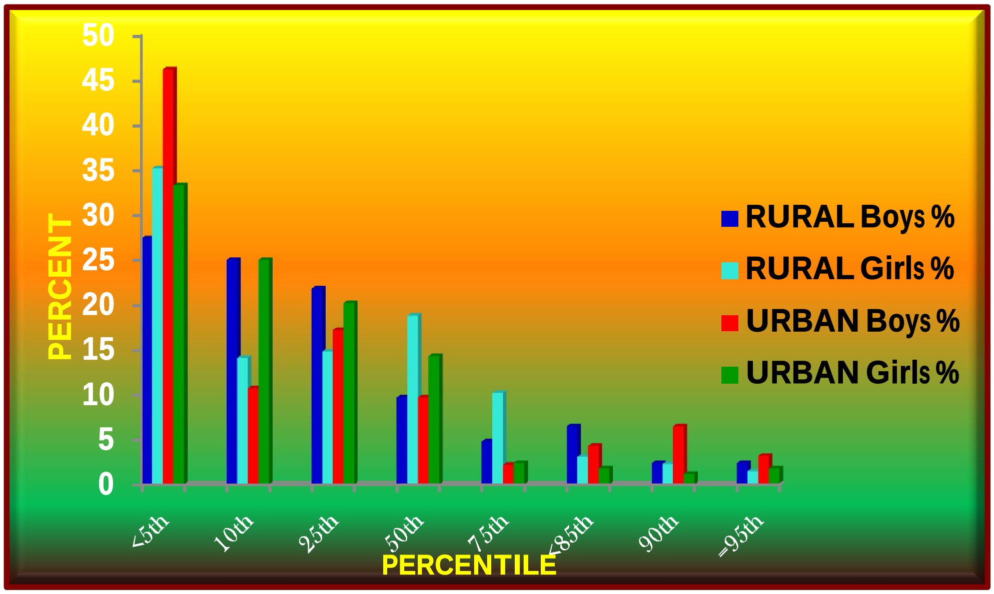


FIGURE - 13

BODY MASS INDEX OF CHILDREN

4) Waist to height ratio of the school going children

Waist to height ratio of the selected school children is given in the Table XI and Figure 14.

TABLE XI

WAIST to HEIGHT RATIO OF THE SELECTED CHILDREN (N=513)

Area	0.5				> 0.5				Total
	B	%	G	%	B	%	G	%	
Rural	110	88.7	150	89.3	14	11.3	18	10.7	**292**
Urban	77	82.8	105	82.0	16	17.2	23	18	**221**

With regard to the waist to height ratio of the school children, it is seen from the Table that maximum number of boys accounting to 88.7 per cent and 82.8 per cent from rural and urban areas respectively had normal waist to height ratio of 0.5. Among girls, 89.3 per cent in rural and 82 per cent in urban had normal level of waist to height ratio.

About 11.3 per cent of rural boys and 17.2 per cent of urban boys were above the normal level whereas10.7 per cent of rural and 18 per cent of urban girls had more than the normal level of waist to height ratio of > 0.5.

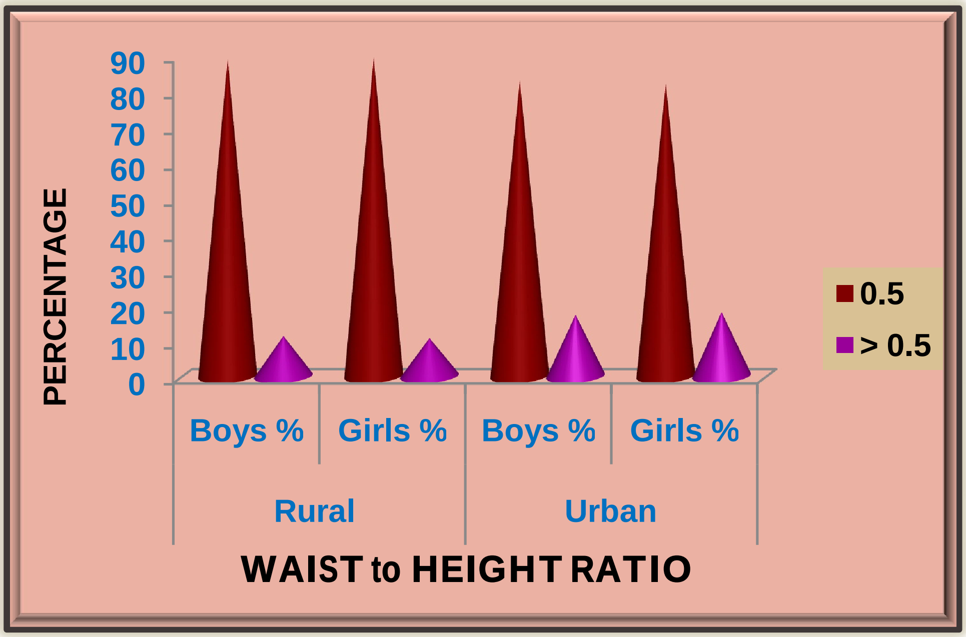


FIGURE- 14

WAIST TO HEIGHT RATIO OF CHILDREN

C.CLINICAL STATUS OF THE SELECTED SCHOOL CHILDREN

Clinical status of the selected school children is presented in Table XII

TABLE XII

CLINICAL STATUS OF THE SCHOOL GOING CHILDREN (N=513)

Conditions		**Rural**				**Urban**			
		B	**%**	**G**	**%**	**B**	**%**	**G**	**%**
Hair	Normal	46	37.1	84	50	24	25.8	43	33.6
	Thin	54	43.5	45	26.8	46	49.5	38	29.7
	Brittle	24	19.4	39	23.2	23	24.7	47	36.7
	Total	**124**	**100**	**168**	**100**	**93**	**100**	**128**	**100**
Skin	Normal	90	72.6	124	73.8	56	60.2	73	57
	Rough and dry	34	27.4	44	26.2	37	39.8	55	43
	Total	**124**	**100**	**168**	**100**	**93**	**100**	**128**	**100**
Eyes	Normal	72	58.1	104	61.9	67	72	72	56.2
	Pale	52	41.9	64	38.1	26	28	56	43.8
	Total	**124**	**100**	**168**	**100**	**93**	**100**	**128**	**100**
Teeth	Normal	87	70.2	124	73.8	65	69.9	104	81.3
	Dental caries	37	29.8	44	26.2	28	30.1	24	18.7
	Total	**124**	**100**	**168**	**100**	**93**	**100**	**128**	**100**
Gums	Normal	108	84.5	144	85.7	74	79.6	102	79.7
	Bleeding	16	12.5	24	14.3	19	20.4	26	20.3
	Total	**124**	**100**	**168**	**100**	**93**	**100**	**128**	**100**
Musculature	Normal	68	54.8	121	72	62	66.7	82	64.1
	Poor	56	46.2	47	28	31	33.3	46	35.9
	Total	**124**	**100**	**168**	**100**	**93**	**100**	**128**	**100**
Nail	Pale &broken	53	42.7	33	19.6	17	18.3	14	10.9
	Normal	71	57.3	135	80.4	76	81.7	114	89.1
	Total	**124**	**100**	**168**	**100**	**93**	**100**	**128**	**100**

From the table it is found that both in rural and urban areas significant per cent of children were found to be clinically normal with regard to hair, skin, eyes, teeth, gums and nails.

In the case of hair conditions it is found that 43.5 per cent of boys and 27 per cent girls in rural areas and 50 per cent boys and 30 per cent girls in urban areas had thin hair. It is revealed that 27.4 per cent of boys 26.2 per cent girls in rural areas and 39.8 per cent boys and 43 per cent girls in urban areas had rough and dry skin. It is also observed that 41.9 per cent boys, 38.1 per cent girls in rural and 28 per cent boys, 43.8 per cent girls in urban had pale eyes.

Among the selected school going children 29.8 per cent boys and 26.2 per cent girls in rural and 30.1 per cent boys and 18.7 per cent girls had dental caries. About 12.5 per cent boys and 14.3 per cent girls from rural areas and 20.4 per cent boys and 20.3 per cent girls in urban areas had bleeding gums. It is seen that about 14.5 per cent boys and 19.6 per cent girls in rural areas and 18.3 per cent boys and 10.9 per cent girls in urban areas had pale and broken nails whereas others had normal nails. About 46.2 per cent of boys and 28 per cent girls and 33.3 per cent boys, 35.9 per cent girls in rural and urban areas respectively had poor musculature.

