NUTRITION STATUS AND ANXIETY LEVEL OF PRE PUBERTAL AND POST PUBERTAL GIRLS AND AN IMPACT OF NUTRITION INTERVENTION

Thesis Submitted for the
Degree of Doctor of Philosophy (Ph.D.)

By
A.ANBUMALAR
Department of Foods & Nutrition

MOTHER TERESA WOMEN'S UNIVERSITY
KODAIKANAL
June, 2011

CERTIFICATE

"It is certified that the thesis entitled, "**Nutrition status and anxiety level of pre pubertal and post pubertal girls and an impact of nutrition intervention**" is a record of research work done by the candidate, **A.ANBUMALAR** during the period of study under me and that the thesis has not formed the basis for the award of any degree, diploma, associate ship, fellowship or other similar title to the candidate and that the thesis represents independent work on the part of the candidate".

Signature of supervisor

Dr. ROSHAN HABEEB M.Sc., M.Phil., P...
Foods Nutrition, Head
Department of Post Graduate Studies
and Research in Home Science
J.B.A.S. Women's College
(formerly S.I.E.T.), Chennai-600 012.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF GRAPHS

ACKNOWLEDGEMENT

I wish to express my gratitude to the ***lord Almighty*** for the infinite grace and benevolence which stirred through out my work

I owe a huge debt of gratitude to my guide **Dr. (Mrs.) Roshan Habeeb**, Former Reader and Head, Department of Human Science, J.B.A.S.College for Women, Chennai for her adroit guidance, meticulous care, valuable suggestions and help rendered through out this study.

I express my profound gratitude and indebtedness to **Dr.A.John William Felix**, Reader in Community Medicine, RMMC, Annamalai University for his expert statistical guidance and idealistic methodological Orientation through out the course of my research program.

I would like to express my profound respects and deep sense of gratitude to **The Director,** School of Distance Education, Mother Theresa Women's University, **The Registrar** and **The controller of Examinations**, Mother Theresa Women's University for giving me an opportunity to carry out my Ph.D. programme.

I would like to express my profound respects and deep sense of gratitude to **Dr.M.Ramanathan,** Vice-Chancellor, Annamalai University, **Dr.N.Chidambaram**, Dean, Faculty of Medicine, Annamalai University, **Dr.S.Rathinasabapathy**, Registrar, Annamalai University for giving me permission to carry out my Ph.D.Programme.

I am very grateful to **Dr. (Mrs.) Vijayalakshmi Ethiraj** for her constant encouragement which has led to the successful completion of this study.

I deem it a great privilege to offer my sincere and heartfelt thanks to school authorities for their co operation, to conduct my research in their esteemed institutions and I am also grateful to the experts, who helped in establishing the content validity of the questionnaire and the girls participated in my study.

I cherish to acknowledge the benevolence of my beloved husband, daughters, parents, brother and my friends whose motivation and encouragement has helped me in the completion of my work.

A.ANBUMALAR

Abstract

The present investigation aims to assess "Nutrition status and anxiety level of pre pubertal and post pubertal girls and an impact of nutrition intervention" in the age group of 11 to 14 years. The study population comprised of pre pubertal and post pubertal girls studying in different schools of Chidambaram in Cuddalore District, Tamilnadu, India.

A core sample of 489 subjects comprising 280 pre pubertal female and 209 post pubertal female children were selected by purposive sampling method. A pre tested questionnaire was used to collect, general details of the subjects. Anthropometric measurements (body height and body weight) were assessed. Bio chemical parameter hemoglobin estimation was done for a sub sample. Dietary intake data were collected through three consecutive days food recall and analyzed for adequacy of food intake using nutritive value of Indian foods, ICMR. The existing knowledge on nutrition, health awareness and menstrual management of the selected girls were assessed by using a questionnaire through a Pre test. Physical activity pattern of the selected girls were assessed by the responses of the parents. Based on the results an educational intervention program was conducted for a sub sample and the impact of the program was evaluated by the post tests. The collected data were analyzed through descriptive and inferential statistics.

The mean age of menarche of urban poor, rural girls and urban girls were 13.76, 13.7 and12.7 respectively. The mean body height and weight of pre pubertal and post pubertal girls were 136.6cm, 33.5kgs and 146.6cm, 44.4kgs respectively. The mean intakes of all the food stuff among three groups (Urban, Urban poor and rural 10-12 years girls) were found to be closer to each other. However the mean intake of milk and green leafy vegetables consumption by urban middle income group was found comparatively higher than in the urban low income group and the rural subjects. Majority of post pubertal subjects were found to be under the category of moderate level anemia. The results indicated that only 24% were normal in post pubertal category where as 36% were normal in pre pubertal category. Regarding menstrual management, the results showed that two thirds of the selected girls (90% urban middle, 19% urban poor, 11% rural poor,) regardless

of age, used disposable pads and 32% of the urban middle, 97% of the urban poor and 98 % of the rural poor girls used cotton or cloth material. With regard to physical activity, totally 202 girls (pre pubertal) and 88 girls (post pubertal) got involved in physical activity. Data on attitude towards the food habits revealed that majority (63%) of the girls had an undecided attitude on the various aspects of food habits followed by 25% who had positive attitude. In the case of knowledge on nutrition it was revealed that majority of the girls (67%) had inadequate knowledge and 32 % had moderately adequate knowledge and only 1 % had adequate knowledge. Intervention program indicated a positive response score. There was significant improvement in the knowledge level and awareness about the various aspects of nutrition and health awareness after the intervention program. However, there is a need to conduct nutrition and health education program, at regular intervals to upgrade their knowledge so that the pre and post pubertal girls get sensitized towards attaining better health.

INTRODUCTION

CHAPTER I

INTRODUCTION

Women's deprivation in terms of nutrition and healthcare rebounds on society in the form of ill health of their off springs.

-Siddiq Osmani and Amartya Sen

India has one of the fastest growing youth population in the world and the adolescent girls in the age group of 13 to 19 years are characterized by limited education, lack of knowledge pertaining to social as well as health aspects and also limited influence on the decisions affecting their lives. During this period, attitudes, beliefs and values tend to settle into a pattern, out of which emerges the shape and directions of one's life style. Adolescence is a critical life stage, during which life style choices are established including health related behaviors with impacts throughout life (WHO 2003). Adolescent girls constitute nearly one tenth of the population and form an extremely important segment of the society (Kulin et al., 1982). Nutritional status during school age is a major determinant of nutritional and health status in adult life. Globally, including in India, health hazards associated with under nutrition and micronutrient deficiencies remain the major public health problems. The planning commission, Government of India, stated in the Tenth five year plan (2002-2007) that the main nutrition problems affecting the adolescent populations worldwide include under nutrition in terms of stunting and thinness, iron deficiency, shortage of intake of minerals and other micronutrients. These problems, if not addressed, would lead to perpetuation of ill health and stunted growth across generations. Targeted programmers and inputs are required to address this urgently and in a systematic manner across the country.

Aarthi *et al.*, (2009) stated that, in India, a staggering 320 billion people live below the poverty line resulting in wide spread prevalence of under nutrition. The growing childhood years are more critical since the curse of under nutrition is more pronounced.

Traditionally, women bear primary responsibility for the well being of their families. Yet they are systematically denied access to the resources they need to fulfill their responsibilities, which includes education, health care services, job training, etc. For young girls in India, poor nutrition status, early childbearing and reproductive health complications compound the difficulties of adolescent physical development. Women's reproductive health is largely influenced by their health status during infancy, childhood and adolescence. Compared with boys, the adolescent girl's health, nutrition, education and development are much more neglected causing adverse effects on the girl's reproductive health. Most of the girls are not adequately aware of their increased nutritional needs for growth (especially increasing their food intake to meet calorie demands of pubertal growth) resulting in underweight and of short stature. Adolescent girls face more problems than boys, largely due to socio-cultural factors. They are deprived of adequate health care, good nutrition and opportunity for schooling.

Health is one of the major issues revolving around the different stages of adolescence. Despite the efforts from different governmental and non governmental agencies focusing on different health aspects, these young populations, especially the girls, are deprived of the basic health care and awareness. The girls are often very ignorant of how their bodies function in terms of sex and reproduction and frequently express a strong desire for the opportunity to discuss such issues.

Santosh jain passi *et al.*, (2005) stated that these girls need special care in view of their role in shaping the health and well being of the present as well as future generations. A study by Passi and Malhotra (2002) found that with the onset of menarche at puberty and in the absence of adequate dietary intake, adolescent girls become highly susceptible to anemia. In a country like India, with varying social customs and common beliefs against females there is a high prevalence of malnutrition amongst the girls. The common causes of malnutrition among the adolescents in the poor community are less access to food and inadequate knowledge about the dietary requirements (Pereira and Mehta 1983).

Age at menarche

The onset of menstruation is a visible event marked by sequence of changes, occurs during adolescence and becomes a definite timed phenomenon and a valid indicator of sexual development. In addition to the rate of maturation, menstruation appears to be dependent on heredity and the environment. There is a wide variation in the normal onset and the rate with which a child progresses through puberty and there are many conditions that may affect this normal process. This variability involves the genetic factors, as indicated by the studies on heritability of menarcheal age. Other factors such as ethnicity, nutritional conditions, and secular trends have been identified to influence the physiological range at the onset of puberty. Secular trends appear to influence the physiological range in pubertal onset. The reasons for this secular trend relate to the decline in the severity and frequency of illness and to a better health and nutritional status of the general population. These factors, in turn, are the results of improvements in medical care and socioeconomic conditions (Muinck, Keizer and Mul ,2001). A number of studies have noted the association between increased body mass index (BMI) and earlier onset of puberty or menarche in the United States and in Europe (Anderson, Dallal and Must et al., 2003).

Delayed onset of puberty and reduced pubertal growth spurt are often reported among girls suffering from chronic diseases. The causes of abnormal puberty can be divided into two groups. Firstly, the adverse effects due to the disease itself and secondly, the adverse effects due to drug therapy, namely glucocorticoid therapy and Pubertal delay could be the result of under-nutrition, emotional deprivation, excess increase in protein degradation, accumulation of toxic substances, stress and the secondary effects of therapy (Simon, 2002). Furthur Verma et al., (2004) stated that low iron stores throughout childhood may contribute to a delayed menarche. In general, girls in poor countries have later menarche than in the countries with better socioeconomic conditions (Eveleth et al., 1990).

Age at menarche is associated with anthropometry during adolescence. It is widely recognized that nutritional status is one of the most important non-genetic determinants of menarche (Riley *et al.*, 1993). In general, better nourished girls

reach menarche earlier than undernourished girls (WHO, 2003). There appears to be a trend of decreasing age at menarche worldwide, other factors aside, it is often assumed that this trend is due to the increase in body fat mass secondary to excess calorie consumption. (Dietz and Robinson, 1998)

Growth status

Growth is the result of the concerted effect of a complex network of many regulatory factors with varying interactions. Each individual has a genetic base with a definite growth potential, which may be modulated by various factors (Eveleth et al., 1990).

Optimal growth can only be achieved when all these factors operate in harmony. The transition, from childhood to adulthood, occurs during adolescence period is characterized by major biological changes like physical growth, sexual maturation and psycho-social development. Jaya Sudha Udipi (2003) stated that the growth velocity in a girl reaches its peak between 10 and 13 years of age. This period of maximum growth for both height and weight is the greatest among the girls in the year preceding menarche. School age is a period of rapid growth with a growth spurt in pre-pubertal years. The growth velocity is slower during the early school years (5-9 yrs), 80% of adolescent growth is completed during the early adolescence (10-15 years) and there is a marked deceleration in weight and height velocity in the post-pubertal phase.

During adolescence the hormonal changes accelerate growth in height. Growth is faster than at any other time in the individual's life except the first year. Increased nutritional needs at this juncture relate to the fact that adolescents gain up to 50% of their adult weight, more than 20% of their adult height and 50% of their adult skeletal mass during this period. Anabolic activity is intense during puberty since, besides the appreciable increases in anthropometric indices (weight and height); there is an increase in the lean mass, changes in the amount and distribution of fatty tissue and development of internal organs and systems (Brasel, 1982).

During this phase of growth the girls for the first time experience menstruation and related problems which is marked by the feelings of anxiety and eagerness

to know about this natural phenomenon. Most of the adolescents go through adolescence with little or no knowledge of the body's impending physical and physiological changes, health issues and problems. Early marriages, high fertility rates, high rates of teenage pregnancy and poor nutritional status are the main health problems among the adolescent population in India. The adolescent girls in the rural areas could be at greater risk of nutritional stress because of early marriage and early conception before the completion of their physical growth (Venkaiah *et al.*, 2002).

Dietary Intake

The nutritional status, often poor during the early life, gets worsened as the adolescent growth spurts occurs. Girls in the rural areas get married early. Adolescent mothers belonging to poor socioeconomic strata suffer more from chronic under-nutrition which retards the skeletal growth and maturation. The adolescent girls with height < 145 cm and weight < 38 kg are at risk for delivering low birth weight babies (Gopalan 1989). Studies on diet surveys have shown that the diets of low income group population are inadequate when compared to the recommended standards (Srihari *et al.*, 2007 and Satyanarayana, *et al,* 1981).

Data from National nutrition monitoring bureau (2002) surveys have shown that energy intake among children and adolescents improved till the nineties and then showed a decline. Energy gap in school age children is lower than the gap in preschool children but larger than the gap in adults from the same households. Their protein and micronutrient intakes continue to be low. There are large interstate variations in energy intake both in boys and girls. Energy intakes are lowest in Gujarat and higher in West Bengal and Andhra Pradesh. Swaminathan (1998) stated that the results of nutrition surveys from the developing countries showed a majority of the school children and adolescents consume inadequate diets and are malnourished.

Results of the study indicated that the Alberta adolescents were not meeting minimum Canada's Food Guide to Healthy Eating (CFGHE) recommendations, and thus had suboptimal intakes and poor diet quality. Suboptimal nutritional intakes, meal behaviors and physical inactivity were all related to poor diet quality

and reflect the need to target these health behaviors in order to improve diet quality and overall health and wellness (Storey *et al.*, 2009). Judith *et al.*, (2005) stated that the girls are more at risk for problems related to nutrition for several reasons as they tend to diet inappropriately or to have more finicky eating habits and to be less physically active.

Adequate nutrient intake during the adolescence is very important for many reasons. The age of adolescence encapsulates a window of time during which the bodies are metamorphosing and evolving into that of an adult. It is a time when the adolescent tries to establish his own identity yet desperately seeks to be socially accepted by his peers (Lulinski, 2001). The adolescents therefore face series of serious nutritional challenges which would cause an impact on their rapid growth spurt as well as on their health as adults. However, the adolescents remain a largely neglected, difficult-to-measure, hard-to-reach population. Consequently, their needs, particularly those of adolescent girls are often ignored (Kurz and Johnson - Welch, 1994).

At this developmental stage protein requirements are maximal. Increased physical activity, combined with poor eating habit and other considerations, for example, menstruation, oral contraceptive use and pregnancy contribute to accentuating the potential risk for the adolescents who suffer from poor nutrition. The main nutritional problems affecting adolescent populations worldwide, Nigeria in particular, include under-nutrition in terms of stunting and wasting. Others are the deficiencies of micronutrients such as iron and vitamin A, obesity and other specific nutrient deficiencies (Kurz and Johnson-Welch, 1994). The lifestyle of people has undergone a drastic change in the present scenario. With the changing norms of the society people are becoming increasingly liberal and busy. The cut throat competition, which occurs in all spheres of the world, has solely changed the equations of family life. In a modern urban family when the parents work they may have little time to pay attention to their children. This is one of the biggest reasons for the shift in the eating habits of kids. Fast food has become the fastest ways for parents as well as children to satisfy their bon-appetite. However, what remains unnoticed, are the ill consequences of the same.

Adolescents are growing and when they enter into marriage with poor nutritional status are likely to give birth to smaller infants than what the mature women of the same nutritional status (WHO, 1997) give birth and it is because of the competition for nutrients between the growing adolescent and the growing foetus (Scholl *et al.*, 1990) and poorer placental function (Olson, 1987). Under-nourished adolescent girls and women give birth to underweight and often stunted babies. These infants are less able to learn as young children and are more likely themselves to be parents of infants with intrauterine growth retardation and low birth weight. However, they are less able to generate livelihoods and are less well equipped to resist chronic diseases in later life. Such life cycle and intergenerational links demand sustained, long-term ameliorative action (ACC/SCN, 2000).

Anaemia is one of the most prevalent conditions in the world and iron deficiency is the most common cause among all other deficiencies. Iron nutritional status of the adolescent girls is a matter of great concern especially in the urban poor and rural areas, since these girls enter reproductive life soon after attainment of their menarche (Child in India 1985 and Raman, 1990). Various studies provided information on the dietary pattern for the children in the middle and high socio economic status (Sarma *et al.*, 2006, Seshadri et al., 1999, Vijayapushpam, 2003). All studies employed either the validated and pre-tested 24 hr dietary recall method or a 3-day food record to obtain daily nutrient intake. In general, studies indicated that the diet of these children was largely cereal and pulse based, milk and milk products were consumed in moderation, whereas, fruit and vegetable intake was inadequate and total fat, sugar intakes were twice the recommended allowances (Seshadri *et al.*, 1999). One study (Iyer *et al.*, 2006) indicated that the intake of saturated and invisible fat among the overweight (23 g/day and 31 g/day, respectively) and obese children (29 g/day and 33 g/day, respectively) was higher when compared to that of normal-weight children (16 g/day and 24 g/day) respectively.

Anxiety among school children

According to Hurlock (1998) anxiety often develops after a period of frequent and intense worry that undermines the child's self confidence and predisposes him/her to a generalized feeling of inadequacy. The profound physical and psychological changes of puberty disturb the child emotionally.

Problems begin when ordinary stress becomes too much stress or distress that results in both psychological and biological changes that could place children at a risk for illness. Today stress levels among the children have been going up dangerously due to the pressure of their academic or cultural activities. Further menarche marks a transition in the risk of depression and anxiety among girls.

Physical activity

In India, there has not been a substantial increase in energy intake among the children except those in the urban affluent families (Gopalan1993). The increasing obesity rates among children are attributable mainly to the substantial reduction in physical activity in the form of household chores, methods of commuting (the use of mortised conveyances instead of walking or cycling) and methods of recreation (with computer games and Television watching having replaced physical play) over the past two decades. Overweight children are at the higher risk of becoming over nourished adults and hence incur a higher risk of developing non-communicable diseases. If under- or over nutrition occurs in combination with anemia, the adverse effects on physical performance will be even greater. Over nourished anemic children tend to curtail physical activity because they get fatigued, besides reduced physical activity further aggravates overweight (Narasinga Rao, 1996).

There are three critical aspects of adolescence that have an impact on chronic diseases.

(i) The development of risk factors during this period.

(ii) The tracking of risk factors throughout life.

(iii) The development of healthy or unhealthy habits tends to stay throughout life, for example, the absence of physical activity, because of television viewing. At the same time, the amount of physical activity has been greatly reduced both at home and in school WHO (2003).

Physical education may help to prevent degenerative disease, improve over all physical condition, maintain emotional balance, promote a sense of social effectiveness, contribute to academic performance and establish positive recreation habits.

Health awareness

Proper knowledge about various health related aspects is very important to combat major health problems in future. Pre pubertal and post pubertal children do not get the appropriate knowledge due to lack of a proper health education program in schools. Moreover, the traditional Indian society regards talks on such topics as taboo and discourages open discussion on some issues. This leads to culmination in repression of feelings which can cause intense mental stress and seek health advice from quacks and persons who do not have adequate knowledge on the subject and such health seeking behavior by the adolescent girls is undesirable. Moreover, the routine health services do not have provisions for adequate care of adolescent health problems. This further exaggerates the problems manifold. Understanding the health problems related to menstruation and the health seeking behavior of the adolescent girls, their awareness about important health problems will help us in planning program for this vulnerable group. This awareness is one of the major indicators which reveal a person's knowledge about health problems.

Need and purpose of the study

Nutritional status during school age is a major determinant of nutritional and health status in adult life. Globally, including India, health hazards associated with under nutrition and micronutrient deficiencies remain major public health problems.

Nutrition surveys conducted by National institute of nutrition on young girls revealed that their diets were based mainly on cereals and contained only negligible amount of greens and fruits. The low intake of protective foods may result in nutritional disorders. Further, the school children are generally occupied with academic work, games and are under emotional stress coupled with unbalanced diets which eventually result in poor health. Jaya Sudha Udipi (2003)

stated that in the Indian scenario about 80% of Indian population live in villages with various television channels reaching the rural areas, adolescent population is exposed to fast food and junk food concepts and they may try to imitate their peers in the urban areas. Wrong prioritization, in the selection of foods, has led to the neglect of traditional foods like ragi, green leafy vegetables.

A person selects foods for a variety of reasons. Whatever those reasons may be, food choice influences human health. The most vulnerable populations are teenagers and adolescents who make many more choices for them than they did as children and are very sensitive to inadequate nutrition (Whitney, S. R. Rolfes, 1999). At the same time, social pressure thrusts choice on them (Glanz, M. Basil et al, 1998). The consequences of these choices will influence their nutritional health both today and throughout life (WHO, 1998). Nutrition Foundation of India (1989) stated that due to dietary insufficiencies adolescent girls do not achieve full height and weight potential. About 35% of rural girls have weight below 38 kg and 23% of girls have height below 145 cm.

The various issues and concerns of adolescents in India are multiple with a wide range from nutritional deficiencies, reproductive health problems and wide variety of stress problems. The world health report (1998) stated that data regarding health and nutrition profile of adolescent girls in India are however scarce. It is being increasingly realized that if focused attention is given to at least one segment of female life- the adolescence – a very significant improvement could be made in the life of women in their long reproductive years as well as in the life of their off-springs. (Kalyan Bagchi , 1999).

Several studies have shown that the adolescent growth spurt and age of menarche are influenced by the nutritional status during early adolescence. Menarche can be said as an indicator of physiological development among females. Menarche is the end result of the sequence of events that precede the on set that is attainment of peak height and peak weight velocity at puberty with the onset of menarche and in the absence of adequate dietary intake the adolescent girls become highly susceptible to anemia. According to recent reports nearly 80 per cent of the adolescent girls in the age group 10 -19 years were suffering from iron deficiency. (Santosh jain passi *et al.*, 2005, Sunitha kumari and Rao shobha

et al., 1993). Nutrition news letter (2001) has shown that more than 320 million people in India suffer from iron deficiency anaemia of which 50 percent are adolescent girls.

Adolescents and young adults, both male and female, can benefit from physical activities that are enjoyable promoting confidence in their ability to be physically active amidst their friends, peers and parents. The current recommendation for physical activity states that school aged youth should engage in moderate to vigorous physical activity at least one hour daily to promote health, (U.S. Department of health and human services, 2008).

Besides nutrition, adolescence is a crucial period with regard to emotions in terms of anxiety depression and memory. Student life coincides with adolescence and stress can manifest among children as a reaction to the changes in life. Increasing stress inside the school and anxiety about their future and related problems need to be included in the counseling.

Adolescent girls may be at risk for poor nutritional status which is even more of concern when considering that they may hold the responsibility of mother hood in the future. Kannan (1995) stated that there have been also studies indicating lack of knowledge about nutritional practices among the adolescent girls from various parts of India. The full range of interventions for adolescent health is not yet developed. In the recent years, emphasis has been placed on supporting efforts that enable the adolescents to build life skills. Counseling has been accepted as an important intervention but the provision of health services to adolescents has received scant attention. It is a fact that adolescence is the last window of opportunity to implement strategies to correct growth deficits and knowledge of the main risk factor and the risk groups are required to design and target appropriate intervention. There is a need to conduct a nutrition intervention program to ensure optimal nutritional status and timely attainment of full growth and developmental potential of adolescents. Park (2003) and Prabhakara (2002) stated that education about health, to an individual, is greatly concerned with establishing or inducing changes which modify the behavior to promote healthy living.

There is a need to understand the adolescents' nutritional status, general health awareness and specific information on menstrual care. Menstrual hygiene and management is an issue that is insufficiently acknowledged and has not received adequate attention. Young girls are nutritionally vulnerable and considered to be a special risk group as they are going to be the "would be mothers".

Knowledge on health care awareness can also help prevent, identify, and treat iron deficiency anemia, and the adolescents' reproductive tract infections. This would promote healthy living and prevent adverse consequences. Furthermore, there are pressing research needs to develop adolescents' specific data to have better documents about the adolescents nutritional status and awareness on various aspects of health care.

Adolescent girls constitute a vulnerable group not only with respect to their social status but also in relation to health. Menstruation is regarded as unclean or dirty in Indian society. Although, a natural process, it is linked with several misconceptions and practices which sometimes results into adverse health outcomes. Nevertheless, reaction to menstruation depends upon awareness and knowledge about the subject. The manner in which a girl learns about menstruation and its associated changes may have an impact on her attitude to the event of menarche (muinck Keizer and mul, 2001).