The overall picture of clinical status revealed a moderate category of prevalence of deficiency symptoms.

D. DIETARY PATTERN OF THE CHILDREN

1) Type of diet followed by the school going children

The dietary pattern of the selected school children is given in Table XII

TABLE XII

TYPE OF DIET FOLLOWED BY THE SCHOOL GOING CHILDREN (N=513)

F Pattern	Rural				Urban				Total	
	B	%	G	%	B	%	G	%	No	%
Vegetarian	7	5.6	11	6.5	2	2.2	2	1.6	**22**	**4.3**
Non vegetarian	113	91.1	151	89.8	88	94.6	123	96.1	**475**	**92.6**
Ova vegetarian	4	3.2	6	3.7	3	3.2	3	2.3	**16**	**3.1**
Total	**124**	**100**	**168**	**100**	**93**	**100**	**128**	**100**	**513**	**100**

From the table it is noted that both in rural and urban areas non vegetarians dominated with a percentage of 92.6 (91.1% boys, 89.8% girls in rural and 94.6% boys, 96.1% girls in urban schools) followed by a lesser percentage of 4.3 (5.6% boys, 6.5% girls in rural and 2.2% boys, 1.6% girls in urban) pure vegetarians. Only a low percentage (3.1%) of children was found to be ova vegetarians. The type of diet pattern followed by majority of the selected children was non vegetarianism.

2) Meal pattern of the selected school going children

The meal pattern of the selected school children is presented in Table XIV.

TABLE XIV

MEAL PATTERN AMONG THE SELECTED SCHOOL CHILDREN (N=513)

Meal pattern	Rural				Urban				Total	
	B	%	G	%	B	%	G	%	No	%
<3	7	5.6	21	12.5	3	3.2	11	8.6	**42**	**8.2**
3	104	83.9	139	82.7	86	92.5	111	86.7	**440**	**85.8**
>3	13	10.5	8	4.8	4	4.3	6	4.7	**31**	**6**
Total	**124**	**100**	**168**	**100**	**93**	**100**	**168**	**100**	**513**	**100**

As evidenced from the Table a majority of 85.8 per cent of families of the selected rural and urban school children had three meal pattern followed by 8.2 per cent with less than three meal pattern. Only 6 per cent of them had more than three meal pattern. It is obvious that most of them had only three meal pattern.

3) Skipping of meals among school children

Details about skipping of meals by the selected school children is given in Table XV.

TABLE XV

FREQUENCY OF SKIPPING OF MEALS AMONG CHILDREN (N=513)

Area	Yes				No				Total
	B	%	G	%	B	%	G	%	
Rural	96	77.4	142	84.5	28	22.6	26	15.5	**292**
Urban	22	23.6	96	75	71	76.3	32	25	**221**

FREQUENCY OF SKIPPING MEALS AMONG CHILDREN

Frequency	Rural				Urban			
	B	%	G	%	B	%	G	%
Regularly	63	65.6	97	68.3	-	-	13	13.5
Once in a week	18	18.8	24	16.9	8	36.3	18	18.8
Twice in a week	-	-	-	-	-	-	-	-
Occasionally	8	8.3	16	11.2	6	27.2	24	25
Rarely	7	7.3	5	3.5	8	36.3	41	42.7
Total	**96**	**100**	**142**	**100**	**22**	**100**	**96**	**100**

Breakfast consumption is associated with positive outcomes for diet quality, micronutrient intake, weight status and lifestyle factors. Breakfast has been suggested to positively affect learning in children in terms of behaviour, cognitive, and school performance. (Adolphus *et al.,* 2013).

From the table it is found that both boys and girls from rural areas skipped meals. Compared with rural school children majority (76.3 %) of the urban boys (22.6%) did not skip their regular meals whereas maximum percentage (84.5%) of girl children skipped their meals. The reasons revealed for skipping meals by majority of children was lack of appetite and lack of time. Others expressed reasons like dislike towards foods and monotonous type of foods.

Regarding frequency, it is found that most of the children (65.6 % boys and 68.3 % girls) skipped their meals regularly. Others expressed that they skipped meals once in a week, occasionally or rarely.

Most of the children who skipped meals from both rural and urban areas were not taking fruits or fruit juices to compensate the skipped meals. Instead majority of the children in rural areas (63 % boys and 90 % girls) were taking snacks to compensate their meals. The type of snacks taken by the children included chips, biscuits, savouries etc.

A majority of 78 per cent of children from rural areas and 64 per cent of children from urban areas had the habit of eating while watching T.V. and majority of children preferred to take snacks while watching T.V which added empty calories to their diet.

4) Frequency of consumption of foods by the school going children

The frequency of consumption of foods by the selected children is presented in Table XVI

TABLE XVI

FREQUENCY OF CONSUMPTION OF FOODS BY THE SELECTED SCHOOL CHILDREN

Food items	Rural (292)						Urban (221)					
	Boys (%)			Girls (%)			Boys (%)			Girls (%)		
	D	W	O	D	W	O	D	W	O	D	W	O
Cereals	100	-	-	100	-	-	100	-	-	100	-	-
Pulses	100	-	-	94	6	-	87	13	-	100	-	-
Vegetables	78	22	-	78	22	-	68	32	-	83	17	-
Roots & tubers	39	44	17	63	24	13	42	47	11	21	53	26
GLV	14	46	50	57	21	22	8	17	75	19	32	49
Fruits	23	36	41	83	14	3	16	28	56	24	36	40
Milk & Milk products	76	24	-	86	14	-	67	18	15	68	32	-
Non- veg	-	78.2	21.8	-	79	21	-	84	16	-	84	16

From the Table it is observed that both in rural and urban areas 100 per cent of children were consuming cereals (rice, wheat, ragi etc) and pulses (red gram dhal) every day. Other cereals and pulses were used weekly once or occasionally. Maximum percentage of children were consuming vegetables regularly. The types of vegetables commonly used were brinjal, drumstick, bitter gourd, ladies finger and broad beans. Common roots and tubers included in their diet were potato, carrot and yam. Green leafy vegetables were used occasionally by maximum per cent of students.

In rural areas, girls were consuming fruits regularly than boys whereas in urban areas less percentage of children were consuming fruits regularly. Maximum per cent of children were consuming milk in the form of tea, coffee or health drinks.

Nearly 80 per cent of children were consuming non vegetarian foods weekly once particularly chicken.

5) Food and nutrient intake of the selected school children

The average food and nutrient intake of the selected sub sample of 50 school children from both rural and urban areas was studied by 24 hour recall method for three days and the observations from the study are presented in the following tables.

i) Food intake of the selected school boys

The mean food intake of selected school boys in comparison with ICMR RDA (2010) is presented in Table XVII.

TABLE XVII

MEAN FOOD INTAKE OF THE SELECTED BOYS

Category	Foods (g)	ICMR RDA (2010)	Rural (N=12)		Urban (N=13)	
			Mean intake	Deficit or excess	Mean intake	Deficit or excess
Under weight	Cereals	300	275	-8	175	-42
	Pulses	60	60	0	50	-17
	Roots& tubers	100	25	-75	80	-20
	GLV	100	15	-85	10	-90
	Other vegetable	200	25	-88	25	-88
	Fruits	100	100	0	20	-80
	Milk& milk products	500	150	-70	200	-60
	Sugar	30	20	-33	25	-17
	Fats & oils	35	15	-57	25	-29

Normal	Cereals	300	300	0	400	33
	Pulses	60	75	+25	100	67
	Roots& tubers	100	60	-40	60	-40
	GLV	100	30	-70	40	-60
	Other vegetable	200	50	-75	75	-63
	Fruits	100	65	-35	75	-25
	Milk& milk products	500	250	-50	250	-50
	Sugar	30	25	-17	25	-17
	Fats & oils	35	15	-57	15	-57
Over weight	Cereals	300	150	-50	235	-22
	Pulses	60	120	100	50	-17
	Roots& tubers	100	35	-65	20	-80
	GLV	100	25	-75	120	20
	Other vegetable	200	75	-63	45	-78
	Fruits	100	90	-10	25	-75
	Milk& milk products	500	150	-70	200	-60
	Sugar	30	25	-17	25	-17
	Fats & oils	35	40	14	20	-43

Regarding the food intake of the selected underweight category boys in rural schools it is found that the intake of pulses and fruits was equal to the Recommended Dietary Allowances (RDA). Intake of all the other food groups was deficit when compared to the RDA with a higher deficit for vegetables and milk and milk products. In the case of urban underweight boys the consumption of all the food groups was deficit than the RDA specially a maximum deficit among vegetables and fruits.

Among the selected boys of normal weight category in rural areas the consumption of cereals was equal to RDA and the consumption of pulses was more than the RDA. All other foods were found to be less than RDA. Among urban boys the consumption of cereals and pulses was in excess whereas all other foods were found to be deficit.

In the case of rural overweight boys the consumption of pulses and fats was excess and the other foods were taken less than the RDA. Among urban overweight boys, consumption of green leafy vegetables was high and the intake of other food groups was inadequate than RDA.

In general, all the selected boys showed an inadequate intake of all categories of vegetables, fruits and milk and milk products.

ii) Food intake of the selected school girls

The mean food intake of the selected school girls compared with ICMR RDA (2010) is presented in the Table XVIII

TABLE XVIII

MEAN FOOD INTAKE OF THE SELECTED BOYS

Category	Nutrients	ICMR RDA (2010)	Rural (N=12)		Urban (N=13)	
			Mean intake	Deficit or excess	Mean intake	Deficit or excess
Under weight	Cereals	240	200	-17	175	-27
	Pulses	60	60	0	50	-17
	Roots& tubers	100	35	-65	45	-55
	GLV	100	25	-75	20	-80
	Other vegetable	200	25	-88	30	-85
	Fruits	100	85	-15	50	-50
	Milk& milk	500	225	-55	150	-70

	products					
	Sugar	30	20	-33	25	-17
	Fats & oils	35	20	-43	25	-29
Normal	Cereals	240	400	67	200	-17
	Pulses	60	100	67	120	100
	Roots& tubers	100	60	-40	65	-35
	GLV	100	40	-60	20	-80
	Other vegetable	200	75	-63	50	-75
	Fruits	100	75	-25	80	-20
	Milk& milk products	500	250	-50	200	-60
	Sugar	30	25	-5	30	0
	Fats & oils	35	15	-20	15	-57
Over weight	Cereals	240	175	-27	175	-27
	Pulses	60	110	83	35	-48
	Roots& tubers	100	45	-55	80	-20
	GLV	100	20	-80	20	-80
	Other vegetable	200	30	-85	30	-85
	Fruits	100	100	0	80	-20
	Milk& milk products	500	150	-70	150	-70
	Sugar	30	25	-17	25	-17
	Fats & oils	35	15	-57	25	-29

In the case of selected underweight category rural girls the consumption of pulses was equal to the RDA whereas intake of all other foods was deficit with vegetables being the maximum. Among urban girls of underweight category the consumption of all the food groups was deficit than RDA.

Among the selected girls of normal weight category from rural and urban areas the consumption of pulses was more than the RDA whereas among both rural and girls consumption of all types of vegetables, milk and milk products, fats and oils, and fruits was found to be inadequate than ICMR RDA.

In the case of rural overweight girls consumption of pulses was high and consumption of fruits was equal to the RDA whereas all other foods were inadequately consumed. With regard to urban girls the consumption of all the food groups even cereals was inadequate compared to RDA. both rural and urban overweight girls consumed vegetables and milk and milk products inadequately.

6) Nutrient intake of the selected school boys

i) Nutrient intake of the selected school boys

The mean nutrient intake of the selected school boys in comparison with ICMR RDA is given in Table XIX and Figure 15.

TABLE XIX

MEAN NUTRIENT INTAKE OF THE SELECTED BOYS

Category	Nutrients	ICMR RDA, (2010)	Rural (N=12)		Urban (N=13)	
			Mean intake	Deficit or excess	Mean intake	Deficit or excess
Under weight	Energy (K.cal)	2190	1629	-26	1541	-30
	Protein(g)	39.9	40	0.5	49	24
	Fat (g)	35	34	-3	60	71
	Fibre (g)	21	4.3	-80	7	-65
	Calcium (mg)	800	360	-55	573	-28
	Iron (mg)	21	6.7	-68	13	-39
	Carotene (µg)	4800	1566	-67	2364	-51
	Thiamine (mg)	1.1	0.9	-9	1.3	15
	Riboflavin (mg)	1.3	0.7	-45	2.4	86
	Niacin (mg)	15	12	20	10	-32
	Vitamin–C(mg)	40	69	72	50	25
Normal	Energy (K.cal)	2190	2291	5	1729	21
	Protein(g)	39.9	81	102	52	29
	Fat (g)	35	43	23	52	47
	Fibre (g)	21	8	-61	10	52
	Calcium (mg)	800	883	10	682	-15
	Iron (mg)	21	16	-24	27	28
	Carotene (µg)	4800	3689	-23	3574	-26
	Thiamine (mg)	1.1	1.6	53	1.1	26
	Riboflavin (mg)	1.3	1.3	-4	13.6	-12
	Niacin (mg)	15	17	14	95	-9.4
	Vitamin–C(mg)	40	84	110	27	138

Over weight	Energy (K.cal)	2190	1930	-12	1808	-17
	Protein(g)	39.9	59	48	59	47
	Fat (g)	35	81	132	59	68
	Fibre (g)	21	10	-51	7	-69
	Calcium (mg)	800	569	-29	954	19
	Iron (mg)	21	11	-50	12	-45
	Carotene (µg)	4800	2780	-42	8887	85
	Thiamine (mg)	1.1	0.9	-13	1.3	18
	Riboflavin (mg)	1.3	1.1	-17	1.2	-8
	Niacin (mg)	15	9.4	-37	13	-15
	Vitamin–C(mg)	40	152	279	258	546

In the case of rural and urban underweight boys nutrient intake of all the nutrients was inadequate when compared to Recommended Dietary Allowances (RDA).

In the case of rural normal weight boys nutrient intake of energy, protein, fat, calcium, thiamine, niacin and vitamin C was more than the RDA whereas all other nutrients were inadequate than RDA. Among normal weight urban boys except energy, calcium, carotene, riboflavin and niacin all the other nutrient intake was higher than RDA (2010).

In the case of overweight boys in rural areas the intake of nutrients like protein, fat and vitamin C was excess than the RDA. Among selected urban overweight boys protein, fat, calcium, carotene, thiamine and vitamin C was excess than the RDA. Other nutrients like energy, fibre, iron, riboflavin and niacin were inadequate when compared to RDA (2010).