This is the period when an individual's social relation expands from a family to a wider community and its members. Peers, social surrounding and other adults come to play the most important roles in this period. It is a cross road in life, when choices and decisions made become crucial for the future of an individual. Adolescents learn and adopt new knowledge and practices more easily and generally these are long lasting with impact on next generation. This is an important aspect with respect to program and impact of nutrition intervention.

Review of literature revealed that studies related to pre pubertal and post pubertal girls belonging to semi urban community, their nutritional status, level of anxiety, nutritional knowledge and physical activity pattern are limited in south

India. The present study was conducted to fill this gap. It was a holistic approach to understand the adequacy of diets, anthropometric measurements and biochemical assessment for hemoglobin content, nutrition and health awareness, physical activity pattern among pre pubertal and post pubertal school children. An attempt was also made to study the impact of the intervention program for improved knowledge on nutrition and health awareness related to age group problems and general health problems.

The results of the study would focus on pre pubertal and pubertal girls with good knowledge about nutrition and various diseases shall be useful to their own family members as well as to other people in the society in enhancing the knowledge on health awareness and nutrition status.

Statement of the study topic

Nutrition status and Anxiety level of Pre pubertal and Post Pubertal girls and an impact of Nutrition Intervention

The study was designed with the following objectives.

1. To assess the nutrition status using anthropometry, biochemical and dietary pattern of pre pubertal and post pubertal girls.
2. To study the clinical signs and symptoms of nutrition deficiency and menstrual health problems of the selected girls.
3. To determine the anxiety level of the selected girls.
4. To assess the nutrition knowledge and health awareness related to their age group problems such as under weight, obesity, anemia, anorexia nervosa and menstrual hygiene and general health problems such as communicable, non communicable and degenerative diseases among the selected girls.
5. To ascertain the physical activity pattern of the selected girls.

6. To study the relationship of the demographic variables with the level of anxiety, attitude towards food habits, nutrition knowledge and health awareness among the selected girls.

7. To appraise the impact of nutrition intervention through pretest and post test.

Delimitations

The study is delimited to,

1. The study sample was limited to the girls in the age group of 10-14 years, pre and post pubertal.
2. The method of data collection was limited to self-report of sample subjects. (Except, Anthropometric measurement and clinical signs and symptoms of nutrition deficiency)
3. The study area was limited to Chidambaram town, Tamilnadu, India.

Definition of terms

Nutrition status is the condition of health of the girls as influenced by the utilization of the nutrients. It can be determined by dietary history, anthropometric measurements, physical examinations and biochemical investigations.

Anxiety level is connected with a girl's mind and the way in which it works. Anxiety is the emotional condition in which fear and uncertainty exist.

Nutrition intervention- An attempt to increase the level of knowledge among pre pubertal and post pubertal girls about nutrition, diseases related to their age group and general health problems.

REVIEW OF LITERATURE

CHAPTER - II

REVIEW OF LITERATURE

The Review of Literature related to the study on "Nutrition status and Anxiety level of Pre pubertal and Post Pubertal girls and an impact of Nutrition Intervention".

2.1 Phases of Adolescent Growth

2.2 Nutrition status of adolescents

2.3. Food habits of Adolescents

2.4. Nutrition related problems of Adolescents

2.5. Anxiety Level

2.6. Nutrition knowledge and health awareness of Adolescents

2.7 Physical Activity

2.8. Nutrition Intervention

Adolescence, the critical period between 10 and 19 years is characterized by rapid growth and development physiologically, psychologically and socially. This is the time of preparation for undertaking greater responsibilities and to ensure healthy all-round development (WHO, 1997). During this period an adolescent should have 35% of adult weight and 11-18% of adult height. Among the adolescents, the girls are more vulnerable, particularly in the developing countries including India, due to various adverse socio-cultural and economic reasons. They are the future mothers and the nutritional problem of any adolescent girls may have an adverse effect on nutritional status of future generations.

2.1 Phases of Adolescent Growth

The adolescent period represents an important physiological phase of life characterized by rapid growth and development.

2.1.1 Pre-Puberty or Pubescence (Early Adolescence- Age 8-12 years):

This is a period of about two years before the onset of puberty. The exact age, however, depends on factors such as heredity, nutrition and the sex of the child. In most of the industrialized societies, these two processes normally start between 8-10 years of age. However, in the developing countries, where more than one-third of the total children are malnourished or undernourished, the onset of these two processes may get delayed beyond the normal limit. Moreover, within the Third World societies, there is a marked variation in terms of socio-economic characteristics between the rural and urban areas. Recent research suggests that exposure to nudity and obscenity mainly through the mass-media, in the urban areas, stimulates the thought process and the pituitary glands, thereby causing an early onset of menarche and gonadarche. Physical growth follows a predictable pattern although variations do occur. Body building through vigorous practice affects both the height and the weight in later childhood period. The annual increase in height is 2 to 3 inches. The average eleven year old girl is 58 inches, and the average boy of the same age is 57.5 inches tall. Weight increase is more variable than height increase, ranging from 3 to 5 or more pounds annually. The average eleven year old girl weighs 88.5 pounds, and the average boy of the same weighs 85.5 pounds.

Puberty (Mid Adolescence, Age 10-16 years):

It is the period in which biological changes reach their climax. In more developed societies, this phase begins by the tenth year of life among the majority of females. In the tropical countries, the beginning of this phase (10-12 years) has dropped surprisingly by 2-3 years the last five decades. Available research shows that a hormonal (endocrinological) factor rather than nutritional correlates is responsible for this change. Several physiological changes take place during this period, the most prominent in girls being the onset of menstruation (menarche) and nocturnal emissions or wet dreams (spermarche) in boys. Among girls, the bodily change continues to include the enlargement of breast, widening of hips and the appearance of pubic hair. In the case of boys, the shoulders broaden, the length of

bones in arms and legs increase, and there is an increase in the amount of body and facial hair.

Puberty: Females

Puberty usually occurs among girls between 10 and 15 years of age. The onset of menstrual periods (menarche) is one of the most visible signs that a girl is entering puberty. Before having the first menstrual period, the pubescent girl will normally experience a phase of rapid growth, especially an increase in height, breast enlargement, pubic, armpit, and leg hair growth, clear or whitish vaginal secretions, and increased hip width.

The rate at which breasts grow and develop varies greatly and depends of the deposition of fat-pads beneath the skin. The development of fat-pads is different for each young woman and depends on many factors like heredity and nutrition.

Pubertal Milestones in Girls

Every girl enters into puberty at her own time. The average age at puberty for girls in India is found to be around 13.1 years. There is a great deal of variation in terms of the average age at menarche between the rural and urban areas, as well as across various socio-economic and ethnic groups. This variation depends on factors such as body girths, weight, and nutrition.

Body changes at puberty

During the puberty growth spurt, four important physical changes occur which transform the child's body in to that of an adult are the changes in body size, changes in body proportions, the development of the primary sex characteristics and the development of the secondary sex characteristics. Growth during the adolescent period is an important determinant of adult size. It represents an important physiological phase of life, characterized by rapid growth and development.

Sexual maturation

Female puberty is the state or condition of having become functionally capable of procreating offspring. Puberty in the female begins with the first sign of secondary sexual development and continues until ovulation occurs. The average duration of adolescent growth spurt is between 2.5 and three years. Most of the girls will menstruate after they have attained their peak height velocity. During pubertal development, the pelvis becomes broader, while the cavity deepens and becomes spacious to accommodate the genital organs completely.

The ovaries increase in size and attain a change in shape, becoming a characteristic rounded structure. As puberty approaches, progressive development of follicles takes place from which there is increase in production of estrogen resulting in the physical features of puberty, have summoned up the changes that occur during adolescence in the following manner.

1. Muscle mass increases significantly.
2. Fat tissue increases steadily during the entire period in girls.
3. Breast budding and widening of the hips are the first signs of development and are followed by pubic hair.
4. Menarche occurs after the peak of the growth spurt and can occur from one to six years after the first signs of adolescence appear, the average age of onset being 13 years and the weight increase and height spurt occur concomitantly.

FIGURE 1

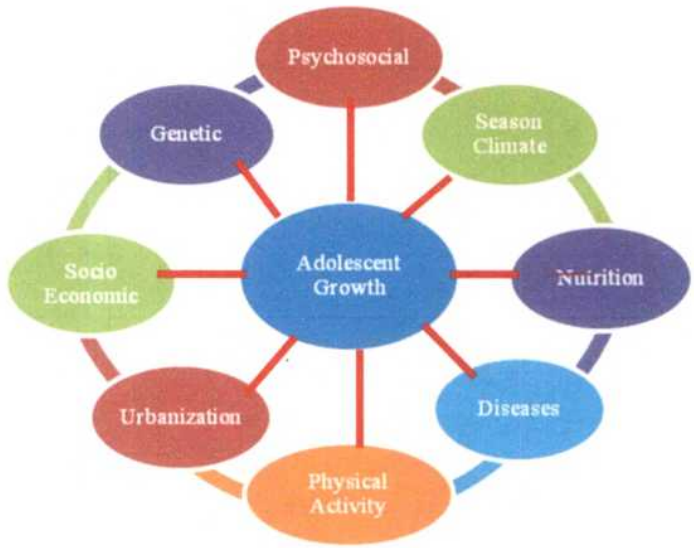


Figure1 represents factors related to Adolescent growth.

Alterations in body dimensions

The process of physical development from a child to an adult is called puberty. During late childhood growth begins to accelerate with pubescence until the rate is as rapid as that of early infancy. At the time of puberty, the second rapid growth spurt occurs; because of the hormonal changes involved, multiple body changes occur including growth of long bones (such as femur), development of sex characteristics and fat and muscle development. This growth period is earlier for girls who begin at around eight years and by end between 13 and 15 years of age. For boys, this period begins slightly later, around nine years of age and ends by about 18 years. Growth of girls in terms of height and weight is maximum prior to menarche. It is very rare that girls gain height after menarche, which is hardly 2-3 cm. For the boys growth continues till late teens. They tend to gain weight at a faster rate and by 18-20 years, they would have achieved their full height (Narasinga Rao, 1985).

All these physical and physiological changes that occur during the adolescent period place a great demand on their nutrient requirement (Narasinga Rao, 1985). Thus sexual maturation, the transition from pre reproductive to reproductive phase, is a dynamic biological process, characterized by visible changes in stature, body composition and body proportions (Biro *et al.*, 2003, Apter and Heason, 2002). On the other hand pubertal maturation is beside growth, the most reliable indicator of health status among the adolescents (Bodzsar and zsakai, 2002).This is especially true of the female pubertal maturation, in particular, of the age at menarche.

Psychosocial changes (Emotional Aspects)

As this period is a transition to adulthood, they try to develop self-identity. The desire to be accepted in their peer group changes their food habits, dressing and group conduct. This in turn brings psychological, emotional and social stress. Adolescence usually does not know fully what is happening to their bodies. They become moody at times and parents need to understand this to help their adolescent cope with the changes. In mid puberty, the adolescents begin to experiment with independence from their parents and this is the stage in which they are most vulnerable to experimentation. Towards the end of puberty most of the conflicts begin to diminish and the adult is now thinking about the future. At this point there is lot of anxiety development. The most important factors, in an adolescence journey through puberty are peers, family, and school. Any disturbance in these three factors can be a heavy burden on the growing adult. This could lead to depression, drugs, criminal acts, and/or more.

Menarche and body build

Postmenarcheal girls were significantly taller and heavier than their premenarcheal counterparts. This was true of all girls ageing between 11 and 14 years. At the age of 15 years postmenarcheal girls were also taller and heavier than premenarcheal ones; however, these differences were not of statistical significance. Regarding body mass index significantly higher values were found for all age groups with the exception to 11 year old girls. Postmenarcheal girls surpassed their premenarcheal counterparts in lean body mass, absolute fat mass and fat

percentage. The comparison of body composition parameters yielded also significant differences between premenarcheal and postmenarcheal girls (Kirchengast and Bauer, 2007). (Table1).

Table 1

COMPARISON OF SOMATOMETRIC FEATURES BETWEEN PRE- AND POSTMENARCHEAL GIRLS

Particulars	Premenarcheal Mean (SD)	Postmenarcheal Mean (SD)	t value
11years			
Stature (cm)	149.6(6.2)	157.1 (5.9)	<0.003
Body weight (kg)	39.8 (10.3)	50.2 (10.4)	2.64 p<0.01
BMI(kg/m^2)	17.59 (3.59)	20.23 (3.58)	1.91 NS
12 years			
Stature (cm)	154.5 (6.9)	158.9 (6.6)	4.82 p<0.001
Body weight(kg)	45.9 (10.8)	53.8 (12.8)	5.13 p<0.001
BMI (kg/m2)	19.12 (3.96)	21.17 (4.05)	3.81 p<0.001
13 years Stature (cm)	158.4 (6.3)	161.9 (6.5)	4.06 p<0.001
Body weight (kg)	46.5 (9.4)	54.2 (10.9)	3.41 p<0.001
BMI(kg/m2)	18.48(3.1	20.6(3.41)	4.83 p<0.001
14 years Stature (cm)	158.5 (5.4)	163.2 (5.3)	5.06 p<0.001
Body weight (kg)	48.3 (9.4)	55.6 (10.9)	3.89 p<0.001
BMI (kg/m2)	19.16 (3.41)	20.84 (3.77)	2.58 p<0.01
15 years-stature(cm)	164(6.4)	164(5.9)	0.21ns
Body weight(kg)	48.7(4.7)	56.9(10.1)	1.81ns
BMI(kg/m2)	18.11(1.23)	21.12(3.21)	5.1p<0.003

The above study indicated that the Postmenarcheal girls were significantly taller and heavier than their premenarcheal counterparts.

2.1.2 Factors influencing early menarche

Various researchers have investigated the relationship between age at menarche and socioeconomic status in India. The study by ICMR (1972) reveals the decline in age at menarche with increase in per capita income of the family. Bagga and Kulkarni (2000) observed a positive correlation between occupation of parents and age at menarche. The other studies in India (Ghosh 1973, Bhalla M and Srivastav 1974, Agarwal *et al.*, 1981) revealed a strong association between socioeconomic status and the age at menarche. The high socioeconomic status which is usually associated with small family norms, better living conditions, proper nutrition could be the reason along with other factors for earlier growth spurt and better physical and psychosexual maturity among them explain the early onset of menarche. However, a few studies of Serap, 2009 observed that the association of age at menarche with socio economic status is not significant.

A plausible explanation could be the ethnic differences, among other factors. The use of different criteria by different researchers to define the socioeconomic status makes it difficult to compare with such studies. So also, the differences in the norms about the per capita income set by different countries to decide the socioeconomic status, variation in currency exchange rates, inflation / deflation of the currency of a country have become the hindrance to compare the economic status of people of different countries. Thus, it is a high time that we should categorize the parents on the basis of their occupation rather than income to establish the socioeconomic status. All the manual workers like loaders, attendants, housemaids and others can easily be put in lower socioeconomic status and so on. Defining socioeconomic status by parental occupation has been used recently by Danker and Hopfe (1986) and Serap (2009).

Physical growth is one way in which the adolescent assess their own and their peer's maturity. It is true that growth patterns are variable, but proper nutrition throughout childhood and adolescence is essential if one's own growth

potential is to be achieved. Proper nutrition throughout childhood and the teens ensures normal physical growth during adolescence. Various factors have been postulated to affect the age at menarche like the socioeconomic status, diet, exercise, environment, sib ship, religion, genetic and hereditary factors, ethnicity, psychological stress, migration and chronic illnesses with opinions both supporting and rejecting it (Singh 1986, Moisan *et al.*, 1991, Bagga A and Kulkarni 2000, Deo and Gattarji 2004 and Serap etal., 2009).

Age at menarche and diet

Nutrition has always been considered a major influential factor in pubertal growth period. The age at menarche in the girls taking mixed diet was marginally lower than that of the vegetarian ones, Singh (1986). In another study by Ghosh *et al.,* (1973) and Bagga and Kulkarni (2000) observed a positive correlation between the age of menarche and nonvegeterian diet on Maharashtrian girls. The diet having high contents of calories and rich in proteins causes better physical maturation and early menarche (Merzenich *et al.*, 1993).

Dietetic habits in India are influenced by the religion, customs, dietary pattern and culture. It is our general observation that in most of the Indian families taking mixed diet, the nonvegetarian food is taken once or twice per week. Even the quantity of the nonvegetarian items in such meal is restricted to one or two dishes and bulk of the rest is formed of vegetarian items. Thus, the amount of proteins and calories in such diet may not be much higher than those of vegetarian diet Ghosh *et al.*, (1973). Padmavati *et al.,* (1984) even reported that the nonvegeterian girls have a delayed onset of menarche by about six months than their vegetarian counterparts. The amount of proteins and calories in the nonvegeterian diet may also vary from family to family. Shastree *et al.*, (1974) recorded two traditional nonvegeterian groups showing the lowest and highest menarcheal age. So, rather than categorizing the girls on the basis of the type of diet consumed, it will be more logical to categorize on them on the basis of proteins and calorie intake.

The most significant factor affecting the age of puberty onset is nutrition. The single best predictor of the onset of a girl's first period is her weight and there's plenty of evidence suggesting that the nutritional state of a population accounts for most of the variation in the timing of puberty. It's well established that obesity and extra calories initiate puberty sooner, while severe caloric restriction (girls with Anorexia Nervosa or in ballet dancers) delays puberty. But it's not just the calories: Certain foods and nutrients seem to affect puberty onset more than others. A new study in Public Health Nutrition followed more than 3000 British girls' diets at age 3, 7 and 10 years of age, and correlated diets to age of onset of the girls' first period. They found that higher intake of meat and animal protein at age 3 and 7 correlated strongly with earlier periods (high meat intake at age 3 was defined as 8 portions a week or more, and 12 portions of meat a week or more at age 7). This finding was independent of the girls' body weight, and the age at which their mothers started menstruating. As expected, they also found that higher caloric intake overall correlated with early periods. It was concluded by various authors, led by Imogen Rogers, suggested that diet in early and mid-childhood may affect the onset of puberty much more than the diet in later childhood, and concluded that the higher intakes of meat and protein in childhood may promote earlier periods.

Genetics

The onset of puberty is influenced by genetics, and there's some correlation between a mother and her daughter's age at puberty.

Contaminants

There is a reasonable concern that chemical contaminants and hormonal residues in the food chain and in our drinking water may affect puberty in humans. The 'Times' article also suggests BPA is a suspect worth investigating. The mechanism seems plausible-hormonal residues and hormone-like chemicals can potentially affect the complex and finely tuned system that initiates puberty, and there are some animal experiments that support this notion.

It is going to be quite difficult to prove or disprove that these contaminants are implicated in human puberty, but as always, prudency suggests that it's not a very good idea to be exposed to or ingest contaminants with potential hormonal activity-that stuff definitely isn't food.

Age at menarche and exercise

Along with energy intake, the energy expenditure has been considered by researchers to be one of the factors influencing the age at menarche. Rokade and Mane (2009) reported in their study that percentage of girls attaining menarche is more among girls undergoing occasional /no exercise than those with regular exercise, the difference being statistically significant ($p<0.01$). The girls having regular exercise and/ or those participating in outdoor games showed a comparable age of onset of menarche to those with no / occasional exercise ($p>0.05$)

It is well known that intensive exercise during pre pubertal period results in pubertal delay. A Study by Sidhu and Grewal (1980) has established that the age at menarche is delayed among sports women. Moison *et al.,* (1991) observed that participation in dance, ballet, gymnastics figure skating, synchronized swimming and diving competitions had lower risk of reaching menarche at an early age. Merzenich *et al.,* (1993) noted that the increased sport activity is associated with delay in age at menarche. It may be the vigorous exercise, intense physical and mental stress which delays the menarche.

Early puberty is a health issue

Earlier periods are associated with an increased risk of breast cancer. Less established is the correlation between early periods and ovarian cancer and heart disease. On the other hand, early periods may protect against osteoporosis.

A new study suggests that young girls are, increasingly, reaching puberty earlier between 2004 and 2006 twice as many Caucasian girls showed breast maturity at age 7 as compared to 1997. The percentage of African-American girls showing the same early sign of puberty remained constant over the same time period. The analysis, conducted by researchers collaborating in the multicenter

Breast Cancer and the Environment Research Centers, adds to the growing evidence that the onset of puberty in girls may be shifting earlier and earlier, possibly due to obesity or exposure to environmental chemicals (http://www.time.com/time/health/article).

During puberty, the pubertal growth spurt produces an extra increase in height, but thereafter growth soon ends (Bourguignon, 1988). There is a close relationship between pubertal development and the growth process, and the onset of puberty is more correlated with skeletal age than with chronological age (Marshall, and de Limongy, 1976). There has been a lot of study on the onset of puberty for females. The major concern is whether or not going through puberty at a different time than others of the same age is good. The studies all point toward the same outcome that early onset of puberty for girls can be psychologically damaging many girls who start puberty early tend to view their body negatively. This could be due to the social pressures that force women to want to be thin. A girl who has gone through puberty early tends to be bigger and fatter than a girl who has not gone through puberty. This girl will stand out in comparison to the rest of her friends and will usually have a low self esteem.

These females are usually rejected by their peers. Instead of looking for different friends within the same age group, they tend to make older and more mature friends. This can be bad for the less experienced and mentally immature individual. Hanging out with the older crowd can lead a teen into premature sex, and drug experiences. Ge *et al.*, (1996) has theorized that these females may not have had enough time to complete the necessary childhood developmental tasks before entering the world of the older crowd. They have had less time to form a sense of self, which could lead them in making bad decisions for them as well as for the future.

2.2 Nutrition status of adolescents

Growth and development of the children is largely dependent on its nutritional status. The nutritional status of children is assessed by various methods viz., Anthropometry, Biochemical, Clinical, and Dietary Intake. Nutritional status is the condition of health of the individual as influenced by the utilization of the

nutrients. It can be determined by correlation of information obtained through medical and dietary history, physical examination and laboratory investigation.

Measurements of height and weight are still the simplest and one of the reliable means by which the progress of a normal child is evaluated even when no other sign of illness is manifested (ICMR, 1989). Anthropometry reflects both health and nutritional status and predicts performance, health and survival (Rajeswari *et al.*, 2006).

Research shows that there is direct links between good nutrition and the ability to learn, play, grow and develop well nourished children have higher test scores, better school attendance and fewer behavioral problems. Swaminathan (1997) reported that the mean height and weight of Indian Children belonging to higher income groups are significantly greater than those reported for children of all income groups in India. This is evidently due to more nutritious diets consumed by the high income groups.

Studies conducted on nutritional status of the girls in different parts of India and the results are summarized in the following table (2).

Table-2

Sl.No.	Author and Year	Place	Title of the Study	Sample Size and age	Results
1.	Jaishree *et al.*, 2001	Pharbhani, India	Nutritional status of school going adolescent girls of Pharbhani	300 girls 13-15 years	On the basis of body mass index, 267 adolescent girls were found to be having under nutrition of different grades.
2.	Hitendr *et al* .,	Gujarat, India	Physical growth standards for urban adolescents (10-	1158 girls 10-15	While comparing with ICMR standards a little

	2004		15 years) from South Gujarat.	years	slowing down of growth was observed.
3.	Ghalib Haboubi and Rixwana Shaikh, 2005	India and UAE	A comparison of the Nutritional status of adolescents from selected schools of South India and UAE: A cross – sectional study.	2459 girls 10-16 years	Prevalence of stunting and thinning was very high among the south Indian students in India compared with south Indian students in the UAE.
4.	Yustina Anie et.al 2006	Indonesia	Anaemia and Iron deficiency anaemia among young adolescent girls from peri urban coastal area of Indonesia.	1358 girls 10-12 years	The prevalence of under nutrition was high. 42.1% were under weight 45.1% stunting and 34.6% thinness.
5.	Prashant and ChandanshaW, 2009	Andhra Pradesh, India	Nutritional status of Adolescent girls from an Urban slum area in South India.	223 girls 10-18 years	There is a high prevalence of under nutrition among adolescent girls in this slum community.
6.	Banerjee *et al.*, 2009	West Bengal, India	Growth and Nutritional status of Bengali Adolescent Girls.	527 girls 10-18 years	In nutritional assessment Gomez's classification indicates about 60% to 70% adolescent girls show either moderate to mild

					malnutrition during their growth period.
7.	Vijayata Sengar *et al* .,2009	Gujarat, India	Assessment of the nutritional determinants of malnutrition among rural adolescent schoolchildren along with development of healthy eating index and a food behaviour check list to assess the quality of their diet.	250 girls	There was 68.2% wasting, 42.8% stunting and 48.2% under weight among adolescents.
8.	Anand. *et al.*, 1999	India	Nutritional status of Adolescent School children in Rural North India	12-18 years	Prevalence of stunting was 37.2% and thinness as defined by a BMI < 5^{th} percentile was present in 30.1% of girls.