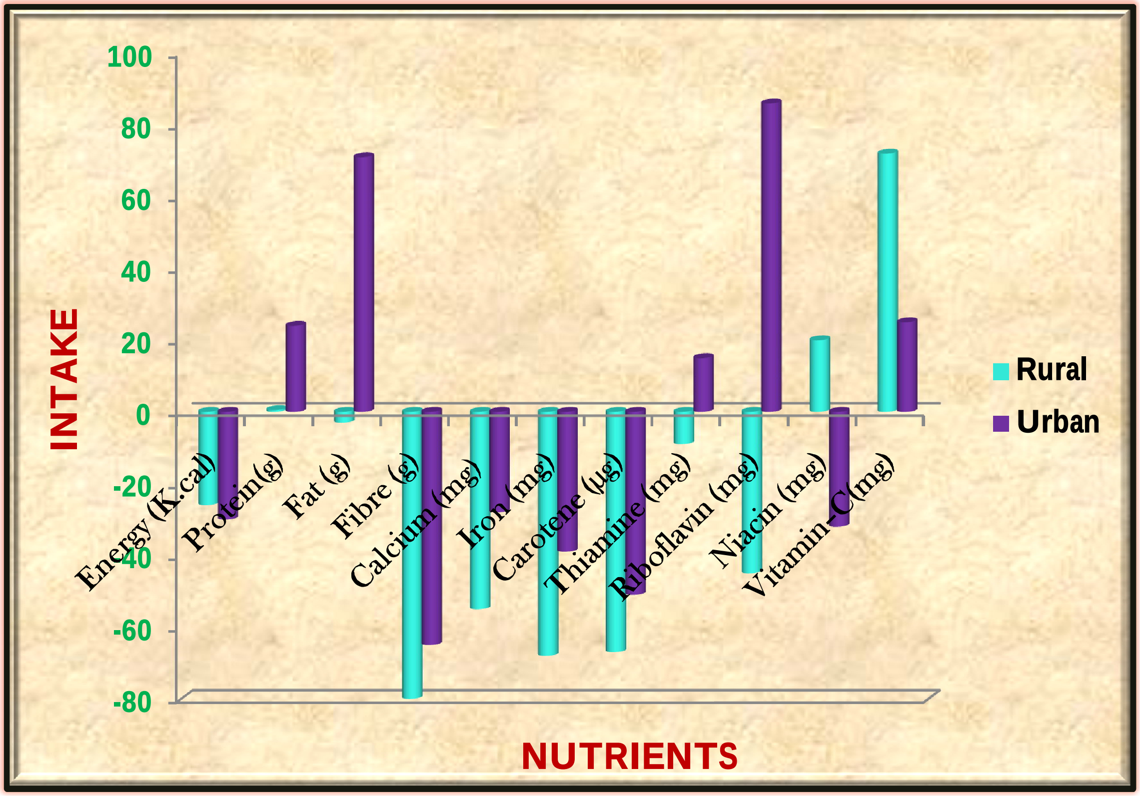


FIGURE - 15

MEAN NUTRIENT INTAKE OF UNDERWEIGHT BOYS

(RURAL AND URBAN)

ii) Mean nutrient intake of the selected school girls

The mean nutrient intake of the selected school girls compared with ICMR RDA is presented in Table XX and Figure 16.

TABLE XX

MEAN NUTRIENT INTAKE OF THE SELECTED GIRLS

Category	Nutrients	ICMR RDA, (2010)	Rural		Urban	
			Mean intake	Deficit or excess	Mean intake	Deficit or excess
Under weight	Energy (K.cal)	2010	916	-54	1659	-72
	Protein(g)	40.4	24	-40	36	-11
	Fat (g)	35	46	32	105	105
	Fibre (g)	27	8	-70	78	-78
	Calcium (mg)	800	615	-23	438	45
	Iron (mg)	27	6	-79	8	-69
	Carotene (µg)	4800	2323	-52	2811	-41
	Thiamine (mg)	1	0.5	-48	1.0	0.4
	Riboflavin (mg)	1.2	0.8	-38	0.7	-42
	Niacin (mg)	13	4.4	-71	0.5	-96
	Vitamin–C(mg)	40	99	147	72	79
Normal	Energy (K.cal)	2010	1729	-14.0	1774.9	-11.7
	Protein(g)	40.4	52	27.6	53.1	31.4
	Fat (g)	35	51	46.8	47.9	36.8
	Fibre (g)	27	10	-62.7	8.5	-68.5
	Calcium (mg)	800	682	-14.7	578.8	-27.7
	Iron (mg)	27	27	-0.6	11.5	-58.9
	Carotene (µg)	4800	3574	-25.6	1970.2	-14.6
	Thiamine (mg)	1	1.4	38.3	1.1	-23.3
	Riboflavin (mg)	1.2	1.1	-4.9	0.9	-18.5
	Niacin (mg)	13	14	4.6	10.6	55.0
	Vitamin–C(mg)	40	95	138.3	62	-57.4

Over weight	Energy (K.cal)	2010	1927	-4	1595	-21
	Protein(g)	40.4	58	43	36	-11
	Fat (g)	35	66	89	62	76
	Fibre (g)	27	7.4	-73	9	-68
	Calcium (mg)	800	487	-39	453	-43
	Iron (mg)	27	11	-59	10	-62
	Carotene (µg)	4800	2172	-55	2307	-52
	Thiamine (mg)	1	1.1	12	1.1	7
	Riboflavin (mg)	1.2	1.1	-7	-3	114
	Niacin (mg)	13	11	-13	10	-26
	Vitamin–C(mg)	40	56.7	42	58	45

In the case of rural and urban underweight girls intake of nutrients except fat and vitamin C all other nutrients were deficit when compared to Recommended Dietary Allowances (RDA).

Among normal weight girls intake of energy, calcium, iron, β-carotene, and riboflavin was less than the RDA whereas other nutrients like protein, fat, fibre, thiamine, niacin and vitamin C was more when compared to the RDA. Among urban normal weight girls except protein, fat and niacin the other nutrients intake was higher than the RDA (2010).

In the case of overweight girls in rural areas the intake of nutrients like protein, fat, thiamine and vitamin C was adequate whereas other nutrients were inadequate when compared to RDA. Among urban overweight girls except nutrients like fat, thiamine, riboflavin and vitamin C, all other nutrients were deficit than the RDA.

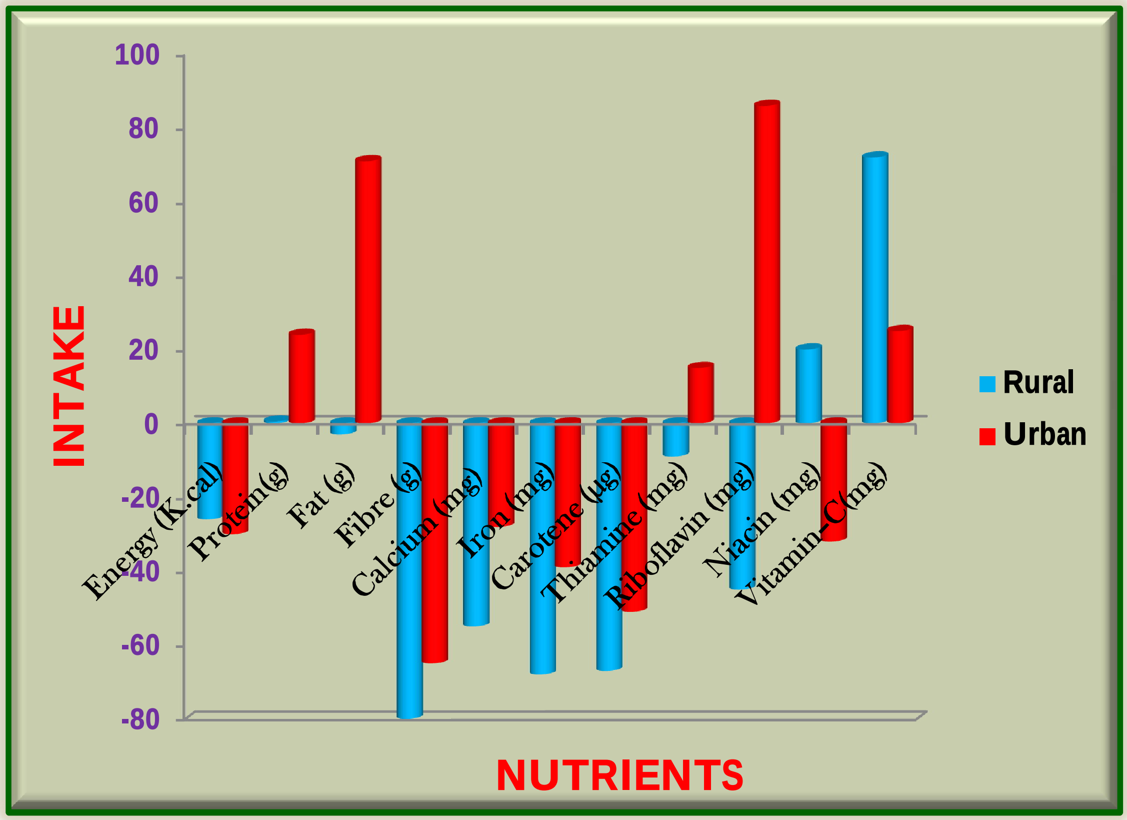


FIGURE - 16

MEAN NUTRIENT INTAKE OF UNDERWEIGHT GIRLS

(RURAL AND URBAN)

7) Frequency of consumption of fats and oils by the families

The consumption of fats and oils by the families of the selected school children is given in Table XXI

TABLE XXI

FREQUENCY OF CONSUMPTION OF FATS AND OILS (N=513)

Type of fat	Rural				Urban			
	B	%	G	%	B	%	G	%
Saturated (Butter, Vanaspathi)	29	23.4	21	12.5	10	10.8	18	14
MUFA (Sea same oil. Groundnut oil)	23	18.5	31	18.5	31	32.3	34	26.3
PUFA (Sun flower oil, Corn oil)	72	58.1	116	69	52	54.5	76	59.7
Total	**124**	**100**	**168**	**100**	**93**	**100**	**128**	**100**

It is observed from the Table that families of 58 per cent of boys and 69 per cent of girls in rural areas and 54.5 per cent of boys and 59.7 per cent of girls from urban areas used sunflower oil daily for cooking purposes. Some fats like butter, hydrogenated fat and ground nut oil were used occasionally in their cooking. It is found that vanaspathi was commonly used to prepare sweets during festival time.

The consumption of fats and oils by the families of the selected school children was found to be above the recommended allowance. It may be due to the size of the family or may be due to the consumption of fried foods. Most of the families (95.2 % boys and 81 % girls in rural and 86 % boys and 94.5 % girls in urban) were using more than two litres of oil per month.

8) Frequency of consumption of junk foods by the school going children

The frequency of consumption of junk foods by the selected school going children is given in Table XXII.

TABLE XXII

FREQUENCY OF CONSUMPTION OF JUNK FOODS BY THE CHILDREN (N=513)

Foods	Rural (292)						Urban (221)					
	Boys (%)			Girls (%)			Boys (%)			Girls (%)		
	D	W	O	D	W	O	D	W	O	D	W	O
Baked items	-	18.5	81.5	-	43.4	56.6	-	50.5	49.5	-	50	50
Fried items	-	36.3	63.7	-	33.9	66.1	-	60.2	39.8	-	59.4	40.6
Chat items	-	30.6	69.4	-	25.6	74.4	-	54.8	45.2	-	25.8	74.2
Chocolates	21.8	58.3	19.4	39.9	48.8	11.3	19.4	40.9	39.8	32	53.1	14.8
Sweets	-	28.2	71.8	-	16.1	83.9	-	22.6	77.4	-	36.7	63.3
Savouries	37.9	50	12.1	57.1	31.5	11.3	-	36.6	63.4	17.2	52.3	30.5
Ice cream	-	35.5	64.5	-	28.0	72	-	57	43	-	39.8	60.2
Carbonated beverages	-	29.8	70.2	-	13.7	86.3	-	24.7	75.3	-	28.1	71.9

According to Philips,*et al.,* (2004) most of the junk foods are rich in fats and poor in other nutrients. Common junk foods included fast food, chips, candy, gum, sweet desserts as well as alcoholic beverages Consumption of energy dense foods especially sweetened beverages like fruit drinks, carbonated soft drinks and energy drinks may lead to type 2 diabetes and cardiovascular risk.

From the study it is observed that children from both rural and urban areas had the habit of skipping meals. To compensate their skipped meals almost all the children were consuming savouries like chips, biscuits, etc., It is found that children especially girls from rural areas consumed snacks like biscuits and chips during their break time in school.

Children from rural areas were consuming baked items, chat items occasionally whereas significant per cent of urban children were consuming them weekly once. Twenty two per cent boys and 39.9 per cent girls in rural areas and 19.4 per cent boys, 32 per cent girls in urban areas were consuming chocolates daily. Maximum per cent of children were taking ice creams and carbonated beverages occasionally. Except chocolates and savouries, all other junk foods or fast foods were consumed by children either weekly once or occasionally.

9) Consumption of beverage by the school going children

According to Graham (1996) tea is the most frequently consumed beverage in the world. A regular consumption of black tea throughout the day helps to maintain mental alertness and reduce fatigue. Almost all the children were consuming tea, coffee, milk and health drink every day except 14 boys and 10 girls from rural areas and 6 boys and 13 girls from urban areas were not consuming any beverage. Most of the children were consuming any one of the beverages in the morning hours.

10) Knowledge about balanced diet among the school going children

It is observed that only a few percentage of children (9% in rural and 8% in urban areas) were aware of balanced diet. Few children reported to have food restrictions to some type of foods especially brinjal, dry fish, and chicken due to food allergy.

E. LIFE STYLE PATTERN

1) Exercise pattern of the school going children

The duration of exercise of the selected school children is presented in Table XXIII

TABLE XXIII

DURATION OF EXERCISE BY THE SCHOOL CHILDREN (N=513)

Duration	Rural (292)				Urban (221)			
	B	%	G	%	B	%	G	%
<30 min	14	11.3	31	18.4	7	7.5	13	10.2
30 – 45 min	101	81.4	129	76.9	76	81.7	36	28.1
> 1 hour	9	7.3	8	4.7	10	10.8	6	4.7
Total	**124**	**100**	**168**	**100**	**93**	**100**	**128**	**100**

From the study it is observed that children performed some physical activity. Majority of the children 81.4% boys and 76.9% girls in rural areas and 81.7% boys and 28.1% girls from urban areas performed 30-45 minutes of exercise. Only about 7.3 per cent boys, 4.7 per cent girls in rural and 10.8 per cent boys and 4.7 per cent girls in urban areas performed more than one hour of exercise everyday followed by 11.3 per cent boys, 18.4 per cent girls in rural and 7.5 per cent boys and 10.2 per cent girls in urban areas performed less than 30 minutes of exercise per day. Type of exercise performed by most of the children was yoga, walking, running and other aerobic exercises.

2) Regarding time spent in tuition by the school going children

The time spent by the selected school children towards tuition is presented in Table XXVI.

TABLE XXVI

TIME SPENT IN TUITION BY THE SELECTED CHILDREN (N=513)

School	Tuition - Yes				Tuition - No			
	B	**%**	**G**	**%**	**B**	**%**	**G**	**%**
Rural	6	4.8	12	7.1	118	95.2	156	92.9
Urban	46	49.4	53	41.4	47	50.5	75	58.6
Duration of tuition								
Duration	**Rural**				**Urban**			
	B	**%**	**G**	**%**	**B**	**%**	**G**	**%**
1 hour	-	-	-	-	-	-	-	-
1-2 hours	4	66.7	7	58.3	38	82.6	48	90.6
> 2 hours	2	33.3	5	41.6	8	17.4	5	9.43
Total	**6**	**100**	**12**	**100**	**46**	**100**	**53**	**100**

Among the selected school children a majority of 95.2 per cent boys and 92.9 per cent girls in rural areas and 50.5 per cent boys and 58.6 per cent girls in urban areas) were not going to tuition. Only about 4.8 per cent boys, 7.1 per cent girls in rural area and 49.4 per cent boys and 41 per cent girls in urban areas were going to tuition.

Among both rural and urban areas majority of children were going to tuition for 1-2 hrs followed by more than 2 hrs per day.

3) Sleeping pattern of the school going children

The sleeping pattern of the selected school children is given in Table XV

TABLE XV

SLEEPING PATTERN OF THE SELECTED SCHOOL CHILDREN

Hours	**Rural (292)**				**Urban (221)**			
	B	**%**	**G**	**%**	**B**	**%**	**G**	**%**
< 4 hours	-	-	-	-	-	-	-	-
4 - 6 hours	-	-	-	-	-	-	-	-
6- 8 hours	98	79.1	143	85.1	78	83.8	114	89.1
> 8 hours	26	20.9	25	14.8	15	16.2	14	10.9
Total	**124**	**100**	**168**	**100**	**93**	**100**	**128**	**100**

From the present study it is found that majority of children (79.1% boys, 85.1% girls in rural and 83.8% boys, 89.1% girls in urban) slept for 6-8 hours daily followed by the remaining boys and girls who slept for more than 8 hours daily. Since the children are of younger age there are no problems regarding sleeping pattern.

4) Average percentage of marks obtained by the school going children

The average percentage of marks obtained in the last exam by the selected school children is presented in Table XVI.