The above studies have reported that the majority of girls were under nourished and found to be below the level of NCHS standards.

2.3 Food habits of adolescents

High prevalence of under nutrition in children and adolescents is an acute crisis in global point of view especially in developing countries like India. Menarche is the major indicator of growth and maturation during puberty in girls. Adequate nutrition should be ensured to adolescent girls who will have to bear the future generation. But most of the young girls have poor nutritional status because of ignorance in family, lack of awareness, widespread gender discrimination in India, perceptions and knowledge about food and health and teenage eating patterns.

2.3.1 Nutrient requirements of healthy pre and pubertal girls

Pre and pubertal girls need to consume sufficient energy to match their increased growth. With the profound growth, comes the increased demand for nutrients like proteins, energy, vitamins and minerals. Since majority of the adolescent girls especially, representing the lower segments of society, are undernourished with associated social maladies like son preference, incidence of early marriage and high rates of maternal mortality, a strong focus on improvement in nutritional status of adolescent girls through IEC is warranted. Several studies reported earlier also confirm the need for special attention to improve the health and nutritional status of the adolescents Vijaraghavan *et al.*, (1971) and Kurz (1996)

Energy and protein

The requirements for calories and proteins increase during school age. The calorie requirements remain almost the same for girls throughout. Boys 10-12 years of age require more calories as adequate reserves are being laid for growth spurt during adolescence. The protein requirements are slightly higher for girls than boys between 10-12 years for the approaching menarche. The metabolic demands of growth and energy expenditure increases the calorie needs. The ICMR committee has suggested that energy should be provided on the basis of ideal weight for age. The energy requirements for the boys are more than that of girls which is 1970 k.cal and 2060 k.cal for girls 11-12 years and 13-14 years

respectively. The need for additional protein and nitrogen during this age is high. If they do not take the required amount of proteins at this time, it could lead to lower growth spurt and lower resistance to infection. The daily recommended allowance of protein 57 gm for girls (11 -12 years) and 65 gm for girls (13-14 years).

Fat

In terms of visible fat the ICMR has recommended an intake of 5-6 percentage of total energy from linoleic acid. Considering this the minimum visible fat required has been estimated to be 12g / day but ICMR has suggested the desirable visible intake for school going children as 22g/day.

Minerals

The 10-12 year old children require more calcium than adults to meet the demand for skeletal growth. The iron requirements are increased as blood volume increases. Also the mean increase in body weight from second year to the twelfth year in boys and tenth year in girls is 2.5 to 2.7 kg per year which is equivalent to iron requirement of 0.3mg/day. The iron requirement is further increased by the gradual rise in the haemoglobin concentration and losses. Iron and calcium are the two most important minerals required during puberty, more so for girls, as the two will influence the health and well being throughout life. Deficiency of iron in the diet leads to nutritional anaemia. During puberty, the need for iron increases in girls, as there is loss of iron during menstruation. The normal level of haemoglobin for, females is above12mg/dl .The daily recommended iron allowance is19 mg (11 -12 years) and 28 mg (13-14 years) for girls. Calcium is another very important mineral required during the teen years. Low intake of calcium can lead to retarded calcification of bones and teeth. 600 mg recommended for the age group11 to 14 years.

Vitamins

Vitamin A requirements of 11-14 year old girls is 600μg. The RDA of vitamins A and C are same as adult RDA. The requirements for B vitamins are in proportion with the calorie requirement.

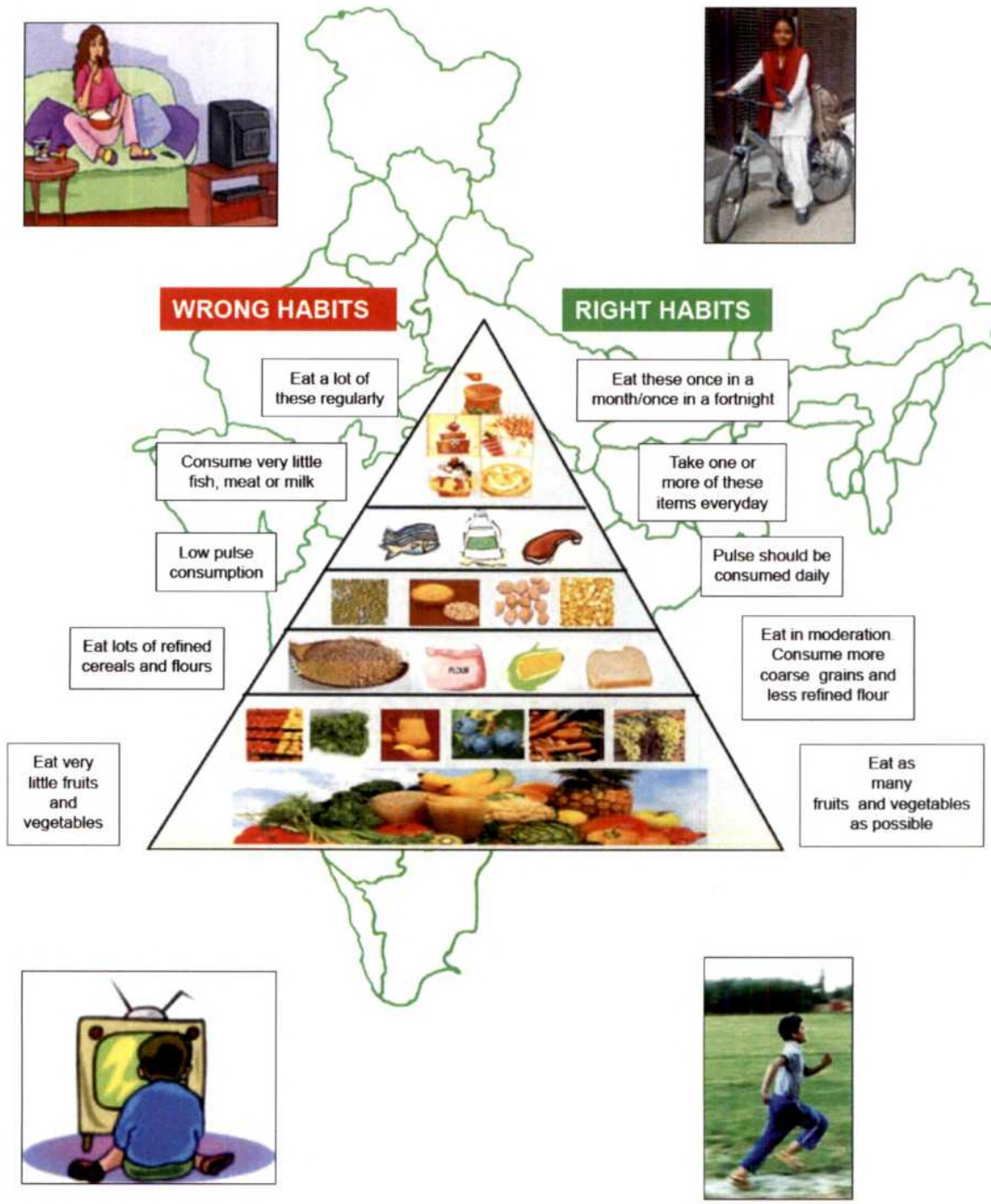
The requirement for B vitamins namely thiamine, riboflavin and niacin increase in direct proportion with increase in calorie intake. Folic acid and vitamin

B12 requirements also increase when there is rapid tissue synthesis as they participate in synthesis of DNA and RNA. Transamination to synthesize non-essential amino acids requires more vitamin B6. The structural and functional integrity of newly formed cells depends on the availability of vitamins A, C and E. Increased nutritional needs at this juncture relate to the fact that adolescents gain up to 50 per cent of their adult weight, more than 20 per cent of their adult height and 50 per cent of their adult skeletal mass during this period. (ICMR, 2004)

Adequate Food and nutrients can be met through balanced diet and it is represented in the following figure.

Figure-2

Adequate Food and nutrients can be met through balanced diet



Reference: NFI July 2009

Williams and Worthington (1988) as quoted by Farthing (1991) have given a schematic diagram of factors influencing adolescent life style and food behavior as indicated below.

Figure-3

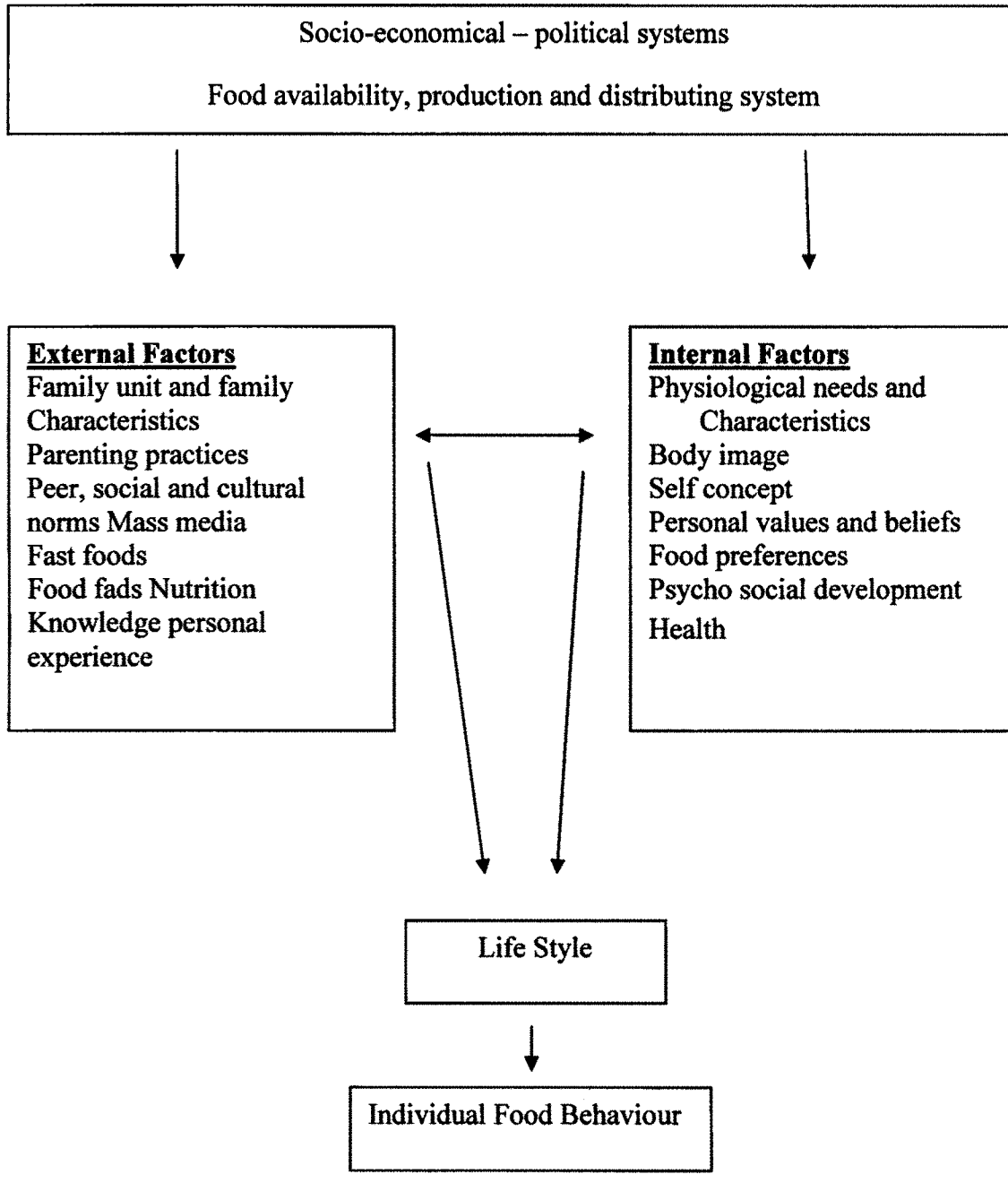
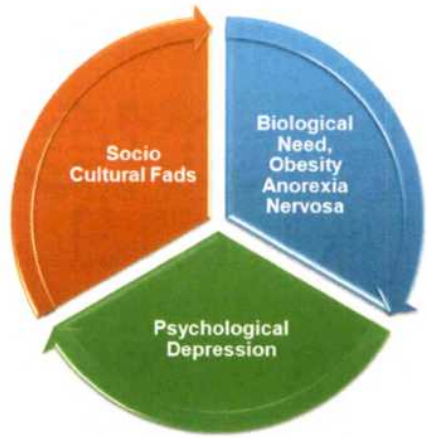


Figure: Factors influencing Adolescent life style and Food Behaviour

Ref: William, S.R., Worthington B.S. (1988) Nutrition throughout the Life Cycle, ST.Louis, Times Mirror/Mosby Pula

During Adolescence an individual's total nutrient needs reach their highest point in life cycle. Healthy eating is important at this stage not only because of the nutritional needs but also practices formed in one's life carry in to adulthood. Factors influencing food habits of Adolescents are represented in figure 4.

Figure 4



Factors influencing food habits of Adolescents

2.3.2Factors affecting food intake of adolescents in relation to fast food consumption

The changing eating habits of adolescents contribute to various health problems among adolescents (Savitha and Aruna Narayanan, 2007). The four main factors that influence adolescent's food choices and eating habits are family and house hold influences, economic availability and advertising influences, perceptions and knowledge about food and health and eating patterns (Brown , 1998).

In Nepal, a study conducted by Sharma (1998) among school children, stated that fast food (ready to eat snacks and chips) were preferred by more than two thirds. French *et al.*, (2001) observed in their study eating away from home is more common and fast food restaurant use in particular is growing even more rapidly. National Restaurant Association (2007) reported between 1977 and 1995 the percentage of meals and snacks eaten at fast food restaurants increased 200% while other restaurant use increased 150%. Sadana *et al.*, (1997) revealed that 73.3 and 78.4% of girls of Jalandhar and Ludhiana cities respectively consumed fast foods. As these foods are consumed between meals they reduce one's appetite for

regular meals, so adolescents are more prone to nutritional problems than any other age group.

It has been specified that the rise in the prevalence of overweight and obesity may be attributable to the increase in the number of meals and snacks eaten away from home (Patanam, 1999). According to Frazao (1999) foods available at fast food restaurants and other 'away from home' eating locations tend to be high in calories and fat compared with foods eaten at home which may contribute to energy intake in excess.

Paeratakul *et al.*, (2003) stated that meals eaten away from home may contribute to excess energy intake and in turn obesity. These findings are in agreement with other studies that have examined the association of fast food consumption with energy intake (French *et al.*, 2000). Further more the frequency of fast food restaurant use has been found to be associated with increased body weight and obesity (Pereira et.al 2003). Increased fast food consumption has been tied to the increase in obesity in the United States (Shanthy *et al,* 2004 & Elsie Taveras *et al.*, 2005). High intake of energy, saturated fat, cholesterol and sodium leads to the development of hypercholesteremia, atherosclerosis, obesity and hypertention (Ful Kerson and Neumark, 2001).

Heterocyclic cromatic amines are sometimes formed during the cooking of muscle meals and their mutagenic and carcinogenic effects are of potential concern in etiology of cancer. Fast food meat products contribute a small percentage of the heterocyclic amines. Samples of fast foods analysed in a blind study which also contained quality. Control samples of two types, one high and one low in heterocyclic amine content and antigenic activity results from the fast food products showed undetectable levels of heterocyclic amines in ten of seventeen samples (Knize *et al.*, 1995).

In some studies of the African American adolescents who consumed enormous amounts of milk based fast foods, the prevalence of lactose mal digestion has been reported to be as high as eighty three percent (Johnson *et al.*,

1999). Lactose mal digestion is the inability to completely digest lactose, the major carbohydrate found in milk (Hertzter *et al.*, 1996).

It has been suggested that fast food may encourage soft drink consumption and may be associated with low intake of fruits, vegetables and milk in children, adolescents as well as adults (Paeratakul *et al.*, 2003). Soft drinks are heavily consumed as part of fast food and restaurant meals (Bowman, 2002). The body's ability to compensate for carbohydrate energy ingested in solid form, thus increasing the risk for excess total energy intake when energy is consumed in the form of fluid carbohydrate such as soft drinks (Matter, 1998). A recent prospects study among children found that one serving of soft drinks per day increased the risk of becoming overweight children also more lightly than normal weight children to be heavy soft drink consumers (Peterson and Gort maker, 2001).

Soft drinks may affect dietary quality of youth by displacing milk consumption (Harnack and Stang, 1999). Displacement of milk by soft drinks can reduce calcium intake among children because milk is the primary source of calcium in children's diet (Morton 1998). Low calcium intake among children and adolescents may increase their risk of osteoporosis in later life by contributing to low peak bone mass (Heaney and Matkovit, 1995).

Savitha et *al.,* (2007) studied the food consumption pattern and nutrient contribution of fast foods in adolescents in India, study findings revealed that a high intake of fast foods leading to reduction in micronutrient consumption and the authors concluded that nutrition education to adolescents regarding the consumption of fast foods is the need of the hour.

2.3.3 Studies related to food and nutrient intake

Nutrition is one of the key factors which helps each person to attain his/her full potential and it depends to a great extent on the quality and quantity of food (Brett glawe *et al.*, 2008).If adolescents are well nourished they can make optimal use of their skills, energies and talents today and be responsible parents of healthy babies tomorrow (Report of Regional Meeting, WHO, 2002).The world health report 1998 stated that of all the age groups this is the age group which must be

healthiest and it is one during which the foundations can be laid for a long and healthy life (WHO, 1998).

The period of adolescence comprises nearly half of the growing period. This period needs increased demand for iron, protein and Vitamins etc. (Mitchell Hs, 1964, Sue Rod Well Williams, 1994 and Savitha & Narayanan., A 2007). More than 60% of school girls aged 10-16 years in Dhaka City consume protein, iron and calcium less than 75% of the RDA for age (Ahmed *et al.,* 1998).

The most important factor is the adequacy of the diet before and during puberty to sustain not only the normal pubertal growth spurts but also make up for previous inadequacy (Garrow *et al.,* 2000). Adolescents are vulnerable from the nutritional point of view, due to their peculiar life style and dietary habits and to their high energy and nutrient requirement (Duyer 1981 & Anderson, 1991). Despite the increased nutritional requirements during adolescence, their average nutrient intake is much below the recommended allowances (Venkaiah *et al.*, 2003 and INP, 1998). According to the results of the studies conducted on School children it has been shown that a majority of the school children consume inadequate diets and are malnourished (Gopalan , 1992) and the intake of all the nutrients were below the recommended values (Rao *et al.,* 2006). More than 60% of School girls aged 10-16 years in Dhaka city consume protein, iron and calcium less than 75% of the RDA for age (Ahmed *et al.*, 1998).

Ahmed *et al.,* (1998) conducted a cross sectional study on Dietary Pattern, nutrient intake and growth of adolescent school girls in Urban Bangladesh, India. The study was conducted in 384 girls aged from 10 to 16 years, who were students of classes VI to IX of 12 girls' high schools in Dhaka City, were selected by systematic random sampling. Nutrient intake was assessed using the 24 hour recall method. The study results indicated that the intake of energy and protein only 9 and 17% of the recommended daily allowance (RDA) respectively. From the study results the authors concluded that the diets of these girls tended to be inadequate both for macronutrients and micronutrients with significant health implications.

Biing Hwan Lin, *et al.*, (2001) analyzed the American children's diet by 1 day individual intakes for children aged 2-17 with particular emphasis on meal and snack patterns and sources of foods. The findings in this study revealed that the Teenage girls, in the age group of 12-17, despite having the greatest needs for calcium and iron, obtain the least amount of these nutrients in their diets.

Ashima Kant (2003) examined the consumption of Low-Nutrient-Density foods by American Children and adolescents with the data collected by the third National Health and Nutrition Examination Survey, 1988-1994. A total of 4852 children and adolescents, aged 8 to 18 years were included in the study. Study findings were about the intakes of total energy and percentage of energy from Carbohydrate and fat related positively, but percentage of energy from protein and dietary fiber related inversely to the reported number of low nutrient density foods ($P < .05$).

Aarthi Sankhala *et al.*, (2004) conducted a household survey in Udaipur District of Rajasthan, India, on dietary status of children up to 12 years. Totally 300 families were selected with equal representation from each village i.e. 25 families each from 12 villages. In diet survey 24 hour recall method was used. The study results indicated that energy intake of 10-12 years was little higher than the RDA. The average intake of protein was inadequate. From the study results the authors concluded that the children belonging to different age groups were exhibiting reduced intake of all the dietary essentials.

Sharma *et al.*, (2005) studied the calorie and protein intake and its determinants among 13-17 years school girls in Delhi, India. In a cross sectional study, 336 girls were given a food frequency questionnaire and completed questionnaire were analyzed. The average calorie intake among government and private school students was 827.9 ± 191.2 and 1491.3 ± 541.0 respectively. Corresponding figures for protein intake were 29.95 ± 6.7 gm and 57.49 ± 20.9 gm respectively. These results revealed that the daily calorie and protein intake was found to be lower than the recommended dietary allowances and the deficit was more profound in respondents of government school and lower socio economic group.

Anitha Malhotra and Santosh Jain Passi (2006) assessed the diet quality and nutritional status of rural adolescent girl beneficiaries of ICDS in North India. Totally 209 girls from six rural blocks were included in the study. Weight and height were measured and dietary intake data were gathered by one day 24 hour recall coupled with food frequency approach. The results revealed that the energy and nutrient gap (particularly for protein, riboflavin and niacin) was found to be more pronounced in the case of younger subjects (10-15 years) than the older subjects.

Chitra and Radha Reddy (2007) conducted a cross sectional survey on the role of breakfast in nutrient intake of urban school children, in the age group of 10-15 years in Andhra Pradesh, India. The breakfast eating patterns of the children were studied and their impact on growth was assessed using dietary recalls and anthropometric measurements. Mean nutrient intakes were calculated and compared with the recommended values for energy and protein. The inadequate energy intake was reflected in a high incidence of malnutrition among 10-15 years girls and it was found 32.1% of the girls were under weight. From the study results the authors concluded that the children who consumed breakfast had higher daily intakes of energy and protein than children who skipped breakfast.

Anuradha Goyle and Ira Yanendra (2009) conducted a case control study to assess the nutrient intakes of young girls studying in a government school in Jaipur City, India. The nutrient intakes of 146 young girls in the age group of 10-16 years were assessed. Dietary data were assessed through one day 24 hour dietary recall method and the data were compared with the balanced diets (Gopalan *et al.,* 1981) and were translated into nutrient intake data with the use of Nutritive value of Indian Foods (Gopalan *et al.,* 1996). From the study results the authors concluded that the dietary and nutrient intakes of the young girls studying in a government school were much below the RDAs. The energy and protein intakes were 55% - 56% and 56% to 61% of the RDAs respectively.

Priya Goswami *et al.,* (2009) conducted a cross sectional study to assess the nutritional status of Punjabi adolescent girls from High Soico-economic group. Totally 302 girls in the age group of 13-15 years were included for the study. The

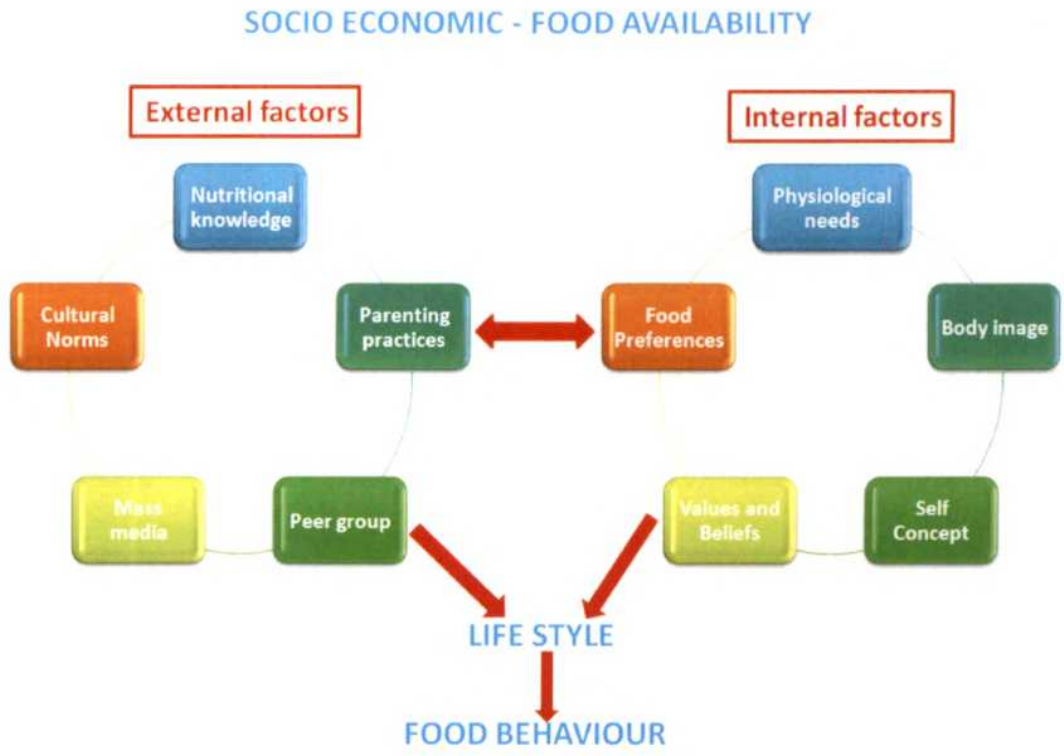
food intake was recorded by 24 hour recall-cum-weighment method for three consecutive days including one holiday. From the study results the authors concluded that the intake of protein, visible fat, calcium, phosphorus, β-carotene, thiamine, riboflavin, Folic acid, Vitamin B12 and ascorbic acid were more than RDA where as energy and iron were less.