TABLE XXVI

AVERAGE PERCENTAGE OF MARKS GOT BY THE SCHOOL GOING CHILDREN

Marks %	Rural (292)				Urban(221)			
	B	**%**	**G**	**%**	**B**	**%**	**G**	**%**
40-50	-	-	-	-	-	-	-	-
51-60	12	9.7	9	5.3	21	22.5	11	8.6
61-70	94	75.8	113	67.3	46	49.4	23	17.9
71-80	13	10.5	35	20.8	18	19.5	84	65.6
81-90	5	4	11	6.6	8	8.6	10	7.8
Total	**124**	**100**	**168**	**100**	**93**	**100**	**128**	**100**

Physical activity throughout the school day has been shown to have positive benefits on academic achievement (Haerens *et al*, 2007). Children who were engaged in more physical activity may have higher academic achievement.

Among the selected school children, a majority of 75.8 per cent boys, 67.2per cent girls from rural schools secured 61-70 per cent marks whereas 49.4 per cent of boys and only 17.9 per cent girls in urban areas got 61-70 per cent marks. It is interesting to note that 10.5 per cent boys, 20.8 per cent girls in rural and 19.5 per cent boys and 65.6 per cent girls in urban schools secured 71-80 per cent marks. Compared to rural school going children more percentage of urban children scored 81-90 per cent marks. None of the children from rural or urban areas scored more than 90 per cent.

About 50 per cent of children in both rural and urban areas were reported to get tensed often. Almost all those children stated the reason that getting scolding from parents or teachers made them to be tense.

All the school children had more than one hour of physical education per week and all the children reported that they were playing during physical education hour and not sitting in class.

Among the selected school going children, most of the students stated that they spent most of their time during holidays by playing, performing house hold works and by watching television.

5) Common ailments suffered by the school going children

Common ailments suffered by the selected school children is presented in Table XXVII

TABLE XXVII

COMMON AILMENTS SFFERED BT THE SCHOOL CHILDREN

Conditions	Rural (292)						Urban (221)					
	Boys			Girls			Boys			Girls		
	F	O	R	F	O	R	F	O	R	F	O	R
Cold	26	78	20	46	67	55	28	34	31	68	34	26
Cough	19	83	22	59	63	46	18	54	21	51	38	39
Fever	34	63	27	118	28	22	36	31	26	39	46	43
Head ache	66	31	27	132	25	11	26	31	36	67	38	23
Vomiting	-	29	95	-	27	141	-	35	58	-	37	91
Diarrhoea	-	17	107	-	16	152	-	-	93	-	-	128
Constipation	-	-	-	-	-	-	-	-	-	-	-	-
Abdominal pain	-	36	88	-	72	96	-	32	61	14	43	71

From the study it is observed that the common ailments suffered by the children in the last one year were cold, cough, fever and head ache. Almost all the children in both rural and urban areas were reported to have head ache often. No children were reported to have constipation and sleeping disorders. Children stated that they had stomach pain when they were not taking foods.

f) Family history of diseases of school going children

Family history of diseases of selected school children is given in Table XXVIII.

TABLE XXVIII

FAMILY HISTORY OF DISEASES OF SELECTED SCHOOL CHILDREN

Diseases	Rural (292)		Urban (221)	
	Parents (No)	Grand parents (No)	Parents (No)	Grand parents (No)
Diabetes mellitus	-	23	12	24
High cholesterol	-	15	-	17
Hypertension	-	8	16	21
Obesity	-	6	3	8
Heart diseases	-	-	-	4

It is observed that none of the parents of rural school children were not affected by any diseases whereas a total of 52 grand parents of rural children were affected by diabetes, high cholesterol, hypertension and obesity.

In the case of urban children 31 parents of school children between the ages of 35-45yrs were affected by diabetes, hypertension and obesity and 74 grandparents were affected by diabetes, high cholesterol, hypertension, obesity and heart diseases.

It is evident from the Table that majority of grandparents of urban children are affected by chronic diseases might be due to changed lifestyle, food pattern, stress etc which is of greater concern.

F. PHYSICAL ACTIVITY PATTERN OF THE SELECTED SUB SAMPLE.

The level of physical activity and energy balance of the selected sub sample of 50 school children are presented and discussed in the following tables.

i) Physical activity level of selected school boys.

The physical activity level and energy balance calculated from energy expenditure of selected school boys and girls is presented in the Table XXIX.

Table XXIX

PHYSICAL ACTIVITY AND ENERGY BALANCE OF SELECTED SCHOOL BOYS AND GIRLS

Category	Rural (n=12)				Urban (n=13)			
	Energy intake (K.cal)	**Energy Output (TDEE) (K.cal)**	**Energy balance**	**PAL***	**Energy intake (K.cal)**	**Energy Output (TDEE) (K.cal)**	**Energy balance**	**PAL***
Under weight	1629	2140	-ve	2.3	1541	2218	-ve	2.1
Normal	2291	2432	-ve	2.1	1729	2086	-ve	1.9
Over weight	1930	1984	-ve	1.7	1808	2043	-ve	1.6
(Girls)	**Rural (n=12)**				**Urban (n=13)**			
Under weight	916	2038	-ve	2.4	1659	2184	-ve	2.1
Normal	1729	2126	-ve	2.3	1775	2067	-ve	2.1
Over weight	1927	2078	-ve	1.9	1595	1987	-ve	1.6

Source: * Jess Kroll (2013), PAL – Physical Activity Level, TDEE – Total Daily Energy Expenditure

From the table it is clear that the energy intake of underweight, normal and overweight boys was less than the energy output indicating a negative energy balance and the physical activity level was found to be 2.1, 1.9 and 1.6 respectively according to the latest value suggested by Jess Kroll (2013).

It is interesting to note that the energy output of underweight, normal and underweight was found to be high than the energy intake revealed a higher negative energy balance with a physical activity level of 2.1, 2.1 and 1.6.

The findings revealed a close relationship between energy balance and physical activity level that lesser the energy balance higher the physical activity.

CORRELATION BETWEEN PAL AND ACADEMIC PERFORMANCE

The correlation between Physical Activity Level (PAL) and academic performance is presented in the Table XXXI.

TABLE XXXI

CORRELATION BETWEEN PAL AND ACADEMIC PERFORMANCE OF SCHOOL GOING CHILDREN (N=50)

Category	Rural		Urban	
	Boys	**Girls**	**Boys**	**Girls**
Underweight	0.187NS	-0.578	-0.274	-0.127
Normal	0.438 NS	-0.86	-0.356	-0.843
Overweight	-0.429	-0.422	-0.596	-0.465

NS – Not Significant

From the table it is found that correlation between PAL and academic performance among underweight and normal category rural boys was not significant. A negative correlation was observed between PAL and academic performance among other girls and boys from both rural and urban areas.

Although observational studies have found relationships between physical fitness and grades and test scores, those between PA and direct measures of academic achievement often had null findings. Sibley and Etnier (2003) concluded that there is a significant positive relationship between physical activity and cognition but there is insufficient evidence to conclude that an additional physical education time increases academic achievement; however, there is no evidence that it is detrimental.

In the present study it is observed that there is a no correlation between PAL and academic performance.

SUMMARY AND CONCLUSION

V. SUMMARY AND CONCLUSION

School age is considered as a dynamic period of growth and development because children undergo physical, mental, emotional and social changes. In other words the foundations of good health and sound mind are laid during the school age period.

Physical inactivity is an important risk factor for many chronic diseases and contributors to obesity and poor mental well-being. Physical inactivity with faulty dietary habits such as junk foods rich in high calories and fat and inadequate nutrient intake may lead to unhealthy life including the risks of obesity, hypertension, coronary heart diseases and type II diabetes. Physical inactivity is strongly linked to depression in school children.

This study on **"Dietary Habits and Physical Activity Pattern of Rural and Urban School Going Children (10-12 yrs)"** was carried out in rural and urban schools in Coimbatore to find out their nutritional status and physical activity level. Subjects for the study were selected from sixth and seventh standard. A well-structured interview schedule was formulated and used as a tool for collecting the data on background information.

To elicit the socio economic background, nutritional status, clinical status and dietary habits a survey was conducted among 513 children which included both boys and girls from three rural and three urban schools in Coimbatore. Physical activity pattern was determined for a selected sub sample of 50 who are categorized by the BMI into three groups namely underweight, normal and obese.

Food and nutrient intake of the selected sub sample was calculated from the 24 hour recall method for three days. Energy balance for the selected sub sample of 50 was found out by energy intake and energy expenditure. Physical activity levels were determined using the standard formula.

The study reveals the following findings:

- ❖ Children for the present study comprised of 292 (124 boys and 168 girls) from rural schools and 221 (93 boys and 128 girls) from urban schools.
- ❖ Out of 513 children 73 and 39 boys from rural and urban areas were in the age group of 10-11 yrs and 39 and 54 boys in rural and urban areas were in the age

group 11-12 yrs. With regard to girls 69 and 63 girls from rural and urban areas were in the age group of 10-11 years and the remaining 99 girls in rural and 65 girls in urban schools were in the age group of 11-12 yrs.

- About 40 per cent of rural children belonged to nuclear families and the remaining 60 per cent were joint families whereas among urban children 66 per cent belonged to nuclear and 35 per cent were from joint families.
- The study revealed that 63 boys and 59 girls from rural areas and 58 boys and 72 girls from urban areas lived in families of 3-5 members. About 47 boys and 93 girls and 31 boys and 49 girls from rural and urban areas respectively lived with 6-8 members and the remaining 14 boys and 16 girls from rural areas and 4 boys and 7 girls lived in families with more than 8 members.
- A majority of 42.9 per cent families were earning Rs. 7000-10,000 per month followed by 39.4 per cent families with more than Rs. 10,000 per month.
- A maximum of 61.2 per cent families spent 50-75 per cent of their income on food followed by 27.9 per cent families spent more than 75 per cent of income for food. Only about 10.9 per cent spent 25-50 per cent of their income on food.
- The mean height of 11 yrs old boys of rural and urban areas was similar with a value of 139 cm but compared with ICMR, (2010) reference values of 144.8cm, it was found to be below the expected values. Rural boys of 12 yrs had a mean height of 142.7 cm found to be more than the mean height of urban boys with 138.9 cm. It was also found to be less than the ICMR values of 151.1cm.
- The mean height of 11-12 yrs girls from rural and urban areas were less than the reference values. The findings revealed the prevalence of long term malnutrition resulting in stunting.
- The mean weight of 10-12 yrs rural boys was 32.5 kg and mean weight of urban boys was 31.6 kg which was less than the standard value of 34.3kg. The mean weight of 10-12 yrs rural girls was 34.2 kg and urban areas 32.9 kg was also less than the reference value.
- Based on Body Mass Index a majority of boys (61.3% in rural and 37% in urban) were in healthy weight category followed by 27.9 per cent in rural and 46.2 per cent in urban children below the 5th percentile which was considered as

underweight. Only 2.4 per cent and 3.2 per cent in rural and urban areas respectively were above the 95th percentile which is considered as overweight. Among selected girls 57.9 per cent from rural and 61.9 per cent from urban areas were in healthy weight category whereas 35.2 per cent and 33.3 per cent in rural and urban areas were underweight followed by 1.5 per cent from rural and 1.8 per cent from urban areas being overweight.

- Based on waist to height ratio 11.3 per cent of rural boys and 17.2 per cent of urban boys were above the normal level whereas10.7 per cent of rural and 18 per cent of urban girls had more than (> 0.5) the normal level of waist to height ratio.
- Both in rural and urban areas significant per cent of children were found to be clinically normal with regard to hair, skin, eyes, teeth, gums and nails.
- Non vegetarians dominated with a percentage of 92.6 both in rural and urban areas followed by a lesser percentage of 4.3 pure vegetarians and 3.1per cent of children was ova vegetarians.
- A majority of 85.8 per cent of families of the selected rural and urban school children had three meal pattern followed by 8.2 per cent with less than three meal pattern. Only 6 per cent of them had more than three meal pattern.
- Compared with rural school children majority (76.3 %) of the urban boys did not skip their regular meals whereas maximum percentage of girl children skipped their meals.
- Most of the children (65.6 % boys and 68.3 % girls) skipped their meals regularly. It was also found that majority of the children in rural areas (63 % boys and 90 % girls) were taking snacks to compensate their meals.
- A majority of 78 per cent of children from rural areas and 64 per cent of children from urban areas had the habit of eating while watching T.V. and majority of children preferred to take snacks while watching T.V.
- Children from both rural and urban areas were consuming cereals, pulses, vegetables and milk and milk products regularly. Green leafy vegetables were used occasionally by maximum per cent of children. In rural areas, girls were

consuming fruits regularly. Non vegetarian foods particularly chicken were consumed nearly by 80 per cent of children.

- Among underweight category boys intake of all the food groups was less whereas among normal weight category boys except cereals and pulses, intake of all other food groups was deficit and in the case of overweight boys the consumption of pulses and fats was excess and the other food groups were taken less than the RDA.
- Among underweight category girls, the consumption of pulses was equal to the RDA whereas intake of all other foods was deficit with vegetables being the maximum. Among normal category girls both rural and urban areas all types of vegetables, milk and milk products, fats and oils and fruits was found to be inadequate than RDA. In the case of overweight girls except fruits and pulses all other foods were inadequately consumed.
- Both rural and urban underweight boys nutrient intake of all the nutrients was inadequate when compared to RDA. Nutrients like protein, fat, calcium, thiamine and vitamin C was excess in normal, underweight and overweight boys.
- Among rural and urban underweight girls intake of nutrients except fat and vitamin C all other nutrients were deficit. Among normal weight category girls nutrients like protein, fat, fibre, thiamine, niacin and vitamin C was more whereas among the overweight girls nutrients such as protein, fat, thiamine and vitamin C was adequate when compared with RDA.
- Families of 58 per cent boys and 69 per cent girls in rural areas and 54.5 per cent boys and 59.7 per cent girls from urban areas used sunflower oil daily for cooking purposes. Some fats like butter, hydrogenated fat and ground nut oil were used occasionally in their cooking, with vanaspathi being used to prepare sweets during festival time.
- Consumption of fats and oils by the families of the selected school children was found to be above the recommended allowance.
- From the study it is observed that children were consuming savouries like chips, biscuits, etc., regularly. It is found that children especially girls from rural areas consumed snacks like biscuits and chips during their break time in school.

- Children from rural areas were consuming baked items, chat items occasionally whereas significant per cent of urban children were consuming them weekly once. Nearly 30 per cent of children were taking chocolates every day. Maximum per cent of children were taking ice creams and carbonated beverages occasionally.
- Almost all the children were consuming tea, coffee, milk and health drink every day except 14 boys and 10 girls from rural and 6 boys and 13 girls from urban areas were not consuming any beverage.
- Only a less percentage of children (9% in rural and 8% in urban areas) were aware of balanced diet.
- Few children reported to have food restrictions to some type of foods especially brinjal, dry fish, and chicken due to food allergy.
- Majority of the children (81.4% boys, 76.9% girls and 81.7% boys and 28.1% girls) from rural and urban areas performed 30-45 minutes of exercise. Only about 7.3 per cent boys, 4.7 per cent girls in rural and 10.8 per cent boys and 4.7 per cent girls in urban areas performed more than one hour of exercise everyday followed by 11.3 per cent boys, 18.4 per cent girls in rural and 7.5 per cent boys and 10.2 per cent girls in urban areas performed less than 30 minutes of exercise per day.
- Among the selected school children majority (95.2% boys and 92.9% girls in rural areas and 50.5% boys and 58.6% girls in urban areas) were not going to tuition. Only about 4.8 per cent boys, 7.1 per cent girls in rural area and 49.4 per cent boys and 41 per cent girls in urban areas were going to tuition.
- Majority of children (79.1% boys, 85.1% girls in rural and 83.8% boys, 89.1% girls in urban) slept for 6-8 hours daily followed by the remaining boys and girls who slept for more than 8 hours daily.
- Among the selected school children, a majority of 75.8 per cent boys, 67.2per cent girls from rural schools and 49.4 per cent of boys and only 17.9 per cent girls in urban areas secured 61-70 per cent marks. It is interesting to note that 10.5 per cent boys, 20.8 per cent girls in rural and 19.5 per cent boys and 65.6 per cent girls in urban schools secured 71-80 per cent marks. Compared to rural

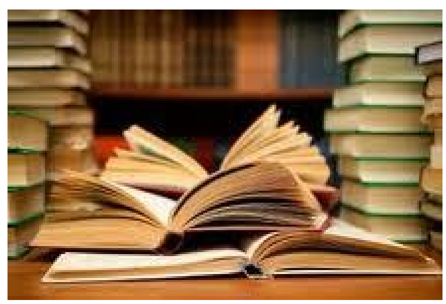
school going children more percentage of urban children scored 81-90 per cent marks.