A deficiency or lack of required nutrients has now been identified as one of the key determinants of low birth weight (LBW) babies (Elizabeth, 2001 and Barkey *et al.*, 2000) and diseases (Bhaskaran. 2001) when the girls reach adulthood.

Nutritional status of Indian school children 6-18 years from middle and high socio economic status (MHSES) was reviewed. Literature search was conducted and the result showed that anemia prevalence (hemoglobin concentration <120 g/L) ranged from 19-88% across five different cities in India. Other micronutrient deficiencies including, folate, riboflavin, niacin, vitamin C, vitamin A, and vitamin B12 were also present based on biochemical parameters in one study and clinical signs of deficiency in three other studies. Overweight and obesity were prevalent among 8.5-29.0% and 1.5-7.4% respectively among the school children. Predominant components in children's diet were cereals and pulses, followed by milk and milk products; the fruits and vegetables component was comparatively lower and the authors concluded that the nutritional status of MHSES (Middle High Socio Economic Status) children in India needs attention especially with respect to the high prevalence of anemia, overweight and obesity. There are indications that micronutrient deficiencies exist, but sufficient data are lacking, in particular biochemical data. A current estimate, using well designed methodologies, of prevalence of micronutrient deficiencies and information on the etiology of anemia among children of MHSES groups would be valuable to help understand the nutritional status and extent of micronutrient malnutrition (Srihari *et al.*, 2006).

Williams and Worthington (1988) as quoted by Farthing (1991) have given a schematic diagram of factors influencing adolescents' life style and behavior as seen in figure 5.

Figure 5



2.4 Nutrition related Problems of Adolescents

The adolescence is considered especially vulnerable nutritionally for several reasons. First there is an increased demand for nutrients related to the dramatic increase in physical growth and development. Second the change of life style and food habits of adolescents affect both nutrient needs associated with a participation in sports, development of an eating disorder, excessive dieting, or other situation common to adolescents (Savitha and Narayanan 2007). Many adolescents make poor nutritional and life style choices that put them at risk of health problems (Theresa *et al.*, 2010). Eating disorders and unhealthy eating behaviours such as restrictive dieting, over eating and the use of harmful weight

control behaviours represent major health concerns affecting adolescents (Striegel, 1997).

2.4.1 Anaemia

Anaemia is a major world wide health problem (Umbreit, 2005), and it is a public health problem among adolescents and women (Kumar *et al.*, 2006, Seal *et al.*, 2005 Skjelbakken *et al.*, 2005 Ahmed Khan *et al.*, 2000, Usha chandrasekar 1997).

Anaemia continues to be a major public health problem, particularly among the females of reproductive age in developing countries (Kumar *et al.*, 2006). The study conducted by the Indian Council of Medical Research (ICMR, 2001) in 16 districts of 11 states reported that about 90 percent among adolescent girls had haemoglobin levels indicative of anaemia.

NNMB reveals that 70 to 90 percent of adolescent girls are anaemic in the country, indicating that there is an urgent need for including the adolescent girls as beneficiaries in the national intervention strategies. The problem appears to be uniformly high in all the states (NNMB, NIN 2003). In the developing countries the prevalence rate is higher (44%) where as it is lower in developed countries (12%). Anaemia in the adolescent girls affects the growth and development. Anaemia produces retarded neuromuscular development impairment in motor skills, attention span, learning capacity and educational attainment in adolescent girls. Mahajan and Gupta, 2003 and Kurniawan *et al.*, 2006 stated that among adolescent girls anemia will bring negative consequences on growth, school performance morbidity and reproductive performance.

There are many factors determining anaemia among adolescent girls. First factor is, puberty which increases the risk of being anaemic. Many researchers determined prevalence of anaemia in various age groups.

Jolly Raja Ratnam, *et al.*, (2000) studied the prevalence of anemia among girls of Rural Tamil Nadu, India. The prevalence was assessed in a representative sample of 316 girls in K.V.Kuppam and Gudiyatham block. Study findings

revealed that the anemia among rural girls of Tamilnadu is also high as in other parts of the Country. The prevalence of anaemia was 40.7% in premenarcheal girls as compared to 45.2% in post menarcheal girls.

Goel S *et al.*, (2007) assessed, the low anemia prevalence among adolescent of an urban hilly community by a school based Cross-Sectional study. A total of 390 girls in the age group of 10-19 years were included. The students were asked about their age, dietary habits, water and food hygiene, history of worm infestation, menstrual problems and symptoms of anaemia. The findings revealed that the prevalence of anemia was highest in 10-13 year age group and decreased with increase in age. Socio economic status is also a main determinant of anaemia.

Varsha Zanvar *et al.,* (2007) studied the prevalence of anaemia among the selected adolescent girls of Marathwada region, India. Totally 500 girls belonging to the age group 13-18 years were selected from urban and rural areas of Marathwada region. The socio economic status, food habits and commonly observed health problems were assessed by personal interview with a preplanned questionnaire. To judge the extent of prevalence of anaemia blood samples were taken and haemoglobin content was determined. The findings revealed that the urban girls were better in their anthropometric measurements than rural and tribal adolescent girls. Inadequate consumption was noted for all food groups especially the consumption of green leafy vegetables, roots, tubers, fruits and milk were nil in tribal girls. The hemoglobin values of selected girls were ranging between 8.72 ± 1.77 to 10.96 ± 0.91.

Soekarjo *et al.*, (1997) conducted a study on Socio economic status and puberty are the main factors determining anaemia among the adolescent girls in East Java, Indonesia. The Researchers determined the prevalence and contributing factors of anaemia in adolescents by Cross-Sectional study among 3486 girls in the age group of 12-15 years. Following were the study findings. Anaemia prevalence was 25.8% among the girls. Socio-economic status indicated by type of school attended and it was an important factor determining the risk of anaemia.

revealed that the anemia among rural girls of Tamilnadu is also high as in other parts of the Country. The prevalence of anaemia was 40.7% in premenarcheal girls as compared to 45.2% in post menarcheal girls.

Goel S *et al.*, (2007) assessed, the low anemia prevalence among adolescent of an urban hilly community by a school based Cross-Sectional study. A total of 390 girls in the age group of 10-19 years were included. The students were asked about their age, dietary habits, water and food hygiene, history of worm infestation, menstrual problems and symptoms of anaemia. The findings revealed that the prevalence of anemia was highest in 10-13 year age group and decreased with increase in age. Socio economic status is also a main determinant of anaemia.

Varsha Zanvar *et al.*, (2007) studied the prevalence of anaemia among the selected adolescent girls of Marathwada region, India. Totally 500 girls belonging to the age group 13-18 years were selected from urban and rural areas of Marathwada region. The socio economic status, food habits and commonly observed health problems were assessed by personal interview with a preplanned questionnaire. To judge the extent of prevalence of anaemia blood samples were taken and haemoglobin content was determined. The findings revealed that the urban girls were better in their anthropometric measurements than rural and tribal adolescent girls. Inadequate consumption was noted for all food groups especially the consumption of green leafy vegetables, roots, tubers, fruits and milk were nil in tribal girls. The hemoglobin values of selected girls were ranging between 8.72 ± 1.77 to 10.96 ± 0.91.

Soekarjo *et al.*, (1997) conducted a study on Socio economic status and puberty are the main factors determining anaemia among the adolescent girls in East Java, Indonesia. The Researchers determined the prevalence and contributing factors of anaemia in adolescents by Cross-Sectional study among 3486 girls in the age group of 12-15 years. Following were the study findings. Anaemia prevalence was 25.8% among the girls. Socio-economic status indicated by type of school attended and it was an important factor determining the risk of anaemia.

Dietary intake consumption of green leafy vegetables, post meal consumption of tea/coffee is also important factors which are having close correlation with prevalence of anaemia. Rossander (1979) observed the Association between the habit of taking tea/coffee after meals and anaemia is due to the interference of the dietary bio availability of iron by the tannin contents of tea/coffee.

Verma *et al.,* (2004) assessed the factors influencing anemia among the girls of school going age (6-18 years) from the slums of Ahmedabad City, India. The authors conducted a cross sectional study on 1295 randomly selected girls and collected the data with the structured questionnaire. Out of 1295 girls, 1153 (89.0%) agreed to give blood samples for haemoglobin estimation. The main research variables are hemoglobin level, age, body mass index, parent's education, parent's occupation, socio economic status, consumption of tea/coffee, green leafy vegetables, lemon/sour fruits, knowledge about anemia and status of menstruation. The findings revealed that prevalence of anemia (Hb < 12mg/dl) was 81.8% and had significant association with variables such as occupation of father, habit of post meal consumption of tea/coffee, consumption of green leafy vegetables and body mass index. The author's conclusion was that the prevalence of anemia necessitates pragmatic intervention to improve the dietary intake, nutritional supplement of iron and folic acid tablets.

Various researchers strongly enlightened the need of educational campaigns to reduce the prevalence of anaemia. (Monge-Rojas *et al.,* 2005, Agudello 2003, Binay 2002, Bartoline1998, Nelly 1996).

2.4.2 Obesity

A wide spread problem is the increasing prevalence of overweight children throughout the world (Carroll Lutz and Karen Przytulski, 2010). Srilakshmi (2000) stated that obesity affects 10-20% of adolescent population. An excessive intake of Kilocalories is less often the cause than lack of exercise. Other causes are family habits, emotional stress and hormonal imbalance.

An obesogenic environment, which encourages excess food intake, plays a crucial role in the epidemic of childhood obesity and eating disorders. Multifactors like changes in dietary practices, physical activity, life style pattern and television viewing are reflected in childhood obestiy (Kalpana and Lakshmi, 2009). The increased prevalence of obesity in recent decades may have resulted because of increase in the consumption of high fat foods or in sugar containing drinks (Lissner *et al.*, 1995, WHO 1998 and Ludwig *et al.*, 2001).

Based on the above factors the prevalence rate will vary among each individual. In the following studies the researchers determined the prevalence rate of obesity.

Bharati *et al.*, (2008) examined the correlates of overweight and obesity among school going children of Wardha City, Central India. A cross sectional study was carried out in all the 31 middle schools and high schools of Wardha City, India. Systematic random sampling technique was used to select the children from each section. Pre designed and pre tested questionnaire was used to elicit information on family characteristics and individual characteristics. From the study results the authors concluded that the magnitude of overweight/obesity among the school going children of Wardha City was found to be 4.3 percent. Family characteristics play an important role in pre disposing the children to overweight / obesity and hence the interventions need to be directed towards the families.

There has been an increased incidence of obesity in the Indian subcontinent. The prevalence of overweight adolescents to be 22 percent in most of the schools in Chennai (Ramachandran *et al.*, 2002) and in an affluent school in Delhi the prevelance of over weight was 31 percent, of which 7.5 percent were frankly obese (Kapil *et al.*, 2002) and it has recently been estimated that adolescent obesity prevalence is increasing not only in developed countires but also in some developing countries (al-Nuaim *etal* 1996, Neutzing *et al.*, 2000, Chu 2001).

Obesity during childhood tracks in adulthood and this may be a serious threat to health as obesity is associated with dyslipidaemia and other metabolic and

vascular abnormalities (Krekoukia *et al.*, 2007, Nassi *et al.*, 2005, Islam 2005, Gasnett 2001, and Freeman *et al.*, 1999). In adolescent girls excess weight is significantly related to body dissatisfaction, drive for thinness and bulimia (Freidman *et al.*, 1995). The most common consequences of obesity in adolescence are those related to Psycho social dysfunction and social isolation (Must *et al.*, 1999 and French, 1995). Obesity is also the major cause of gall stones (Must *et al.*, 1999) and obstructive sleep apnoea is another increasingly recognised complication of childhood obesity (de la Eva *et al.*, 2002).

2.5 Anxiety level

Adolescence is a crucial phase in life and the presence of conditions like depression, anxiety and stress at this stage of life is a matter of concern (John and Cherian, 2001). The world Health Report (2001) has quoted India as having a substantial prevalence of childhood and adolescent mental health disorders. Children contribute to the vital human potential and impart strength to the national economy and development (Niveditha et *al,* 1996). According to world health report (2000), 20% of children and adolescents suffer from a disabling mental illness worldwide. Savitha Malhotra *et al.*, (2009) confirmed that studies on incidence of childhood mental disorders are extremely rare globally. Menarche marks a transition in the risk of depression and anxiety in girls.

A study conducted among 2525 subjects on Menarche and the Onset of Depression and Anxiety in Victoria by Patton *et al.*, (1996), indicated that the overall participation rate of 83%. The levels of depression and anxiety increased with the secondary school years and the girls had, significantly, higher rates at each school year level. For boys, the clearest independent associations with depression and anxiety were raising school year level and high parental educational achievement. For girls menarcheal status emerged as the strongest predictor. Associations with age and school year level, evident on univariate analysis, did not persist when the recency of menarche was taken into account. After addition of measures of perceived social stress to a multivariate model, a significant association between depression/anxiety and parental divorce disappeared but the association with menarche persisted.

Erik Erikson, a German developmental psychologist and psychoanalyst, calls this 'stage one of identity versus confusion'. The adolescent tries to establish an identity fluctuation and vulnerability are only temporary features and gradually the adolescent settles down into maturity. A good adjustment is achieved when one is able to control. In some cases turmoil causes various problems like anxiety.

Archana and Ramachandran stated that anxiety is commonly experienced by adolescents as a usually transient response to many situations and changes experienced during adolescent development. The developmental stage of adolescent necessarily produces a number of biological, psychological and social changes, which have the capacity to produce anxiety. The anxiety faced by these adolescents affects their health and well-being and this health is determined by the focus of control, which is associated with beliefs about control over health outcomes.

Shrine Chapman *et al.*, (2005) suggested that those with frequent anxiety symptoms were significantly likely to report a poor general health. According to the study, anxiety was found to be associated with impaired health related quality of life and an increased rate of adverse health behaviors. Studies had found that those with phobic or fearful anxiety may be more likely to experience sudden cardiac death and rates of anxiety disorders are higher than expected in patients with hypertension, thyroid disease and several other conditions.

Anxiety greatly influences cognition, the ability to concentrate, learn, and solve problems. Mild and moderate levels of anxiety are still conducive to concentration, learning, and problem solving. A person of average intelligence who is mildly to moderately anxious discerns relationships between and among concepts with relative ease and can concentrate and solve problems without much difficulty. In contrast, severe anxiety hinders cognitive function.

The following studies are showing the correlation of various variables like age, education, family type, birth order and economical status with level of anxiety.

Abraham (1983) investigated the child's age and ordinal position in the family as factors of anxiety. The researcher studied the relationship between the child's anxiety, age and ordinal position in the family using 600 students aged (13 years). Results showed that younger students had lower anxiety than older students.

Nakazato and Shimonaka (1989) investigated scores on anxiety among the adolescents of different ages. The State Trait Anxiety Inventory was administered on a sample of 1,234 girls and boys whose age ranged above 15 years. A sex difference was also observed on trait anxiety. The results stated that the girls showed higher anxiety than boys.

Hulecki *et al.*, (1998) conducted a study to the self-concept, anxiety level, and academic achievement of school children. A sample of 344 students in 8^{th} grade and 11^{th} grade were randomly selected. The tool used for data collection were Piers – Harris Self-Concept Scale for Children, Revised Children's Manifest Anxiety Scale and Wide Range Achievement Test – Revised. Results indicated that no significant differences existed between the grade and anxiety level.

Alexander and Susan Germain (1998) investigated the adolescent anxiety and determined, if correlations exist between sources of anxiety and the variables of gender, sex and grade level. The two instruments were an open-ended questionnaire and the Nuclear Anxiety Inventory for Adolescents (NAI-A) was distributed among 170 students. The results showed that adolescents participating in this study were consistently concerned about their future in terms of education and career.

Kalita *et al.*, (2009) conducted a study on the prevalence of mental health problems among primary school children. The study has been conducted in the primary schools of urban area in Dibrugarh town. The results indicate that the prevalence of the mental health problem is more among the student of the English Medium than Vernacular Medium. Regarding the association of the problem with different socio demographic profile, lower socio economic status has adverse effect on the children's mental health.

Noreen Mohan *et al.,* (2003) examined anger, anxiety and depression in early adolescents from divorced families and adolescents from intact families. To control for extraneous variables, 24 early adolescents from divorced families were matched with 24 early adolescents from intact families according to gender, age, race and grade in school. Responses were collected to measure the state of anger, state anxiety and depression. The results indicated that (i) the early adolescents from divorced families had a higher level of state anger than early adolescents from intact families [t (46) = 1.70, P = .048] (ii) there were no differences in state anxiety in early adolescents from divorced and intact families [t (46) = .75, P = .23] (iii) there were no differences in depression in early adolescents from divorced and intact families [t (46) = .80, P = .21]

Gates and Lineberger (1988) conducted a study to determine birth order and its relationship to depression anxiety and self concept. Adolescents (n=404) were given State-Trait Anxiety Inventory and Piers-Harris Self-Concept Scale. The results showed that the first born children scored, significantly lower on depression than the later born. In addition the first born show no significant difference in anxiety than the last born.

Bronzalf and Epstein (1982) explored a study to test anxiety in relation to sex and ordinal position in IX and XI grade students. He compared 353 boys and 385 girls who were selected for comparison with the Albert Heyer achievement anxiety test. The girls showed more debilitating ($P < 0.05$) and less facilitating test anxiety than the males ($P < 0.10$). Besides, the study also had put forth that there was no relationship between debilitating test anxiety and birth order. However the relationship between facilitating anxiety and birth order was found to be significant at ($P < 0.01$), with oldest children reporting more facilitating test anxiety than any other group.

Staples and Walters (1981) conducted a study to investigate birth order and susceptibility to social influences on anxiety. It was reported among sixty four girls. 32 first born and 32 later born were given suggestions in the Auto kinetic situation. Before the post suggestion trials, half the first born and half the later born subjects were told that they would receive a shock when their judgments were

in error (anxiety condition). In the pre-suggestion trials, first born subjects responded more quickly than later born subjects. On the post suggestions trials, first born subjects were under the non-anxiety condition. There was no significant difference between later born subjects under the anxiety condition and the later born subjects under the non-anxiety condition.

Keder (1972) conducted a study to determine anxiety and birth order, whether a relationship between anxiety and birth order could be obtained in Indian culture. A total of 72 first born, 63, middle born and 65 last born subjects were given "Sinha's Anxiety Scale". The mean anxiety score of the first born was significantly higher than that of the middle born ($P < 0.01$) and that of the last born ($P < 0.05$) subjects.

VK Rai and Yadava (1993) conducted a study of mental health of higher secondary students in relation to socio-economic status. Subjects numbering 501 in this study were from 9^{th} to 12^{th} grade, higher secondary schools of Azamgarh District, Uttar Pradesh, India. Mental Health Scale (MHS) and Socio-Economic Status Index were used for the collection of data. Study results revealed that the mental health and socio economic status correlated positively and significantly. Girl students were mentally healthier than boy students and also science students were mentally healthier than arts students.

2.6 Nutrition knowledge and health awareness of Adolescents

2.6.1 Nutrition knowledge

Adolescence is the time to learn and adopt healthy habits to avoid many health and nutritional problems later in life (Kruz, 1994). But the results have shown that a majority of the school children and adolescents consume inadequate diets and are malnourished. The main contributory cause is poverty and lack of nutrition education (Swaminathan, 1998).

Linda Hill *et al.,* (1995) conducted a study on adolescent food choices in Newzealand and concluded that the teenagers had little knowledge of what vitamins and minerals did in the body. Nutrition knowledge among adolescents

was inadequate. (Richert, 1996, Thakur.N *et al.,* 1999, Sameeh-Al-Almaie, 2005, and Nurual Alam *et al,* 2010) and Shaaban S.Y., 2009 stated that dificient nutritional knowledge is likely to have a negative impact on their nutritional status, as future mothers as well as nutritional status of their children to come.

Kapil *et al.,* 1991 studied the nutritional knowledge of the Indian adolescent school girls and reported that incorrect dietary beliefs existed in India. Somasang (1996) examined the knowledge and attitude of adolescents towards food in relation to gender. It was found that female response have higher knowledge scores than male response and Mahshid Pirouznia (2001) stated that the relation ship between Nutrition Knowledge and eating behaviour of adolescents was significant for 8^{th} and 9^{th} grade students.

Health and Nutrition knowledge and healthy habits of female adolescents will have critical roles to play in maintaining future family health and nutrition, (Nurul Alam, 2010) and Foerster (1997) stated that nutrition education is the key element in promoting sustainable healthy eating behaviours thereby early learning of nutrition related practices by the adolescent age group results in change of their attitudes and behaviours towards future health. (Tonesk & Tilford (1994) hence it is recommended that health education and information about healthy eating habits and life style must be included in school curriculum (Sameeh-Al-Almaie, 2005).

2.6.2 Health awareness

Adolescent girls of age 13 to 19 years constitute nearly 66 million of population in India. The lives of these girls are characterized by limited education, lack of knowledge pertaining to social as well as health aspects and also limited influence on decisions affecting their lives. Thus, awareness is one major factor for development of this group of population because of the fact that these adolescent girls would be the future housewives.

A cross-sectional study was conducted (Kundan and Manish, 2010) among girls in the age group of 15-19 years from different educational institutes of Rohtak city to know the knowledge regarding key reproductive and sex-related issues.

Three educational institutes were selected randomly from a total of seven institutes for the study. A sample size of 743 was calculated at 95% level of significance, 10% allowable error, and assuming the level of knowledge regarding reproductive health among urban adolescent girls as 35%. A total of 788 girls who consented for the participation in the study were enrolled. A pre-tested, pre-coded, close-ended questionnaire was administered by authors themselves. Prior verbal consent was taken from the participants, their parents, and teachers for the study. Anonymity was maintained by not including the names of the respondents in the questionnaire. The mean age of menarche in the study subjects was 13.1 years. At least two or more modes of contraception were known to 636 girls (80.7%) and oral contraceptive pills (OCP) and Copper-T were the most common known methods. That menstruation is a normal physiological phenomenon was known to 626 (79.4%). The fact that sexual intercourse with an infected person and sharing needles for intravenous drug usage are the most common modes of transmission of STD/AIDS was known to 582 girls (73.9%).

Regarding abortion, 313 girls (39.7%) knew that it can be performed at government and private health facilities but none of them knew about the indications, criterion for the place where legal abortion can be performed, and person who can carry out legal abortion. Only 89 (11.3%) of the girls knew correctly about safe sexual intercourse, that was defined as protected sex (using effective barrier methods during sexual act, e.g., condoms, etc.) with any partner having any HIV status or even unprotected sex (without using effective barrier methods during sexual act, e.g., condoms, etc.) with any partner with proven HIV negative status. A total of 82 (10.4%) of the study subjects had heard of masturbation and only 18 (2.3%) considered it normal. A total of 39 (4.9%) thought masturbation is a wrong practice, 13 (1.6%) considered it as a sign of increased sexual desire, and 12 (1.5%), thought it to be a factor responsible for ill health.

Mothers were the most important source of knowledge (in 47.4%) regarding menstruation among the study subjects followed by friends/peers (23.8%), teachers (4.9%), and mass media (4.8%). Regarding contraception,

friends/peers were the most important source of information (in 23.2%) followed by mass media (20.1%), mothers (14.8%), and teachers (10.4%). In relation to information regarding abortion, friends were the most important source (in 16.1%) followed by mothers (9.3%), mass media (8.7%), and teachers (5.4%) while for safe sex, friends were the most important source (in 4.0% only) followed by mass media (3.%), teachers (2.4%), and mothers (1.3%). Thus it seems that current efforts for increasing awareness among adolescents are doing well with respect to the knowledge regarding contraception, menstruation, and prevention from HIV/AIDS. Others also reported variable knowledge regarding menstruation (Grover 1998, Gandhi 1993 and Ahuja and Tewari, 1995). In this study mothers followed by peers were important sources of information similar to that observed by others (Nair *et al.*, 2007).

A study was undertaken to see the awareness of adolescent girls regarding health aspects through an intervention study. The study adopted a pretest – post test design with an intervention for a specific period. A total of 112 adolescent girls in the age group of 14 to 18 years were selected randomly from government schools of five villages in two blocks of Kangra district of Himachal Pradesh. The tools for assessment consisted of socio-economic status scale and a general awareness scale. The sample group was pretested on their level of general awareness which focused specifically on health aspects. An intervention package was developed on the aspects of health including general health, reproductive and child health, environmental health and nutritional aspects. The intervention was given for nine months to the girls though lectures, discussions and demonstrations. Post testing was done on the girls after the period of intervention. The results showed that the knowledge of girls regarding health aspects improved significantly after intervention. There was a considerable increase in the awareness levels of girls with regard to knowledge of health problems, environmental health, nutritional awareness and reproductive and child health. Thus informative and educable interventions seem to have a positive effect on awareness levels which would eventually encourage expansion of knowledge and positive health habits (Shubhangna Sharma, 2009).

2.6.3 Menstrual hygiene

Menstruation is a natural phenomenon among matured females who experience shedding of blood for 1-7 days every month from the age of maturity until menopause (Abera, 2003). Various aspects such as physiology, pathology and psychology of menstruation have been found to associate with health and wellbeing of women; hence it is an important issue concerning morbidity and mortality of female population. On the other hand, hygiene-related practices during menstruation are of considerable importance for reproductive health, poor practices increase vulnerability to reproductive tract Infections (Das gupta, 2008).

Menstrual hygiene and management is an issue that is insufficiently acknowledged and has not received adequate attention. A cross-sectional study was conducted during 2009-10 on 350 students and seeks to assess hygienic behavior of unmarried females aged 15 to 22 years and factors affecting their behaviors. They were recruited from educational institutions from a major city in South India. Demographic and menstrual history and hygiene questionnaires were used for obtaining required information. Statistical Packages for the Social Sciences (SPSS) for Windows version 16 was used. Descriptive statistics, Chi-sq and Fisher's exact tests were used for analysis and the results indicated that the mean age of menarche was 13.4±1.2 years. Disposable pads were used by two-thirds of the selected girls (68.9%) regardless of age while 45.1% reported to use both disposable and non disposable materials. Frequency of changing pads was 2-3 times a day by 78.3% girls. Socioeconomic Status (SES) of the selected girls and their age influenced choice of napkin/pads and other practices such as storage place of napkins change during night and during school or college hours and personal hygiene. Older girls had better hygienic practices than the younger ones. Seventy six percent of the participants desired for more information regarding menstruation and hygienic practices (*Omidvar and Shabnam*, 2010).

Prior awareness regarding menarche and menstruation among girls is generally low in most cultures. But 64.5% of the participants were aware,

(Nair, *et al.*, 2007 Tiwari and Tiwari, 2006) Mothers, teachers, friends, relatives, television and books are reported as the major source of information. Considerable percentage (54 and 35.3%) of the participants revealed mothers followed by friends to be the source of information. Prior information about menstruation has been reported to prepare the girl child mentally to accept the change in a constructive way and help her to develop better attitude (Tiwari, Tiwari, 2006 and Rajni Dhingra, 2009).

A study from India, reported that majority of rural school girls who used old cloth, sanitize the materials by boiling and drying them before reuse. It is evident that such practices offer protection against possible infections and in their study 19.1% girls used cloth material as menstrual absorbents never the less practice of cleaning or sanitizing was not appraised. Place of storage of pads/ napkins is equally important for their cleanliness, especially practice of storing in bath rooms is disturbing since it could give rise to harboring of dust and insects. The proportion of participants having bathroom as storage place was 21.1%, this practice was significantly prevalent among younger age. In other studies practice of storing in bath room was as high as 49.8%. Literature information regarding the adverse health effect due to bath room storage is meager [Narayana *et al.*, 2001).

A cross-sectional study was conducted to explore the menstrual practices among 1275 female adolescents of urban Karachi, Pakistan from April to October 2006 by using interviews. Descriptive findings showed that 50% of the girls lacked an understanding of the origin of menstrual blood and those with a prior knowledge of menarche had gained it primarily through conversations with their mothers. Many reported having fear at the first experience of bleeding. Half the number (50%) of the participants reported that they did not take baths during menstruation. In univariate analysis, factors of using unhygienic material, using washcloths, and not drying under sun were found to be significant in the Chi square test among those going and not going to schools (Tazneen and Syeda, 2010).

In the existing Indian cultural milieu, the society in interwoven into a set of traditions, myths and misconceptions especially about menstruation and related

issues (Rajni Dhingra *et al.,* 2009). Hygiene- related practices of women during menstruation are of considerable importance, as it has a health impact in terms of increased vulnerability to reproductive tract infections (RTI). The inter play of socio-economic status menstrual hygiene practices and RTI are noticeable. Women having better knowledge regarding menstrual hygiene and safe practices are less vulnerable to RTI and its consequences (Dasgupta and Sankar 2008), Several studies have revealed this (Ahuja *et al.,* 1995, Chowdary 1998, Khanna 2005 and Singh 2006) and showed that there is low level of awareness about menstruation among girls when they first experience it.

Rajni Dhingra *et al.,* (2009) studied the knowledge and practices related to menstruation among Tribal (Gujjar) adolescent girls of Jammu and Kashmir, India. A total of 200 girls in the age group 13-15 years were selected by snowball and random sampling. Information regarding knowledge and practices related to menstruation were collected by using interview guide. The results revealed that there is low level of knowledge about menstruation and its related issues among Gujjar adolescent girls. The level of personal hygiene and management of menstruation was found to be quite unsatisfactory.

Dosgupta *et al.,* (2007) conducted a cross sectional study to assess the menstrual hygiene; How hygienic are the adolescent girls? The study was undertaken among 160 adolescent girls. Data were obtained by the pre designed, pre-tested and structured questionnaire included topics relating to awareness about menstruation, source of information regarding menstruation and hygiene practiced during menstruation to find out the status of menstrual hygiene among adolescent girls. From the study results the authors concluded that the reproductive tract infections, which has become a silent epidemic and devastates women's life is closely inter related with poor menstrual hygiene.

Repeated use of unclean cloth and improper drying of used cloth before its re use results in harboring of micro-organisms resulting in the spread of vaginal infections among adolescent girls (paul 2007).The above studies stressed the need for a sustained public health awareness program among pre and pubertal girls to

create better awareness among this population. Such initiative would make women population self sufficient to manage their health and wellbeing.

2.7 Physical Activity

Adolescents and young adults, both male and female, benefit from physical activity. Physical activity need not be strenuous to be beneficial. Moderate amounts of daily physical activity are recommended for people of all ages. This amount can be obtained in longer sessions of moderately intense activities, such as brisk walking for 30 minutes or in shorter sessions of more intense activities, such as jogging or playing basket ball for 15-20 minutes. Greater amount of physical activity are even more beneficial, up to a point (U.S. Department of Health and Human Services).

2.7.1 Effects of Low Physical activity

In the Swedish study, Adolescents approaching the year 2000 the time spent in inactivity was 9-10 hour, while high activity, example in sports only occupied 0.5-1 hour per day (Bratteby *et al,* 1997). Increasingly sedentary life styles may affect various aspects of child behavior and development. A study conducted among 10 year old children showed that, despite of lower energy intakes, the less active subjects displayed higher body fatness (Deheeger *et al.,* 1997). Reduced activity is associated with decreased functional capacity (Parizkova, 1996), increased cardiovascular risk factors (Harsha, 1995) and has an unfavourable effect on emotional state. A study with data from Greece has shown that low physical activity associated with elevated risk of overweight in 11.5-15.5 year old students (Janssen *et al.*, 2005). Adolescent overweight is a major US public health problem, with prevalence rates increasing for children and adolescents (Troiano *et al.,* 1995). Minority adolescents have consistently high levels of inactivity and low levels of physical activity (Gardon-Larsen *et al.*, 1999, Heath *et al.,* 1994 and Andersen *et al.,* 1998). Inactivity and activity are important biological determinants of obesity and represent major avenues for treating and preventing obesity (Epstein *et al.*, 1995 and Epstein LH *et al.,* 1997). The process of modernization, transport, labour-saving devices and TV viewing has brought

about a number of consequences affecting physical activity patterns that contribute to obesity (OMS/WHO, 1998 & Gold blatt *et al.*, 1995).

2.7.2 Benefits of Physical Activity

Physical activity helps to build and maintain healthy bones, muscles and joints, helps to control weight, build lean muscle and reduce fat and it prevents or delays the development of high blood pressure and helps to reduce blood pressure in some adolescents with hypertension (U.S. Department of Health and Human Services). Regular physical exercise before and during adolescence is important for healthy bone development (Jaya Sudha Udipi, 2003). A study conducted on 16 year old adolescents from England, Scotland and Wales has demonstrated that exercise was positively associated with emotional well being (Steptoe and Butler, 1996). Both physical activity and healthy food have been associated with lower risk of mortality from coronary heart disease (Leon *et al.*, 1997, perry *et al.*, 1994, and Riddoch *et al.*, 1991). Since increasing physical activity patterns are considered a major modifiable factor affecting excessive body weight gain, the implementation of prevention strategies, particularly in children and young subjects should be a key goal in reducing obesity rates (Bar *et al.*, 1998 and Barlow and Dietz, 1998). Physical activity is responsible for treating adolescent morbidity, and it provides long term benefits to bone health and breast cancer and effective in the treatment of Asthma and cystic fibrosis. Self esteem is also positively affected by adolescent physical activity (Hallal *et al,* 2006).

2.7.3 Factors affecting physical activity

Television watching is a common entertainment for adolescents. Many studies have high lighted that, television watching developes greater influence in physical, psychological and educational characteristics of an adolescent.

Increase in time for television viewing is associated with increased calorie intake among the youth (Denvan Bluck. *et al.*, 2004 and Wiecha, 2006). According to Suraj Gupta 2004, Hancox , 2006 and Fletcher, Television viewing should be regarded as an important contributing factor to childhood obesity. Shehab (2005) revealed that adolescent females, who spend a significant amount of

time in watching television, were found to be significantly associated with low back pain.

A violent television program brings adolescent delinquency and violence behavioral problems (Villani. 2001, Suraj Gupta, 2004, Coyne. 2004 and Cape Girardeau 2007).

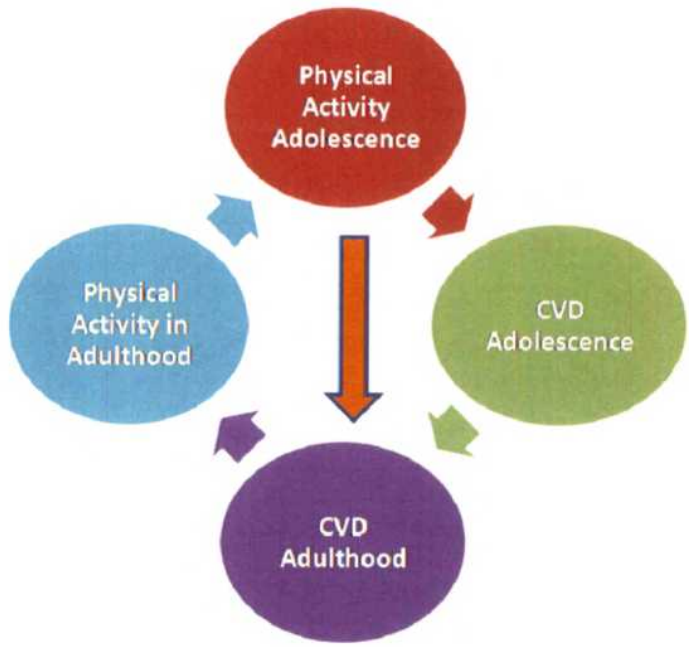
Crjnlein.T (2007) in their study on association between television viewing and insomnia during early adolescence concluded that, a positive relationship between duration of television viewing and shortened sleep time. Aronson (1993) indicated that excessive television viewing contribute to the development of dementia. The long term habitual viewers, an average rate of four or more hours daily, will develop dementia and Channon Patricia (1995) reviewed that, television watching must be properly chosen for child's level of development. Many television shows are very unsuitable and these lead to sleep problems and nightmares to young children.

Johnson. *et al.,* (2007) in their study, on extensive television viewing and the development of attention and learning difficulties during adolescents, concluded that, frequent television viewing during adolescents may be associated with risk for development of attention problem, learning difficulties and adverse long term educational outcomes.

Baljit Kaur and Sukhpal Kaur (2010) conducted a study to identify the risk factors related to life style diseases among the school children. The study results revealed that 21.3% watch television for more than two hours per day and the authors concluded that the knowledge regarding healthy life style must be imparted in order to alleviate the likelihood of developing life style related diseases.

Pathways through which physical activity in adolescence may influence Cardiovascular health in adulthood. Modified from Twisk and co-workers (2002a).

Figure 6



Today, a great number of adolescents are physically insufficiently active for health. Physical activity among adolescence is affected both by genetic and by environmental factors. Studies carried out in Western countries and emphasize that regular physical exercise, doing household activities, regulated television viewing, and healthy eating behaviors could contribute to controlling overweight obesity.

2.8 NUTRITION INTERVENTION

Adolescents represent a positive force in society, now and for the future. But this period is hazardous for adolescent's health due to the absence of proper guidance and counseling. Most of the adolescent problems are preventable; hence health services play a special role in preventing and responding to them (Prashanth Nayak, 2010).

Adolescents lacked knowledge and skills related to their nutritional needs, healthcare and reproductive health. Attention to information, education and communication needs should be given utmost importance (Report of Reginal meeting, WHO 2002). Nutrition education program can significantly improve nutrition knowledge (Vijaya Pushpam *et al.*,2001,Little *et al.*, 2002, Saibaba *et al.*, 2003, Mani and Soflaei 2006, Rao *et al.*, 2007, Fahlman *et al.*, 2008, Neetu Gupta and Kochar 2009).

Unhealthy behaviors influencing adolescents' eating habits must be considered to develop nutrition intervention (Turconi *et al.*, 2008). Adolescents require more total energy than adults. Good nutrition is essential for the attainment of normal growth and development not only for physical growth and development but also for the intellectual development. It is opined that by appropriate educational action about 50 percent of nutritional problems can be solved.

Nutrition education program, thus served to be a vital tool in driving the children to put into practice their knowledge and awareness (Leupker *et al.*, 1996). Sheila John and Vidya Narasimhan (2008) and Jagmeet Madam *et al.*, (2009) suggested the need for intervention program on childhood obesity in India and Adhikari *et al.*, (2007) concluded that the girls should be educated about the menstrual hygiene so that there won't be any misconception with the adolescent girls about menstrual hygiene.

Passi and Malhotra (2004) have answered a question of nutrition and health status of rural adolescent girls in the selected ICDS blocks and reported that the prevalence of anemia among adolescent girls were 93.2%. He supported to impart nutrition education to the adolescents which has the potential not only to break anaemia prevalence but also to ensure improved knowledge and empowerment of these girls to face their challenging role and Tontisirin.K (2005) also high lightened the importance of creating awareness through nutrition education about the prevalence of anaemia. Nutrition education was an important strategy to combat anaemia and for better knowledge gain (Mckinley 2005, Agarwal *et al.*, 2003, Gopal das 2002, Berger and Dillon 2002, Ahluwalia 2002, Yegammai and Gandhimathy 1993).

Classroom based intervention resulted in a significant improvement in nutrition knowledge (Subha Rao *et al.,* (2006), Raghunatha et *al.,* 2007). The intervention through nutrition games to the school children result in significant impact in nutrition knowledge (Meera and Sreedevi 2009). In Nutrition education, comic book and audio cassette can bring about significant changes in nutrition related knowledge (Kavitabisht and Rita, Raghu Vanshi, 2007).

Adolescent is an age of group activities. Therefore, if nutrition education is imparted as a group activity, it may help in improving the eating habits; girls may need to pay special attention to foods rich in protein, iron and other nutrients necessary for synthesis and regeneration of red blood cells (Sumati Mudambi and Raja Glopal, 2005). It has been well recognized that one of the weakest links in intervention programmes to control malnutrition is the absence of proper nutrition education (Joshi and Singh, 2002).

METHODOLOGY

CHAPTER III

METHODOLOGY

The methodology pertaining to the present study on "Nutrition status and anxiety level of pre pubertal and post pubertal girls and an impact of nutrition intervention" is discussed under the following headings.

1. Research Design and variables
2. Hypotheses of the Study
3. Selection of area
4. Selection of the subjects
5. Tools used
6. Data Collection
7. Pilot study
8. Development of Intervention program
9. Statistical analysis

RESEARCH DESIGN AND VARIABLES

Research design is the arrangement of condition for collection and analysis of data with an aim to combine the relevance of the research purpose with economy in procedure.

Phase-1

The present investigation was planned in two phases.

In phase I of the study, a descriptive correlation design was selected. The variables included in the study were nutrition status, dietary intake and attitude towards food habits, haemoglobin level, clinical signs and symptoms of nutrition deficiency, menstrual health problems, anxiety level of the subject, physical activity pattern, knowledge related to nutrition, health awareness related to their age group and general health problems.

The socio economic variables such as age, educational status of the girls and parents, family size, income, religion, residence and pubertal status of the girls were built into the study and their association with nutrition status, anxiety level, nutrition knowledge and health awareness were compared.

Phase-2

One group pre test – post test experimental design was used in order to test the effectiveness of the intervention program in improving knowledge on nutrition, health awareness related to their age group problems and general health problems.

Following were the dependent variables

- Knowledge of nutrition
- Health awareness related to their age group problems (underweight, obesity, anemia, anorexia nervosa, menstrual hygiene)
- Health awareness related to general health problems (Communicable, non communicable and degenerative diseases)

Independent variable was the intervention program on nutrition knowledge and health awareness.

Hypotheses

Phase-1

Hypothesis 1: There will be a significant association between age at menarche and place of residence of the selected girls.

Hypothesis 2: There will be a significant difference in the mean body height, body weight and BMI between pre pubertal and post pubertal girls.

Hypothesis 3: There will be a significant association between degree of malnutrition in relation to age among pre pubertal and post pubertal girls.

Hypothesis 4: There will be a significant difference in the hemoglobin level of the selected pre and post pubertal girls.

Hypothesis 5: There will be an association between age and class of the selected pre and post pubertal girls and the level of anxiety.

Hypothesis 6: There will be a significant difference in the anxiety level between pre pubertal and post pubertal subjects.

Hypothesis 7: There will be a significant association between participation in physical activity by pre pubertal girls in relation to age and income level.

Hypothesis 8: There will be a significant association between participation in physical activity by post pubertal girls in relation to age and the income level.

Hypothesis 9: There will be a direct correlation between attitude towards food habits and pubertal status of the selected girls.

Hypothesis 10: There will be a direct correlation between nutrition knowledge and age, class, father's education, mother's education of the selected girls.

Hypothesis 11: There will be a significant difference in the mean score on nutrition knowledge between pre pubertal and post pubertal girls.

Hypothesis 12: There will be a significant difference in the mean score on health awareness I between pre pubertal and post pubertal girls.

Phase II

Hypothesis 13: There will be a significant difference in the mean nutrition knowledge score between pre test and post test score of the selected girls.

Hypothesis 14: There will be a significant difference in the mean score on attitude towards food habits of the selected girls between pre test and post test.

Hypothesis 15: There will be a significant difference in the mean score on health awareness I of the selected girls (age group problems) between pre test and post test.

Hypothesis 16: There will be a significant difference in the mean score on Health awareness II (communicable, non communicable and degenerative diseases) of the selected girls between pre test and post test.

SELECTION OF AREA

The criteria for the selection of schools for conducting the study were

1. Schools having classes from 6^{th} to 12^{th} standard
2. The schools should be within the town limits to aid easy accessibility to the investigator.

Phase-1

It was decided to conduct the study in the schools located in Chidambaram town of Cuddalore District, Tamilnadu. Chidambaram is the Head Quarter of the Chidambaram Taluk in the Cuddalore District. It is one of the thickly populated towns in Tamilnadu. Following were the names of the schools included in the study

- Government Girls Higher Secondary School
- Venus Matriculation Higher Secondary school
- Kamaraj Matriculation Higher Secondary School

Phase-2

Among the three schools, where Phase-I was conducted one school was selected randomly and one standard from VI to IX standards was selected randomly.

SELECTION OF SAMPLE

Study population

The study population comprised of pre pubertal and post pubertal girls in the age group of 11-14 years from different schools of Chidambaram in Cuddalore District, Tamilnadu, India.

Sampling technique

The subjects were selected by purposive sampling technique.

Criteria for sample selection

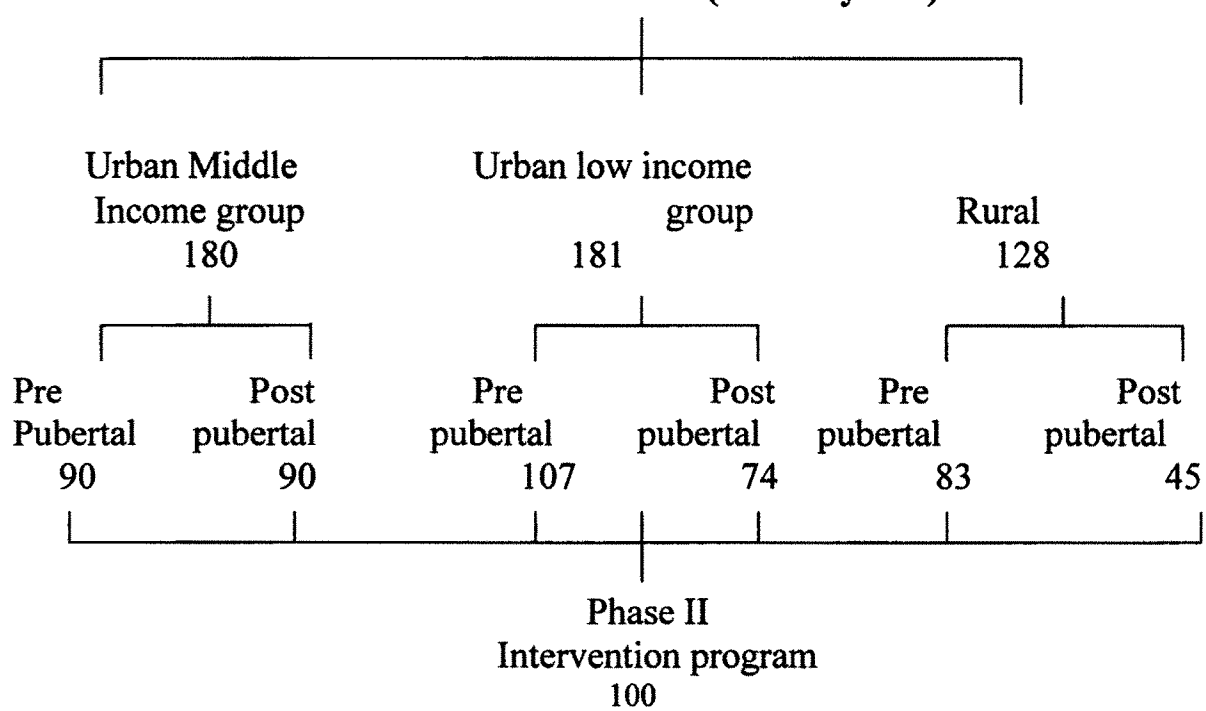
1. Girls aged between 11 and 14 years
2. Both pre pubertal and post pubertal subjects.
3. Willingness to participate in the study.
4. No complications or chronic illness.

Phase-I

A total of 489 females comprising both pre pubertal and post pubertal subjects (from VIth to IXth standard), were enrolled from three different schools. Out of 10 matriculation schools in Chidambaram town, three schools were randomly selected after obtaining prior permission from the school authorities. (Appendix-1) From VIth to IXth standards one section has been randomly selected and all the girls in the respective sections were included for the study.

A core sample of 489 subjects comprising 280 pre pubertal girls and 209 post pubertal girls in the age group of 11 to 14 years were selected (Figure1).

Figure 7- Schematic representation of selected Pre and Post Pubertal girls



Phase-2

Among the three schools, where Phase-I was conducted, one school was randomly selected and from VI to IX standards one was randomly selected. A total of 100 girls, in VIII standard were included for Phase II of the study.

Period of study

The study was carried out for a period of two years.

Description of the tools used in the Study

Questionnaire method was used to elicit information for the present study. A questionnaire consists of a number of questions printed in definite order or form or set of forms. A questionnaire is a popular means of collecting different kinds of data in a research study. A well structured questionnaire with closed ended questions, providing limited option to choose, was used to collect data from the subjects.

The study was carried out in two phases.

Phase I questionnaire consisted of the following sections.