- ❖ About 50 per cent of children in both rural and urban areas were reported to get tensed often
- ❖ Common ailments suffered by the children in the last one year were cold, cough, fever and head ache. Almost all the children in both rural and urban areas were reported to have head ache often.
- ❖ None of the parents of rural school children were not affected by any diseases whereas 52 grand parents of rural children were affected by diabetes, high cholesterol, hypertension and obesity. In the case of urban areas 31 parents of school children between the ages of 35-45 were affected by diabetes, hypertension and obesity and 74 grandparents were affected by diabetes, high cholesterol, hypertension, obesity and heart diseases.
- ❖ Energy intake of underweight, normal and overweight boys was less than the energy output indicating a negative energy balance and the physical activity level was found to be 2.1, 1.9 and 1.6 respectively
- ❖ It is interesting to note that the energy output of underweight, normal and underweight was found to be high than the energy intake revealing a higher negative energy balance with a physical activity level of 2.1, 2.1 and 1.6.
- ❖ The findings revealed a close relationship between energy balance and physical activity level that lesser the energy balance higher the physical activity.
- ❖ There is a negative correlation between the PAL and academic performance among selected children.

RECOMMENDATIONS

- ➢ Schools can assess nutritional status by taking anthropometric measurements of the children once in three months and physical activity pattern of school children which may help to identify the children’s health and fitness.
- ➢ Government can take efforts to provide more nutritious foods along with midday meals and also can extend physical education for 1 hour every day.

- Government can include the chapters on health, nutrition, benefits of physical activity, in the school curriculum or in the physical education programme to make them aware of physical activity and its importance.
- Schools can organize guest lectures and health promotion programmes which can include importance of good nutrition and physical activity among children.
- Counselling can be given to the parents regarding children’s food intake, choice of foods and encourage their children to involve in more of physical activities.



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2. Age (in years):

APPENDICES

APPENDIX- I

Interview schedule to elicit Information on Socio economic, Dietary Habits and Physical Activity Pattern of Rural and Urban School Going Children (10-12yrs).

I.GENERAL INFORMATION:

1. Name of the child:

2. Age (in years):

3. Date of birth:

4. Sex:

5. Class:

6. Type of family: i) Nuclear ii) Joint

7. Size of the family: i) <3 ii) 3-5 iii) 5-8 iv)>8

8. DETAILS OF THE FAMILY MEMBERS

S. no	**Names**	**elationship**	**Age**	**education**	**Occupation**	**Monthly Income (Rs)**

9. Total family monthly income (Rs):

10. Food expenditure in a month (Rs):

II. ANTHROPOMETRIC MEASUREMENTS

Height in (cm):

Weight in (Kg):

BMI:

Waist circumference (cm):

Waist to height ratio:

III.DIETARY HABITS AND FOOD CONSUMPTION PATTERN

11. Are you a …….
    i) Vegetarian ii) Non vegetarian iii) Ova vegetarian
12. Frequency of meals taken in a day
    i) 3times ii) 4-5 times iii) > 5 times
13. Do you skip meals?

    i) Yes ii) No

14. How often do you skip meals?

    i) regularly ii) Once in a week iii) Twice in a week

iv) Occasionally v) rarely

15. How do you compensate for the skipped meals?

    i) By drinking fruit juices ii) by eating fruits

    iii) By eating snacks iv) others (specify) v) none

16. Do you eat while watching T.V?

i) Yes ii) No

17. Food intake (24 hours recall method)

Days	Breakfast	Lunch	Evening	Dinner
First day				
Second day				
Third day				

18. FOOD FREQUENCY LIST

S.no	Food items	Daily	Weekly	Monthly	Occasionally
1.	Cereals and whole grains Rice Wheat Ragi Bajra Maize Others				
2.	Pulses and legumes Bengal gram Green gram Red gram dhal Horse gram Others				
3.	Vegetables Brinjal Pumpkin Ladies finger Drumstick Broad beans Others				
4.	Roots & tubers Carrot Potato Raddish Yam Others				
5.	Green leafy vegetables Amaranths Spinach Mint Agathi Others				
6.	Fruits Banana Apple Orange Sapota				

	Others				
7.	Milk & milk products				
	Milk				
	Curd				
	Buttermilk				
	Others				
8.	Non veg				
	Egg				
	Fish				
	Chicken				
	Mutton				
	Others				

19. Consumption of fats and oils

I) Saturated fats

i) Butter ii) Vanaspathi

II Mono unsaturated fats

i) Sesame oil ii) Groundnut oil

III Poly unsaturated fatty acids

i) Sunflower oil ii) Corn oil iii) Rice bran oil

20. Total quantity of oil used per month

i) <0.5 L ii) 0.5-1 L iii) 1-1.5 L iv) 2 L

21. CONSUMPTION OF SNACKS & PROCESSED FOODS

S.no	Food items	Daily	Weekly	Monthly	Occasionally
1.	Baked items				
2.	Fried items				
3.	Chat items				
4.	Chocolates				
5.	Sweets				
6.	Savouries				
7.	Ice cream				
8.	Carbonated beverages				
9.	Traditional snacks				
10.	Others				

22. Consumption of beverages? i) Yes ii) No

If yes,

i) Tea ii) Coffee iii) Milk iv) Health drinks v) others

23. Do you follow any food restrictions? i) Yes ii) No

If yes, what are the types of foods you avoid?

24. Do you know what is balanced diet? i) Yes ii) No

If yes, describe shortly:

25. Are you taking any vitamin/mineral supplements? i) Yes ii) No

If yes, please list

V.LIFE STYLE PATTERN

26. Did you do exercise regularly? i) Yes ii) No

If yes,

i) <30 min ii) 30-45 min iii) > 1 hour

27. Are you going to tuition? i) Yes ii) No

If yes,

i) <1 hour/day ii) 1-2 hours/day iii) >2 hours/day

28. How many hours do you sleep in a day?

i) <4 hrs ii) 4-6 hrs iii) 6-8 hrs iv) >8 hrs

29. Do you get tensed? i) Yes ii) No

If yes, i) often ii) occasionally iii) rarely

30. Do you have physical education hour? i) Yes ii) No

If yes, how many hours in a week?

i) 1 hr ii) <1 hr iii) No hr

31. What will you do during games hours?

i) Play games ii) sitting iii) others (specify)

32. What will you do most of the time during holidays?

i) Playing ii) Watching T.V iii) others (specify)

33. Average percentage of marks in the last exam? …………………

34. MORBIDITY PATTERN (In the last one year)

s. no	Conditions	Frequently	Occasionally	Rarely
1.	Cold			
2.	Cough			
3.	Fever			
4.	Diarrhoea			
5.	Headache			
6.	Vomiting			
7.	Sleeping disorders			
8.	Abdominal pain			
9.	Constipation			
10.	Others			

35. FAMILY HISTORY OF DISEASES

Diseases	Relationship to the student
Diabetes mellitus High cholesterol Hypertension Obesity Heart disease	

INSTITUTIONAL HUMAN ETHICS COMMITTEE

Avinashilingam
Institute for Home Science and Higher Education for Women
University
(Estd. u/s 3 of UGC Act 1956)

2nd January 2014

To
Ms. U. Karthika,
Department of Food Science and Nutrition,
Avinashilingam Institute for Home Science and
Higher Education for Women,
Coimbatore – 641 043

Dear Madam,

Ref : Your proposal AUW.IHEC. 2013:17 entitled "Dietary habits and physical activity pattern of rural and urban school going children (10-12 years)" submitted for approval of the IHEC on 6th December 2013

The Institutional Human Ethics Committee of our University hereby grants approval to your research proposal AUW.IHEC. 2013:12 entitled "Dietary habits and physical activity pattern of rural and urban school going children (10-12 years)" submitted by you. The Approval number for the same is AUW/IHEC-13-14/XMT-01.

We wish you all the best in your research endeavours.

Regards,
2/1/14
Dr.P.R.Padma
Member Secretary

Institutional Human Ethics Committee