1. General Data (Part A)
2. Nutrition Status assessment questionnaire (Part B)
    - 2.1. Anthropometric data – This includes data on body height, body weight, and Body Mass Index.
    - 2.2. Dietary data – This includes food and nutrient intake of the girls, which was studied for three consecutive days using 24 hour recall method.
    - 2.3. Clinical and Biochemical details.
    - 2.4. Health problems related to puberty, methods to alleviate menstrual pain, attitudes towards menarche, special foods given at the time of puberty, special supplements for post pubertal girls and menstrual management.
3. Manifest anxiety scale to assess anxiety level of the girls (Part C).
4. Questionnaire related to knowledge on nutrition and health awareness (Part D).
5. Physical activity assessment questionnaire (Part E).

1. General data (Part A)

Information pertaining to age, residential status, type of family, composition of the family, total monthly income of the family, educational level of the subjects and parents, age at menarche of both mother and the subjects were collected for the study and hence questions pertaining to these areas formed one part of the questionnaire. This base line data is essential to find out the influence of these factors on the nutritional profile. Therefore, the questionnaire included questions regarding the above.

2. Anthropometric data

Anthropometric indicators may be reflective of past events, predictive of future events or indicative of current nutritional status. Height and weight measurements were taken by the researcher according to the procedure given by Jelliffe (1966).

Body Height

Height was measured by allowing the subjects to stand erect on barefoot with heels together on a flat floor, against a vertical wall with the neck, shoulder and the back touching the wall. The arms were made to hang freely by the side and a mark made on the wall with the help of a scale touching lightly at the top of the head. Height was then measured to the nearest 0.1 cm using a non-stretchable measuring tape held from the mark on the wall of the floor.

Body Weight

Weight is the simplest and most important measurement of growth and is a valuable index of the nutritional status. A portable weighing machine with an accuracy of 100gms was used to record the weight of the girls. Checking the scale with a known weight was done frequently and adjustment to zero was done every time for accurate reading. Girls were instructed to stand on the weighing machine with light clothing and without footwear and with feet apart and looking straight and the weights were recorded to the nearest value. Care was taken to record the weight before meal time after the subjects had emptied the bladder and with

normal clothing. The weighing balance has been standardized, at regular intervals, in order to get reliable data.

Body Mass Index (BMI) – BMI was calculated using the formula

Weight in kg/height in m^2

The subjects were categorized into four groups based on BMI according to WHO Asian Pacific standards as

<18.5 kg/m^2	-	Chronic energy deficiency or under weight
18.5-22.99 kg/m^2	-	Normal
23 – 24.99 kg/m^2	-	Over weight
> 25 kg/m^2	-	Obese

2.2. Dietary data

A diet survey as the part of nutritional assessment was conducted and the nutrient intake of the subjects were assessed for three consecutive days using the Food recall method. The serving sizes were described in house hold measures or as number of pieces to find out the intake of various food items in different meals of a day. Mean nutrient intake was assessed and compared with the recommended dietary allowances (RDA) for the respective age groups, pre pubertal and post pubertal female subjects (11 to 14 years). This section also included Food habits, Food likes and dislikes. Nutrient percentage of Adequacy was also assessed by using a formula, $\frac{\text{Nutrient intake}}{\text{RDA}} \times 100$.

2.3. Clinical Signs and symptoms of Nutrition deficiency

Clinical signs and symptoms of nutrition deficiency were assessed by a trained nurse. Pale conjunctiva, Angular stomatitis, mouth ulcer, Dental carries, Bleeding gums, Phyrynoderma and pale skin were the signs and symptoms of nutrition deficiencies detected among the girls.

2.4. Haemoglobin level of the selected girls (11-14 years) N=100

Estimate of Haemoglobin was done by cyanmethemoglobin method on a 20% sub sample of subjects of pre pubertal and post pubertal girls, drawn by convenient sampling. The WHO cut off levels were taken as standards to classify the haemoglobin status.

Cyanmethaemoglobin Method, (Harold varley (1988).

The haemoglobin is treated with a reagent containing potassium ferricyanide, potassium cyanide and potassium dihydrogen phosphate. The ferricyanide forms methaemoglobin which is converted to cyanmethaemoglobin by the cyanide.

Reagents 1 Ferricyanide-cyanide reagent. Dissolve 200mg potassium ferricyanide 50mg. Potassium cyanide and 140 mg. Potassium dihydrogen phosphate in water and add 1 ml. of Noridet P40 (Shell chemical company of London or 0.5 ml. of Sterox S.E. Hartman-Leddon Company, Philadelphia) and make to a litre with water. The last two are colourless surface-active agents. Check the pH which should be between 7-0 and 7-4. The reagent keeps for several months in a dark polythene bottle between 4 and 20°C. It should not be frozen.

2. Cyanmethaemoglobin standard. This is now available from several firms, for example, Messrs.C.Davis Keeler, London. It is supplied in sealed ampoules, sterile and without suspended particles. Keep in the dark between 4 and 20°C. Then the colour will remain unchanged until the date stated. The concentration is given on the label. A typical value is 60 mg. per 100ml.

Technique Add 0-02 ml. of blood to 4-0 or 5-0ml of the reagent. Stand at least 4 minutes and read against a water blank at 540 mμ. Read the standard in the same way. Then

$$\text{Grams haemoglobin per 100ml blood} = \frac{\text{Reading of unknown}}{\text{Reading of Standard}} \times \text{Dilution factor} \times \frac{\text{Concentration of standard in mg. per 100ml}}{1{,}000}$$

The dilution factor is 201 or 251 according to whether 4-0 or 5-0 ml of reagent is used.

2.5. Menstrual Health Problem

Menstrual health problems of the adolescent girls (pimples, stomach pain, sudden increase in body weight and leg pain) were assessed with their response.

Methods to alleviate menstrual Pain

Methods to alleviate menstrual pain (Tablets/Fruit Juice/Butter Milk/Any other) were assessed with their response.

Attitudes towards Menarche

Attitudes towards Menarche (felt boring, uncomfortable, undesirable because of customs and tradition, desirable, neither happy nor unhappy) were assessed with their response.

Special Foods given at the time of puberty

Special foods given at the time of puberty (sweets, raw egg, ulundhu kali, gingelly oil, pongal) and special supplements for the post pubertal girls were assessed with their response.

Menstrual Management

Menstrual management (Type of napkin, storage areas, disposal/reuse details and personal hygiene during menses) were assessed with their response.

3. Anxiety level of the Girls (Part C)

This section contains 40 statements to assess the anxiety level of the selected girls. A standardized tool (Manifest anxiety scale for children) was used to elicit information to determine the anxiety level. The girls were requested to go through the statements given in the tool carefully and asked to respond to each of the statements with the answer either Yes or No. According to manifest scale interpretation points the results were made.

Manifest Anxiety Scale (Interpretation)

Scores	Category
29+	Very high anxiety
24-28	High anxiety
19-23	Normal anxiety
14-18	Moderate anxiety
9-13	Low anxiety
8 and below	Very low anxiety

4. Knowledge on Nutrition and Health awareness (Part D)

This section had three divisions to obtain information about the existing nutrition knowledge, health awareness related to their age group problems and general health problems.

Division I consisted of 25 multiple choice questions to assess the nutrition knowledge and ten statements related to food habits have been given, to assess the attitude towards food habits. Based on the expert's response each right answer was given 1 mark and the wrong was given a zero and the total score was 25 for nutrition knowledge.

5- point likert scale has been used to assess the attitude level towards food habits with the responses of the girls through questionnaire. Maximum possible score in this division was 50. Ten statements related to food habits were given. If the score was below 10, it would show negative attitude, The score 11-20 showed negative attitude, 21-30 showed undecided attitude, 31-40 showed positively favorable attitude and 41-50 showed fully favorable attitude towards food habits.

Division II consisted of 20 multiple choice questions which were used to assess the awareness about their age group problems, such as under weight, obesity, anaemia, anorexia nervosa and menstrual hygiene. The total score in this division was 20.

Division III consisted of 12 multiple choice questions which were used to assess the awareness about general health problems such as communicable, non communicable and degenerative diseases. The total score in this division was 12.

5. Physical activity level of the subjects

Parent's perception on the physical activity level of the girls.

A three Day physical activity rate (3DPAR) was used to assess the physical activity pattern of the subjects. Mode of transport to school and the girl's other activity level was also assessed.

This was evaluated through the following indicators namely 1. Mode of transport to school - active means by walking to school, inactive means-by bus or by two wheeler to reach school.

2. Girl's other activity level - Time spent on sedentary activities like indoor games, watching TV/ playing video games.

Parents were asked to fill in the above details to know the number of hours the children spent in these activities.

Content Validity

To ensure the content validity the tool was given to nine experts consisting of two physicians (one pediatrician, one-surgeon), two readers in the field of Nutrition, two community health nursing professors, two Nursing professors and one bio-statistician.

The experts were chosen on the basis of their experience and their interest in the area under study. They were requested to validate the questionnaire for its relevancy, clarity and meaningfulness. Suggestions given by the experts were incorporated and the tool was finalized (Appendix 2)

The final form of the tool was translated into Tamil, as it is the spoken language (mother tongue) of the respondents.

DATA COLLECTION

The investigator explained the purpose and need for the study and got consent from the subjects and also from their parents. To collect information from the subjects the investigator personally contacted the subjects and distributed a well structured pre-tested questionnaire to fill in the particulars in the questionnaire. They were requested to spare 30 to 45 minutes to complete the schedule. In addition, an informal questionnaire was completed by the parents. It included information about the physical activity level, time spent on (sedentary activity) watching TV and playing video games as well as energy consuming activities and the mode of transport to the school.

Procedure for Data Collection

Phase I

For phase I of the study the data collection was carried out in 3 schools. The research scholar personally contacted all the sample subjects in the schools and administered the questionnaire. All the students offered good co-operation and completed the questionnaire.

Phase II

For Phase II of the study, out of three schools one school (Govt. Girls Higher secondary School) was chosen for conducting the nutrition intervention program. The subjects involved in intervention program comprising 100 girls. Before conducting the intervention program the nutrition knowledge and health awareness was assessed (pretest). Post tests I & II were conducted to study the impact of the intervention program after 15 days and three months respectively.

Table 3 Protocol of the Study

Tools used	Subjects	Variable Measured	Collection of Data
Questionnaire	Pre pubertal and post pubertal girls N=489	General data – socio economic particulars	Collected once during the study period
Anthropometric measurement	Pre pubertal and post pubertal girls N=489	Body height, body weight	Measurements were taken once at the beginning of the study
Dietary survey three consecutive days using 24 hour recall method	Pre pubertal and post pubertal girls N=489	Food and Nutrient intake of the subjects	Done once during at the study period
Clinical Examination	Pre pubertal and post pubertal girls N=489	General health status	Collected once
Biochemical	Sub sample of 100 subjects from urban middle, urban low income and rural areas	To study the Haemoglobin level of the selected subjects	Collected once
Anxiety level	Pre pubertal and post pubertal girls N=489	To assess their anxiety status	Collected once during the study period
Intervention program	Sub sample of 100 subjects from VIII Standard	To assess their knowledge through pre and post test	Pretest was conducted before intervention and post tests I & II were conducted after 15 days and 3 months of intervention respectively

PILOT STUDY

A pilot study was conducted to make sure whether the subjects could understand the instructions given and to find out the suitability of the tool. This enables easy and convenient elicitations of information from the representative sample usually a small group or number so that successive requirements can be made. The schedule was administered on 25 pre pubertal and 25 post pubertal girls in the age group of 11 to 14 year. Errors were rectified and the corrections were incorporated in the final questionnaire.

Intervention program

Before starting the intervention program the existing nutrition and health awareness was checked (pre-test) with the help of a pre tested questionnaire. The subjects were contacted twice a week in the afternoons. Each topic lasted 30 to 40 minutes and the program was implemented for a period of three months. The main emphasis of the program was

1. To develop healthy eating habits.
2. To enhance nutrition knowledge and health awareness among pre-pubertal and pubertal girls.
3. To increase physical activity level.

   The contents of the intervention program are presented in the following table.

Table 4

Contents of the Intervention program

Session	Contents	Aids
I- Introductory session	Normal growth and development during Adolescence. Importance healthy eating.	Charts and posters
II	Food and its functions, nutrients and nutritional status.	Charts, posters and models
III	Nutritional deficiencies, their prevention and control	Charts
IV	RDA-changes with age and physical activity	Charts
V	Daily food guide and balanced diet, food groups, use of food guide in meal-planning, evaluation	Charts, standard cups, measurements raw and cooked items.
VI	Use of seasonal foods-fruits and vegetables, use of different types of oil, methods of cooking	Charts posters
VII	Need and benefits of physical activity	Charts posters
VIII	Dietary factors associated with risk of	Charts

	factors causing non communicable diseases.	

In order to improve the nutrition knowledge and health awareness, the research scholar designed charts, posters, models, pamphlet, booklet and folder as educational aids for intervention programme. Lecture cum counseling method was followed to enhance nutrition knowledge and Health awareness among the selected subjects. Pamphlets and folders on nutrition were distributed to all the selected subjects. For maximum effectiveness, it was decided to use the regional language (Tamil) while executing the programme and the booklets, folders and all the educational aids were also prepared in Tamil for easy apprehension.

Executing the intervention program

Various topics were discussed according to the program schedule, at the end of each session questions were put forth by the investigator. In addition the doubts of the subjects were clarified. In order to determine the impact of intervention program post test I was conducted after 15 days and after three months respectively and the subjects were contacted again and the questionnaires were given to the subjects to fill in (post test II). An opinion survey was also conducted to elicit information on the utility of the program at the end of the study.

Finally, at the end of the session a booklet was distributed to all the students. The booklet carried the entire program in gist, which would help the subjects for future reference.

Gain in Nutrition Knowledge and health awareness Scores: After imparting nutrition education, the questionnaire was given again to all the subjects for filling their response so as to adjudge the gain in level of nutrition knowledge and health awareness of each of the subject. For evaluating the level of nutrition knowledge and health awareness one mark was awarded for the right and zero for wrong answer. Gain in nutrition knowledge and health awareness and quantum of improvement was calculated as given below:

Gain in Nutrition Knowledge = Score in Posttest - Score in Pre-test.

Quantum of Improvement = Post test score / Pre test score.

Data Analysis

Data analysis enables the researcher to Organize, Summarize, evaluate, interpret and communicate numerical information. The data collected from the subjects were compiled and analyzed. Statistical analysis includes descriptive statistics such as number, percentage, mean and standard deviation to indicate the socio economic variable. The anthropometric data were compared with ICMR and NCHS standard values. The dietary intake was compared with recommended dietary allowances for Indians. To assess the nutrition knowledge and health awareness gain between pre test and post test and to study the effectiveness of intervention programme inferential statistics, such as Benferroni multiple comparison test for repeated measures, ANOVA was computed. To analyse the association between socio economic variables and anxiety level, nutrition knowledge and health awareness, chi-square, the Mann-Whitney test and Kruskal – Wallis test were used.

Selected pre and post pubertal girls were filling the questionnaire

Nutrition intervention

Issueing booklets

RESULTS AND DISCUSSION

CHAPTER-IV

RESULTS AND DISCUSSION

The provision of good nutrition to all, especially for the school going children during their formative period of growth and development, is a matter of great significance. Adequate nutrition is one of the key factors which help each person to attain full potential as an adult. Young girls (pre pubertal and pubertal) are nutritionally vulnerable and considered to be a special risk group as they are going to be the "Would be mothers". The results pertaining to the present study on Nutrition Status and Anxiety level of pre pubertal and post pubertal girls and an impact of Nutrition intervention are presented under the following headings:

4.1. General and specific information.

4.2. Health and Nutrition status

4.2.1 Age at menarche

4.2.2 Anthropometric status of the selected girls – Body weight, Body height

4.3. Dietary habits -Food and nutrient intake of the girls.

4.4. Clinical signs and symptoms of nutritional deficiency of the girls.

4.5. Haemoglobin level of the selected girls.

4.6. Menstrual health problems of the Pre pubertal and post pubertal girls.

4.7. Anxiety level of the selected girls.

4.8. Physical activity pattern of the girls.

4.9. Attitude towards food habits of the girls.

4.10. Nutrition knowledge and Health awareness

4.11. Impact of nutrition intervention.

4.1. General and specific information

The general information regarding distribution of the girls, class and specific information like birth order, residence, religion, pubertal status and type of family, size of family and socio economic status were presented in the following tables 5 and 6.

Table 5

General information

Variable	Number	Percentage
Age		
11	111	23
12	130	26
13	122	25
14	126	26
Class		
6	115	24
7	132	27
8	119	24
9	123	25

Table 5 shows the age and class of the selected girls.

Age: Nearly 23% of girls belonged to the age group of 11 years, 26% of girls belonged to the age group of 12 years, 25% of girls belonged to the age group of 13 years and 26% of girls belonged to the group of 14 years.

Class: Among the selected girls 24% of girls were studying in sixth standard 27% of girls were studying in seventh standard, 24% of girls were studying in eighth standard and 25% of girls were studying in ninth standard. Table 6 presents the specific information about the selected subjects.

Table 6

Specific information

Variable	Number	Percentage
Birth order		
only child	42	9
1	269	55
2	147	30
3 and 4	31	6
Residence		
Urban	361	74
Rural	128	26
Religion		
Hindu	438	90
Christian	11	02
Muslim	40	08
Pubertal Status		
Pubertal	209	43
Pre Pubertal	280	57
Type of Family		
Nuclear	411	84.1
Joint	77	15.7
Separated	1	0.2
Size of Family		
< 5	390	80
> 5	99	20

Table 6 - shows the specific characteristics of selected girls regarding birth order, Residence, Religion, Pubertal status, Type of family and size of family.

Birth Order: From the results it was noticed that 9% of girls were the only daughters in their family. About 55% of girls belonged to first birth order category. Another 30% of girls belonged to second and 6% of the girls belonged to third and fourth birth order category.

Residence: Most of the girls (74%) were coming from urban areas and 26% from rural areas.

Religion: Regarding religion 90% of girls belonged to Hinduism, 2% of girls belonged to Christianity religion and the remaining 8% of girls belonged to Islam.

Pubertal status: Among the selected girls 43% were Post pubertal girls and 57% were pre pubertal girls.

Type of Family

The girls belonged to both joint and nuclear family system. Majority of the subjects (84 percent) belonged to nuclear family and the remaining 15 percent belonged to joint family system, and a meager 0.2 percent belonged to separated family.

Size of Family

From Table 6, it was observed that 80% of the selected subjects have less than five members and 20% of the subjects have more than five members in their family. Table 7 provides the literacy level of the subjects' parents and the details are indicated below.

Table 7

Literacy level of the parents of the selected girls

Variable	Number	Percentage
Father's Education		
Illiterate	22	4
Primary school	62	13
High School	120	25
Higher Secondary	88	18
College	197	40
Mother's Education		
Illiterate	29	6
Primary school	93	19
High School	122	25
Higher Secondary	91	19
College	154	31

Literacy level of the parents

Literacy is an index to determine the stage of progress of the people. Out of 489 parents it was observed that 4% of fathers and 6% of mothers were illiterates, 13% of fathers and 19% of mothers had primary school education, 25% of fathers and 25% of mothers had high school education 18% of fathers and 19% of mothers had higher secondary school education and 40% of fathers and 31% of mothers studied up to college level. Table - 8 displays the economic status of the selected subjects.

Table 8

Distribution of girls as per Economical Status

Classification per Economical status	Economically weaker section(EWS)	Low income group(LIG)	Middle income group(MIG)	Total
Urban Middle income	-	-	180	180
Urban Poor	90	91	-	181
Rural	95	33	-	128
	185(38)	124(25)	180(37)	489(100)

Income based on the Chennai Metropolitan Development Agency (CMDA), Tamil Nadu Government (1999) distinguishes the income level of people as EWS-up to Rs 15,000 per annum, LIG-up to Rs.31, 800 per annum MIG-up to Rs.53, 400 per annum.

Family Monthly Income

The subjects who were selected for the present study have different levels of family monthly income. It is very important to find out that the economic level of the subjects as this determines the amount of money spent on food causing an impact on the nutritional status. Only 38% of the girls belonged to EWS 37% of the girls belonged to middle income group and the remaining 25% of the girls belonged to LIG.

4.2. Health and Nutrition status

Nutritional needs of the adolescent are increasing due to speedy growth during adolescence. Therefore, an understanding and assessing the nutritional status of children would help us to plan the important strategies to overcome the various nutritional problems. Hence Age at menarche, Anthropometric status, dietary habits, dietary intake, Clinical signs and symptoms of nutritional

deficiency, haemoglobin level and menstrual health problems were assessed to determine the nutritional status of the selected girls.

4.2.1. Age at menarche

Menarche is an important indicator of physiological development among the female. Adolescent growth spurt and age of menarche are influenced by many factors and one among them is the nutrition, especially, during early adolescence. Information regarding the attainment of menarche of selected adolescent girls in the urban and rural areas is shown in table- 9:

Table 9

Distribution of adolescent girls in relation to pre and post pubertal status (N=489)

Age (in years)	Pre pubertal				post pubertal			
	Urban	Urban poor	Rural	Total	Urban	Urban poor	Rural	Total
11	39	37	28	104 (37)	7	-	-	7(3)
12	44	44	19	107 (39)	21	2	-	23(11)
13	7	15	24	46 (16)	52	11	13	76(36)
14	-	11	12	23 (8)	10	61	32	103(50)
Total	**90**	**107**	**83**	**280**	**90**	**74**	**45**	**209**

Number in parenthesis represents percentage.

It is seen from Table 9 that 39% in the pre pubertal category, 37 % and 16 % of the girls under the age group of 12, 11, 13 years while a small percentage belonged to 14 years old category. In the post pubertal category 50%, 36% and11% of the girls were in the age group of 14,13and12 years while a small percentage belonged to 11 years category.

Today, girls are attaining menarche at the tender age of eight when they are physiologically, psychologically and socially unfit to adjust with the impact of this major change in their life. Problems like obesity, stress and wrong selection of food may be the reasons to blame according to the experts. Early onset of puberty was not thought to be a health concern in India till the last few years.

Lifestyle-induced obesity and environmental factors such as the presence of endocrine-inhibiting chemicals in food has changed the scene in Indian metros. Dewang Parikh, president of Indian Academy of Pediatrics, Ahmadabad chapter, said: "The signs of puberty that include development of breasts and initiation of menstrual cycle are visible in girls aged around eight to nine while a few years ago the age for early puberty was considered 11-12 years." The major factors behind this are pollutants in food that play havoc with our endocrine glands, sedentary lifestyle causing obesity and early exposure to sexual knowledge due to TV and internet. Rising stress, both at school and at home, also disturbs the hormonal patterns and can be linked to premature puberty as pointed out by the experts. Dipal Parekh, an endocrinologist, said, "The major factors are improved nutrition, added chemicals and other environmental factors. But there is still a vital role that the parents can play to delay the onset of puberty. Parents can create a loving ambience at home and motivate kids to exercise moderately. There should be an open and sensible discussion about sexuality and the changes that puberty brings. "These techniques can help in reducing the stress and anxiety piling up within young girls due to early exposure to half-baked sexual information. And lowering stress and obesity can yield results in delaying puberty," said Dr Param Shukla, adolescent psychiatrist. (Reference: http://siddham.in/puberty-at-the-age-of-8). The following table presents age at menarche in relation to residence.

Table 10

Association between age at menarche and the Place of residence

Class	11years	12years	13years	14years	Total	Chi-square value
Rural	-	-	13(29)	32(71)	45	66.05**
Urban poor	-	2(3)	11(15)	61(82)	74	
Urban	7(8)	21(23)	52(58)	10(11)	90	

Number in parenthesis represents percentage.

** Significant at 1 per cent level

It is seen from table- 10 that 71% of the subjects belonging to rural category had attained menarche in 14 years. A large percentage of the subjects among urban poor also had attained menarche in 14 years. With regard to the urban area 58 % attained menarche at the age of 13 years, 23 percent and 8 percent had attained at the age of 12 years and 11 years respectively. However no one from rural and urban poor category had attained menarche in 11 years and only 3 % of the subjects from urban poor area had attained menarche at the age of 12 years. Chi-square test was used to analyse the effect of residence on age at menarche for each category of the subjects which showed the effect of residence on the age at menarche with a calculated value of 66.05 which was significant at 1% level. The results indicated that majority of the girls' belonged to urban area and attained menarche at the age of 13 whereas the urban poor and rural area girls had attained menarche at the age of 14 years. The observations from the study are similar to those of Dewhurst (1984) which focused the presence of menarcheal age differences among the girls of different socio economic classes.

A study by Parvathi Rau *et al., (*1985) who had also found that 98 %of the upper income girls and 99 %of the slum girls had attained menarche between 13

and 14 years and 14 and 15 years respectively. In another study, conducted among the adolescent girls of Marathwada region of Maharastra by Varsha *et al* 2007 viewed that the age of menarche among urban girls was 12 years, however, a majority of the urban girls was attaining menarche in 13 years of age whereas the rural and tribal girls attained menarche in 14 years. The results of the present study is in line with the results of the above studies that the attainment of menarche among the urban girls was earlier than rural girls showing an inverse relationship with socio economic status. Thus in the present study the majority of urban girls attained menarche (range 11 to 14 years; the mean age 12.7, Table, 12) at the age of 13 years whereas girls belonged to urban poor and rural area had attained menarche at the age of 14 years.

Hypothesis1: There will be a significant association between age at menarche and place of residence of the selected girls.

Based on the results Hypothesis 1 was accepted

Table 11

Mean menarcheal age of selected girls in relation to residence

Urban girls(years) Range	Urban poor girls (years) Range	Rural (years) Range	Mean menarcheal Age
12.72± 0.076 11to13	13.76± 0.495 12 to 14	13.71±0.455 13 to 14	13.3

It is evident from table -11 that the mean age of menarche of urban poor, rural girls and urban girls were 13.76, 13.7 and 12.7 respectively. According to Gopalan (1989) girls attain menarche early in affluent communities, but it is delayed among the poor and under nourished population and, therefore, the growth is prolonged and well extended to 19 years.

In the present study menarche occurred at an average between 11 and 14 years (Table no-10). There are claims put forth by various workers (Beal 1980, Bolton 1982, NIN 1988, Ridder *et al.,* 1991, Varsha *et al.,* 2007) that there is a secular trend towards a decline in the age at menarche over the decades well with that of Raman (1990) where the mean age at menarche for girls in Coimbatore was reported to be 13.4 years and that for girls in Madras was 13.2 and 14.29 years from urban and rural areas respectively. Thus, the study also confirms that the results of both Madras and Kerala rural girls attain menarche more than a year latter than the urban girls (14.6 and 12.7 in Madras; 14.4 and 13.2 in Kerala.

Table 12

Mean menarcheal age of girls and their mothers in relation to residence.

Particulars	Urban Mean & SD	Urban low income Mean & SD	Rural Mean & SD	Mean age (Overall)
Daughter	12.72 ±0.761	13.76 ± 0.495	13.71 ± 0.455	13.3
Mother	13.8 ± 0.77	14.91 ± 0.706	14.84 ± 0.474	14.61

The mean age of menarche in the case of urban girls (daughters) and their mothers were 12.72±0.761 and 13.8±0.77 years respectively. With regard to the urban low income daughters mean age were 13.76 with SD of ± 0.495and the mothers mean age was 14.91with SD of±0.706 and with regard to rural daughters mean age was13.71with SD of ±0.455 and mothers mean age was 14.84with SD of ±0.474years. The results indicated that the distribution of the menarcheal age showed a decrease in the average age of menarche between the two generations in relation to the place of residence.

The mean age of menarche observed in our study is comparable to that of the girls from other urban areas of Maharashtra, (mean age 12.99 years). If compared to the urban girls from other states of India , it could be compared to those of Kolkata Banerjee *et al.,*2007 (mean age 12.3 years) but lower than that of

girls in Chandigarh (Sharma *et al.*, 1989) (mean age13.2 years) and Delhi (Acharya 1990) (mean age 13.34 years). This may be attributed to the differences in socioeconomic status, environment and food habits in different states of India. If compared to the rural girls of Maharashtra, (mean age 13.38 years), the mean age at menarche in our study is slightly higher (mean age13.71). This may be due to the better socioeconomic status of people leading to better living conditions, proper nutrition, better sanitary and health facilities in the urban areas than in the rural areas. Since, the urban girls are more exposed to the psychosexual stimulation by suggestive posters, movies, literature etc than the rural girls, which may partially account for the early attainment of menarche among these girls.

From table 12 it is clear that there is a significant difference in the average age at menarche for the subjects of the different categories.

The results on mean age of the daughters and their mothers in the present study was found to be slightly higher than a study conducted by Elaheh Ainyeta *(2007).*Among 812 subjects (406 daughters and 406 mothers) chosen from 1500 participants of the longitudinal Tehran Lipid and Glucose Study. Demographic information and the age of menarche were recorded in a questionnaire. They have considered a minimal of 25 years duration to be one generation. The mean age of menarche among the daughters and their mothers were 13.22±1.39 and 13.61±1.47 years respectively. The distribution of the menarcheal age showed a decrease in the average age of menarche between the two generations. There was significant correlation between the menarcheal ages of mother's and daughter's ($r=0.25$, $P<0.002$). In another study Ersoy *et al.*, (2005) found that the mean age at menarche for the girls was 12.82 ± 1.07 years and for the mothers was 13.6 ± 1.39 years. The mean menarcheal age of the mothers was higher than the mean menarcheal age of the girls ($P < 0.001$). This difference persisted due to the socio-economic status, nutritional status and physical activity of the girls.

4.2.2. Anthropometric status of the selected girls

Body Weight, Body Height, Body mass index (BMI)

Anthropometric indicators may be reflective of past events, predictive of future events and indicative of current nutritional status. The mean body height, body weight and BMI of 11 – 14 years girls as compared with ICMR (1989) and NCHS (1998) standards for these age groups and the data are presented in Table-13.and graph 1.

Table-13

The mean body height, weight and BMI of 11 – 14 years girls

Age	Height(cms)				Weight(Kgs)				BMI	
	NCHS	ICMR	Mean	SD	NCHS	ICMR	Mean	SD	Mean	SD
11 years	142	133.6 ±9.49	133.7	10.5	33.7	26.4 ±5.53	32.1	8.1	18.1	4.5
12 years	148	139.2 ±10.24	138.1	10.3	38.7	29.8 ±6.63	34.7	8.5	18.2	4.0
13 years	150	143.9 ±9.23	143.1	9.1	44.0	33.3 ±7.25	40.2	8.4	19.5	4.0
14 years	155	±147.5 9.72	146.3	8.7	48.0	36.8 ±7.23	45.3	9.4	21.2	4.2

ICMR-(1989) Studies on growth and development of children, series No 18.

NCHS- National council of Health statistics (1998)

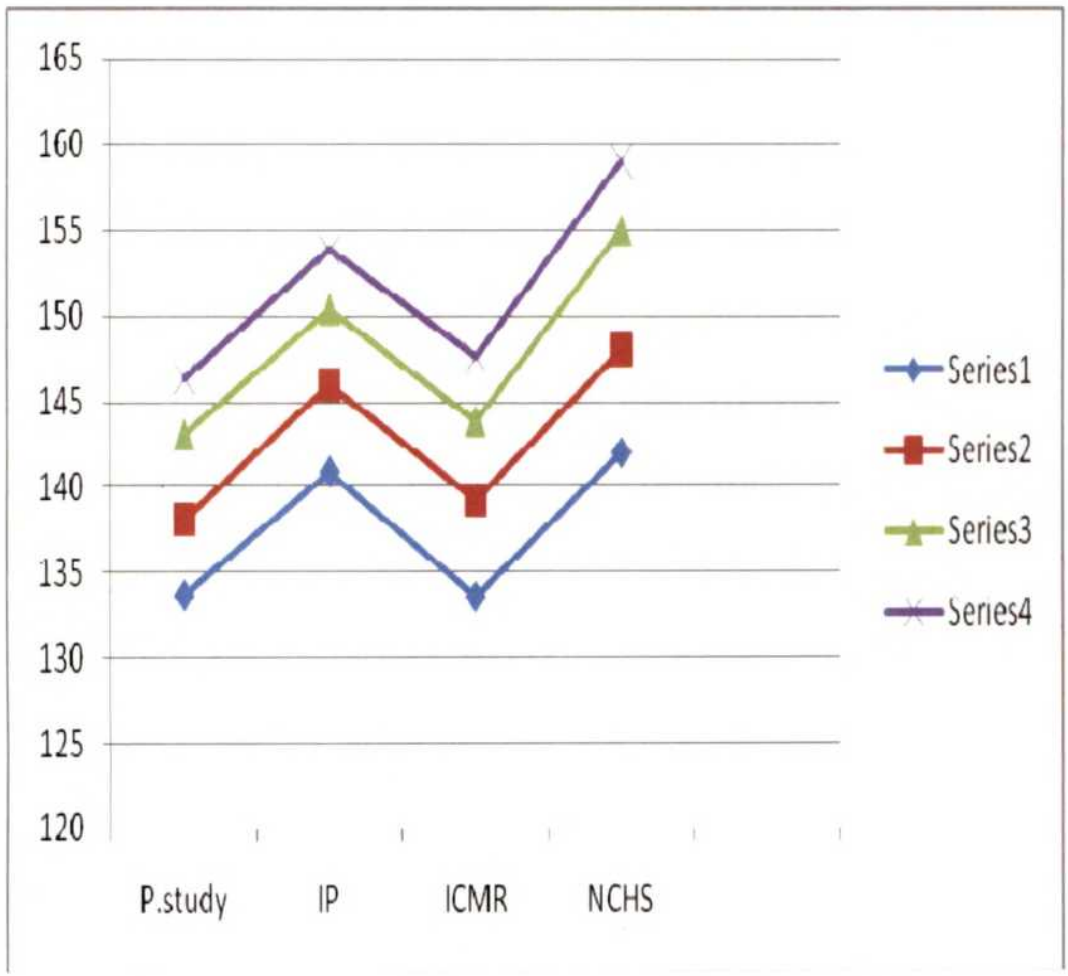
SD- Standard deviation

According to Gopalan (1993), NCHS data are best suited for use as an international reference, since they meet most of the criteria necessary for this purpose. The ICMR standards are also derived from the predominant part of the

urban and rural Indian population. Therefore, the anthropometric measurements of the selected girls were compared with both the standards.

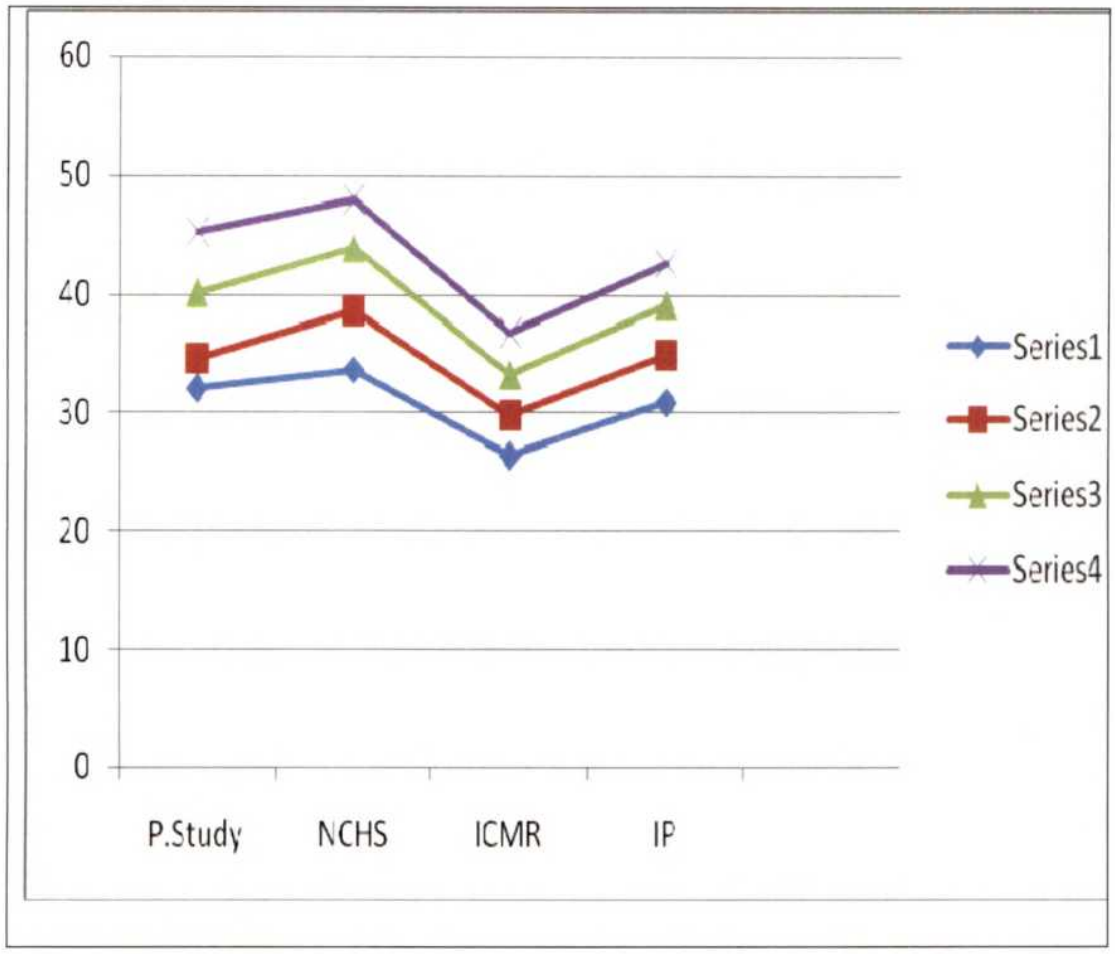
The above table 13 and graph1 and 2 indicated that the mean body height and the body weight of the subjects, obtained in the present study, when compared with ICMR standards were almost closer to each other whereas the values were far below the standards given by NCHS and the standards given by Indian pediatrics. Body Mass Index is an age independent anthropometric criteria. It is an indicator of acute under nutrition, the result of more recent food deprivation (WHO, 1998). The results of the present study focused the fact that as the age increases the BMI of the subjects also increased. A study conducted in an urban slum of Varanasi depicted 70.0% adolescent girls with BMI < 20% and 51.43% and the study subjects were suffering from chronic energy deficiency (Singh and Mishra, 2001).

Graph-1 Mean body height compared with ICMR, NCHS and Indian pediatrics



P.study -present study: IP-Indian pediatrics, 1992.

Graph-2 Mean body weight compared with ICMR, NCHS and Indian pediatrics



P.study -present study: IP-Indian pediatrics, 1992

Table 14

Comparison of mean body height, weight and BMI of Pre pubertal and post pubertal girls (11-14 years) (overall N=489)

Variables	Group(No)	Mean	SD	't' Test	'p' Value
Height	Pre pubertal(280)	136.6	9.1	10.649	0.000**
	Post Pubertal(209)	146.6	10.2		
Weight	Pre pubertal(280)	33.5	7.7	13.744	0.000**
	Post Pubertal(209)	44.4	9.3		
BMI	Pre pubertal(280)	18.0	3.9	7.458	0.000**
	Post Pubertal(209)	20.9	4.3		

** Significant at 1 per cent level

The mean body height and weight of the pre pubertal and post pubertal girls were 136.6cm, 33.5kg and 146.6cm, 44.4kg respectively. In the case of BMI the pre pubertal girls had a lower BMI than the post pubertal girls. Thus, there existed a difference in the mean body height, weight and BMI between pre pubertal and post pubertal girls. The't' test values of the body height was 10.649, body weight was 13.744 and the BMI was 7.458. The difference was found to be significant at 1% level.

Hypothesis 2 which states that there will be a significant difference in the mean body height, body weight and BMI between pre pubertal and post pubertal girls.

Based on the results, Hypothesis 2 was accepted.

Figure-8

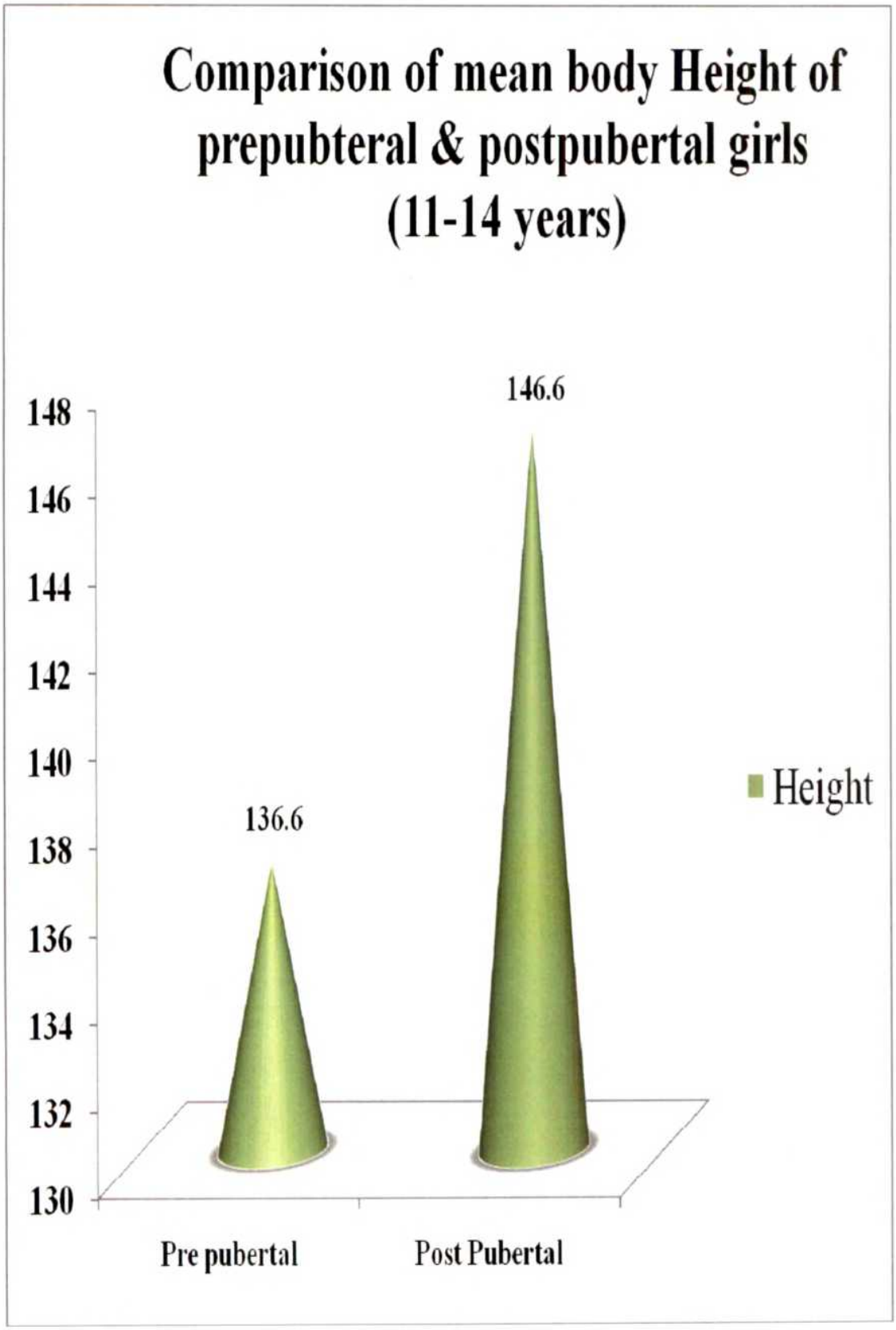

Comparison of mean body Height of prepubteral & postpubertal girls (11-14 years)
148
146
144
142
140
138
136
134
132
130
146.6
136.6
Height
Pre pubertal
Post Pubertal

Figure-9

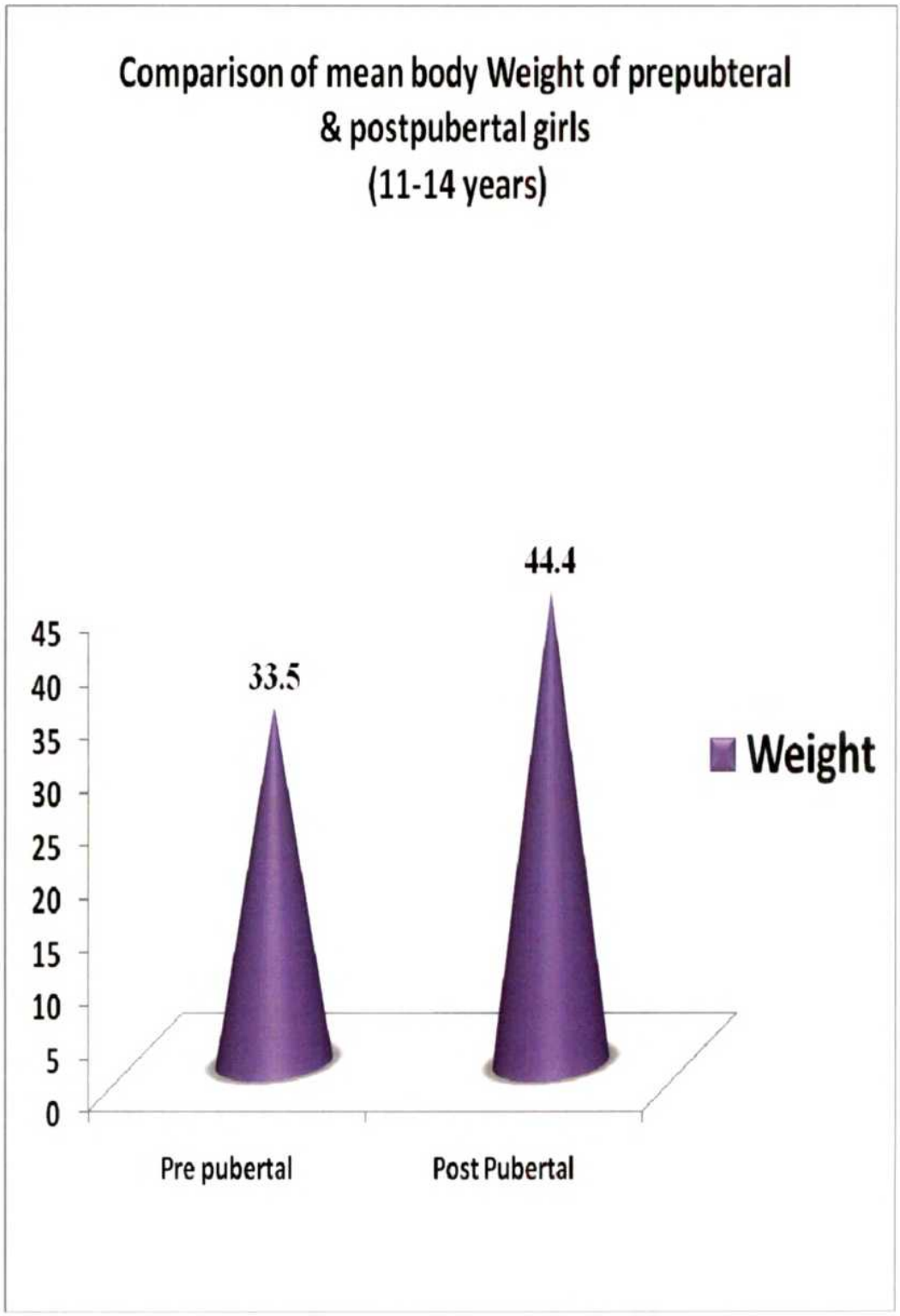

Comparison of mean body Weight of prepubteral & postpubertal girls (11-14 years)
44.4
33.5
45
40
35
30
25
20
15
10
5
0
Weight
Pre pubertal
Post Pubertal

Figure-10

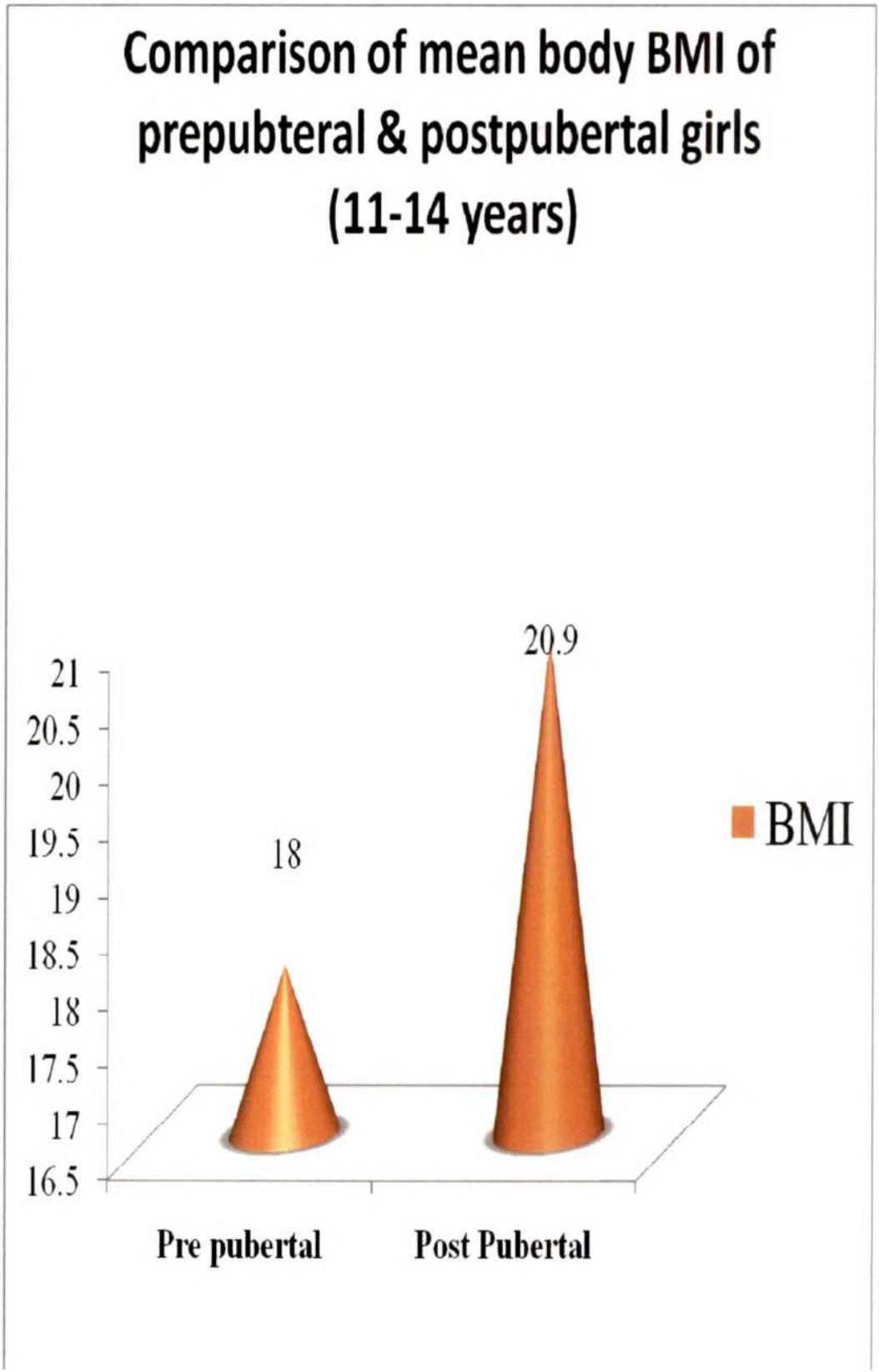

Comparison of mean body BMI of prepubteral & postpubertal girls (11-14 years)
21
20.5
20
19.5
19
18.5
18
17.5
17
16.5
18
20.9
BMI
Pre pubertal
Post Pubertal

Table 15

Comparison of Mean Body height of the girls between pre pubertal and post pubertal status (N=489)

Age in years	N	Mean	SD	't' Test	'P' Value
11 years					
Pre pubertal	104	133.1	10.22	2.46	0.048*
Post pubertal	7	143.4	10.75		
12 years					
Pre pubertal	107	136.3	9.95	2.35	0.02*
Post pubertal	23	141.3	8.98		
13 years					
Pre pubertal	46	142.0	8.65	2.31	0.02*
Post pubertal	76	145.7	9.26		
14 years					
Pre pubertal	23	141.5	7.66	3.2	0.003**
Post pubertal	103	147.4	8.69		

** Significant at 1 % level

* Significant at 5 % level

Table -15 shows the comparison of Mean body height of the girls with pubertal status. In all age groups (11-14 years) the mean height of the post pubertal girls were higher than the mean height of the pre pubertal girls and the 'P' values were significant at 5% and 1% levels.

Figure-11

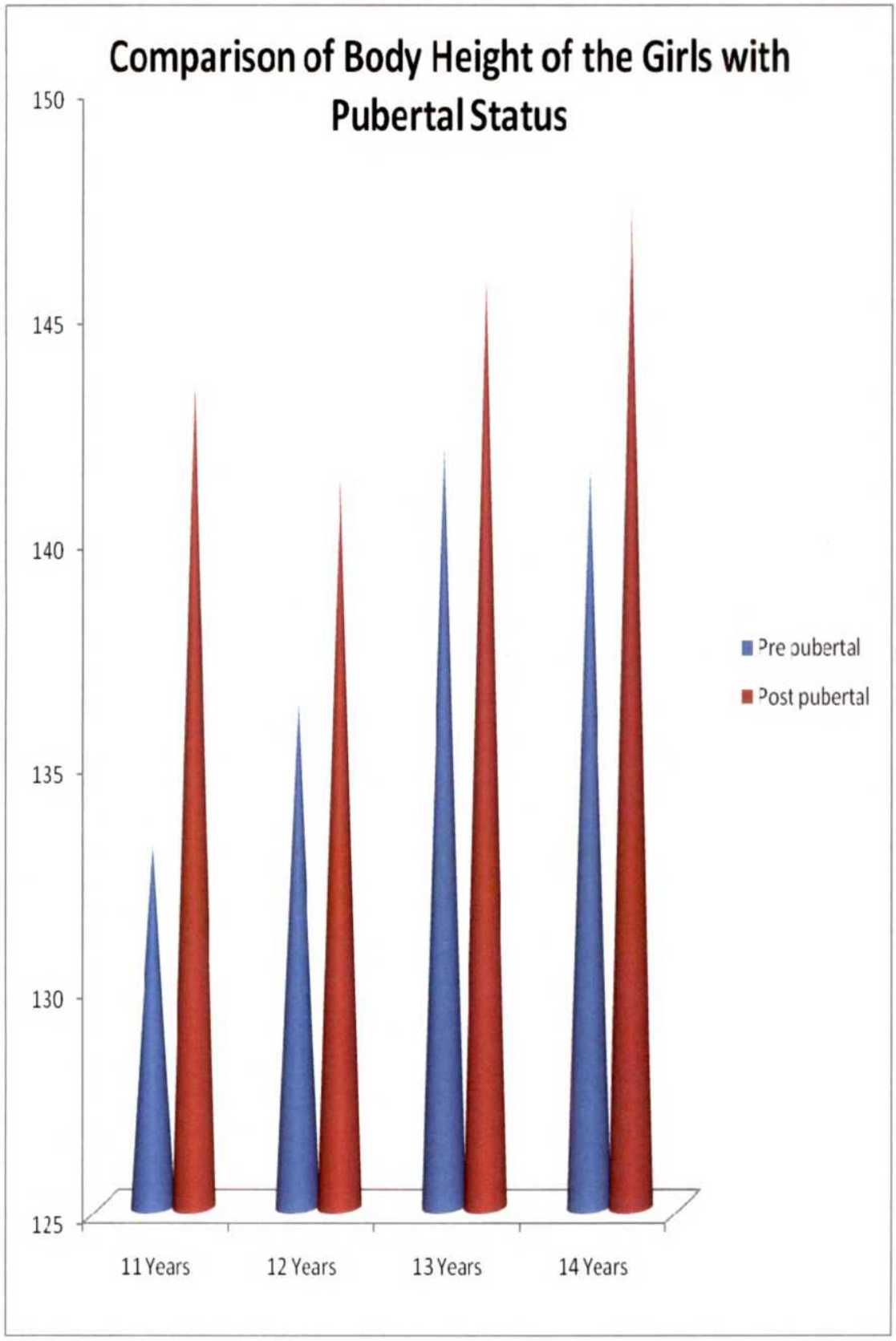

Comparison of Body Height of the Girls with Pubertal Status
150
145
140
135
130
125
11 Years
12 Years
13 Years
14 Years
Pre pubertal
Post pubertal

Table 16

Comparison of Mean Body Weight between pre and post pubertal girls in relation to age (N=489)

Age in years	N	Mean	SD	't' Test	'P' Value
11 years					
Pre pubertal	104	31.5	7.17	1.55	0.17 NS
Post pubertal	7	40.8	15.73		
12 years					
Pre pubertal	107	32.9	6.73	2.5	0.01 NS
Post pubertal	23	39.1	11.43		
13 years					
Pre pubertal	46	36.9	8.38	4.1	0.003**
Post pubertal	76	43.0	7.70		
14 years					
Pre pubertal	23	37.6	9.18	4.4	0.000**
Post pubertal	103	47.0	8.71		

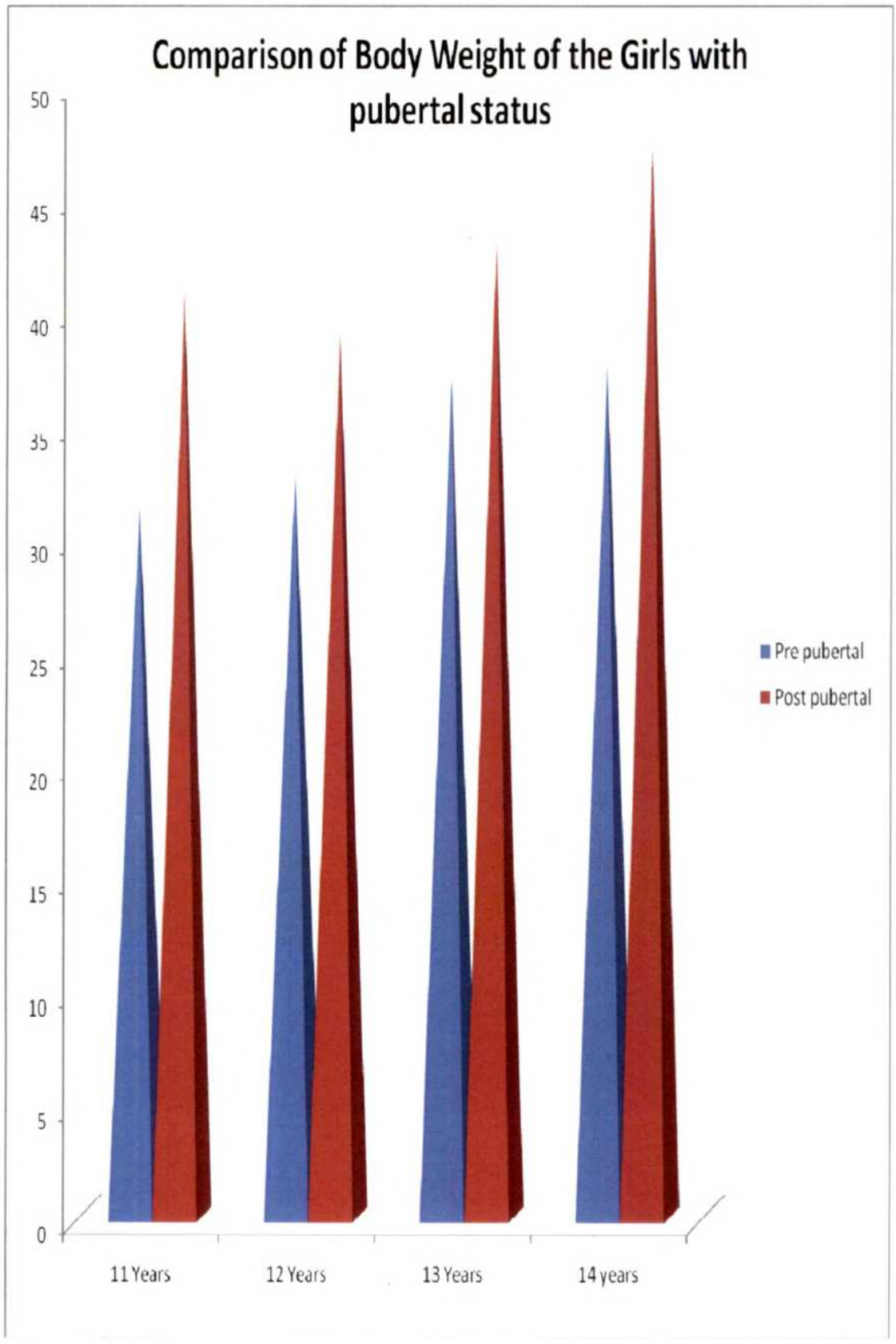
** Significant at 1 per cent level. NS - Not significant.

Table – 16 shows the comparison of body weight of the girls between pre pubertal and post pubertal status. In all age groups (11 to 14 years) the mean weights of the post pubertal girls were higher than the mean weight of the pre pubertal girls. However, the 'P' value for 11 years and 12 years showed a Non significant indication because of the unequal distribution of pre pubertal and post pubertal girls.

The results of the present study correlates with the study conducted by Sudip Datta Banik, (2011) revealed that the Postmenarcheal girls are taller in stature (135.86 cm ± 10.07) and heavier in body weight (28.05 kg ± 9.61) than the pre-menarcheal girls (stature 112.13 cm. ± 15.31 and body weight 17.12 kg ± 5.90) with significant (P = 0.0001) difference (t = -13.76 for stature and t= -13.24 for body weight).

In another study by Kirchengast and Margit Bauer(2007), among 16 schools in the north eastern part of Lower Austria, the impact of biological factors (body composition), socioeconomic factors (educational level of girls and parents) and behavioral factors (eating behavior) on the timing of menarche indicated that Postmenarcheal girls were taller and exhibited a higher weight status, a higher absolute and relative amount of fat mass and a higher amount of lean body mass than their pre-menarcheal counterparts of the same age.

Figure-12


Comparison of Body Weight of the Girls with pubertal status
50
45
40
35
30
25
20
15
10
5
0
11 Years
12 Years
13 Years
14 years
Pre pubertal
Post pubertal

The following table (17) depicts the degree of malnutrition among the selected pre pubertal and post pubertal girls.

Table-17

Degree of Malnutrition among the selected pre pubertal and post pubertal girls (N=489)

Degree of Malnutrition In percentage	Age in Years (11-14 years)				Total	X^2	'P' Value
	11yrs.	12 yrs.	13yrs.	14 yrs.			
90-100 (Normal)	12	22	31	29	94(19)	19.11	0.086(NS)
75-89.9 (Mild/I°)	32	42	38	29	141(30)		
60-74.9 (Moderate/II°)	21	29	18	22	90(18)		
< 60 (Severe/III°)	3	2	4	2	11(2)		
>100	43	28	38	44	153(31)		
					489(100)		

NS -Not significant.

It is evident from the table that among the selected subjects with an age range of 11-14 years, 19 percent girls were in normal level, 30 per cent girls were in mild grade mal nutrition, 90 girls (18 %) were in moderate grade mal nutrition and only 11 girls (2%) were in severe grade mal nutrition. A total of 153 girls (31%) were above the normal level. Chi-square analysis was used to find whether there is any association between different grades of malnutrition and pre and post pubertal girls. Chi-square analysis showed no association between different degrees of malnutrition and pre and post pubertal girls as the mean body weight of the girls were nearer to each other when considering the entire selected subjects.

Hypothesis 3 which states that there will be a significant association between degree of malnutrition in relation to age among pre pubertal and post pubertal girls. The results showed no association between age and degree of malnutrition hence the hypothesis 3 was rejected.

In the present study wasting and stunting were not observed. However these were found in a study conducted on the Nutritional status of 10-16 years school going girls by Ghalib J Haboubi and Rixwana B Shaikh (2005) which showed that the prevalence of stunting and thinning was very high among the south Indian students and a study on the nutritional determinants of malnutrition among the rural adolescent school children conducted by Vijayata Sengar *et al.,* (2009) showed that there was 68.2% wasting, 42.8% stunting and 48.2% underweight among the adolescents.

In another study on the nutritional status of adolescent girls conducted by Saibaba *et al.,* (2005), it was showed that the heights and weights of study subjects were far below the standards and a study on the nutritional status of adolescents conducted by Deshmukh *et al.,* revealed that 53.8% adolescent were thin, 44% were normal and 2.2% were overweight. It was concluded that the majority of the adolescents in rural Wardha were thin. It was inferred from a study by Varsha and Rohini (2007) on the effect of family income on nutritional status of selected adolescent girls of Marathwada region that among the 74 girls in high income group from urban area, 40.54 % girls were normal ,30.78 % were mildly undernourished and 18.29 per cent were moderately undernourished. The severely undernourished were 6.76 % and the per cent of severely undernourished adolescent girls increased by 4 to 6 times as the income level decreased gradually. In the present study the severely under nourished were only 2 per cent.

4.3. Dietary Habits

4.3.1. Type of diet

Dietary habits are the important part of the adolescents' food intake. It affects the amount and type of food consumed. Hence, it is necessary to find out the type of diet consumed by the subjects. During adolescence an individual's

total nutrient needs reach their highest point in the life cycle. Healthy eating is important at this stage of life not only because of the nutritional needs but also because the habits formed early in one's life will most likely carry into adulthood. Insufficient intake of nutrients inhibits growth promoting hormones, impeding or delaying the on set of pubertal development and may even lower height gain during this period of life (Croll, Newmark and Story, 2001). The type of diet consumed by the girls is presented in the following table.

Table-18

Type of diet (N=489)

Type of diet	Number of subjects	%
Vegetarian	109	22
Non-Vegetarian	328	67
Ova-Vegetarian	52	11

It is elucidated from the above table that 11 percent of the girls were Ova Vegetarian, 67 percent of the girls were non vegetarian and 22 percent of the girls were vegetarian. And it is seen that majority of the subjects were non vegetarian, consuming egg, meat, fish and poultry, but the frequency of consumption was low especially among the low income group and economically weaker section. Religious customs also influenced the frequency of consumption of meat, fish and eggs. In spite of being non vegetarian, it was found that the frequency of the consumption of fleshy foods was substantially low. Even though they belonged to non vegetarian group, a meager intake good quality protein was noticed. Among the vegetarian, the only source of good quality protein is from milk and milk products that was found to be lower, especially, among the urban poor and rural girls.

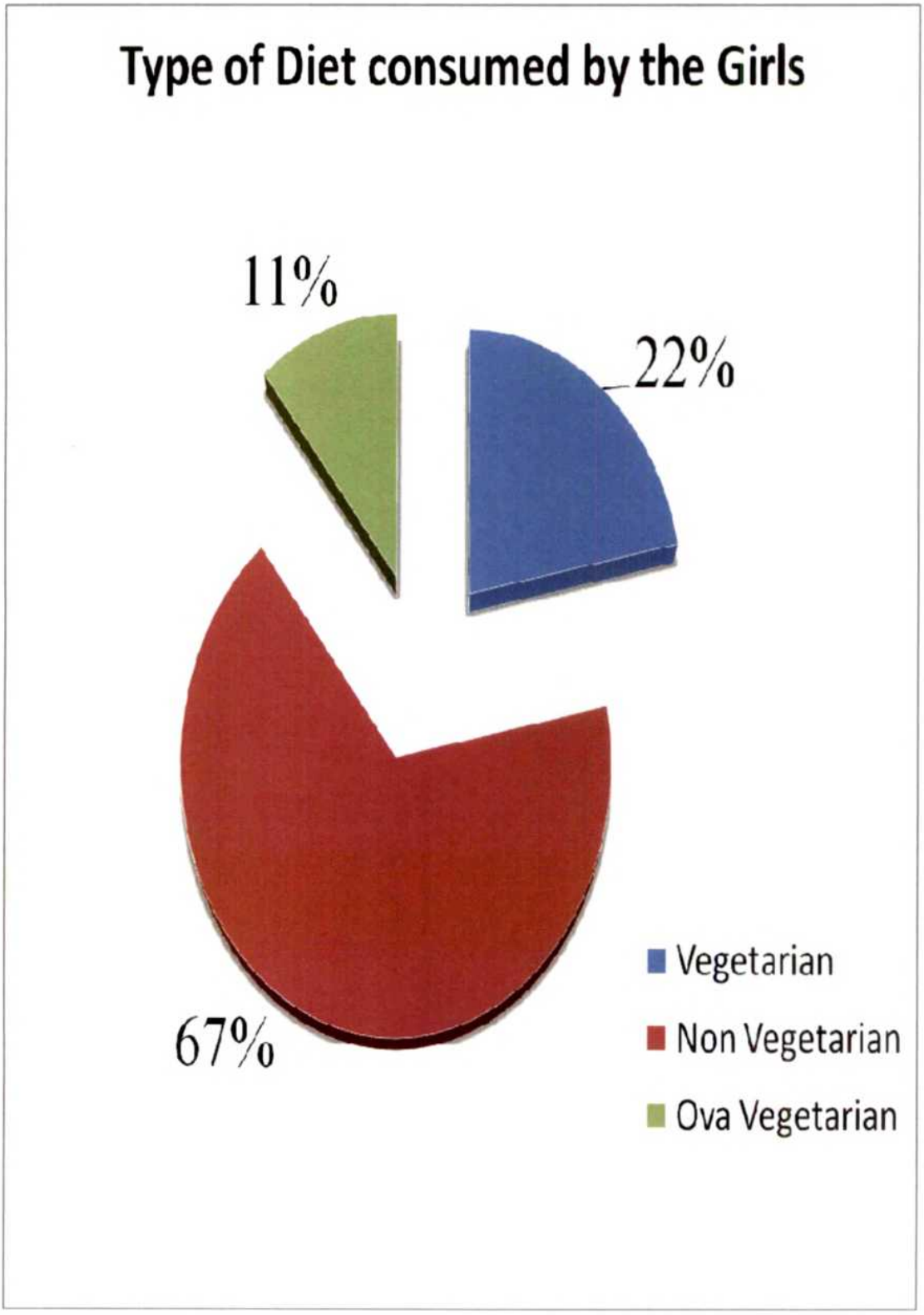
In general the data on the pattern of the diet as obtained from the questionnaire showed that the diet consisted mainly rice with very little pulse and vegetables especially, among the girls of the rural group. Some of these girls were

satisfied with coconut or chillies chutney to eat with rice. In general the pattern of the rural group consisted of items such as idli, dosai and uppuma only occasionally for breakfast, rice, sambar, rasam and vegetables for lunch and the same food kept over for the night.

The chief source of dietary protein for the girls in the rural area was mainly from rice which has a protein content of 6.4 g/100g and other good sources of protein were hardly consumed except on very special days. The only pulse used was red gram dhal in which protein content is 22.3g/100g but this was consumed in a meager amount. Vegetables like carrot, beetroot were hardly included in the diet but root vegetables like potato, yam and colacasia were consumed frequently in their diet. One very obvious observation, made in their diets, were the frequent use of brinjal and ladies finger by nearly all the girls in the group, even the consumption of fruit was very rare and the quantity was very low.

The dietary pattern of the girls in the urban group was much better because there were a greater variety of vegetables with frequent intake of fruits and curds. The dietary protein from the diet of the girls in the urban area was mainly from rice, wheat and animal foods like meat, egg, and fish for the non vegetarian and with curd and pulses for vegetarian. Among the other vegetables cho-cho, knol-khol, green plantain, carrot, bottlegourd were used. Brinjal and ladies finger were used often. Green leafy vegetables consumed were Gogu, fenugreek leaves, cabbage and celery stalks. Srinivasan (1991) reports that with the increase in income, the consumption of cereals was low and that of vegetables, pulses, milk and milk products has increased, while the poorer households were found to consume more of cereals. In the present study, it was found that the consumption of vegetables and fruits was poor and diet was mainly cereal based, which was similar to the observation of Narayanan and Srivatsava (1993).

Figure-13


Type of Diet consumed by the Girls
11%
22%
67%
Vegetarian
Non Vegetarian
Ova Vegetarian

4.3.2. Food Likes & Dislikes

The food choice and acceptability program defined food choice as "the selection of foods for consumption, which results from the competing, reinforcing and interacting influences of variety of factors" (Judy Buttrise et al. , 2004). Jaya Sudha (2003) stated that teenagers make much choice for themselves. This is a period when the independent character of an individual is established often the adolescents' dietary habits differ from those of children and adults. Studies have shown that genetic factors influence food likes, dislikes and taste perception (Duffy and Bartoshur, 2000). However, other research studies have shown that children develop their food preferences as they grow and are exposed to a variety of food items (Birch, 1999) and also influenced by their family, parents and siblings (Skinner *et al.*, 1998). Table 19 display food items liked and disliked by the selected girls.

Table-19

Distribution of food items liked and disliked by the selected girls (N=489)

Sl.no.	Food items	Liked		Disliked	
		Number	%	Number	%
1.	Ice Cream	482	98.56	7	1.4
2.	Sweets	374	76.48	115	23.5
3.	Snacks	376	76.89	112	22.9
4.	Cool Drinks	402	82.20	87	17.7
5.	Vegetables	352	71.98	137	28.0
6.	Fruits	458	93.66	31	6.3
7.	Greens	344	70.34	145	29.6
8.	Sundal	379	77.50	110	22.4
9.	Vegetable salad	193	39.46	296	60.5
10.	Bakery foods	347	70.96	142	29.0

Data pertaining to the food likes and dislikes of the girls revealed that 98 percent preferred ice creams. Surprisingly, fruits were preferred by 94 percent of the girls. Most of the adolescent girls (82%) liked cool drinks. Among all the items vegetable salad was the most disliked one. Similar results were shown by various studies as the present study results. Irrespective of the place of residence, majority liked processed packed foods. Street foods play an important role in the diet of poor house holds for break fast and snack because they are cheap and convenient. The frequency of consumption of street food consumption is determined by the regularity of income, the time available to prepare meals at home as most of the parents return home late night from work place. Hence low income girls procure processed foods from locally available street foods and poor quality packed items which are not tested for quality. Riet *et al.,* (2001) explained the role of street foods in the dietary pattern of two low income groups in Nairobi; the study revealed that the house hold members of all ages and of both sexes consumed street foods, except infants of less than one year of age. In all other age groups at least 22% of the house hold members consume street foods daily. In another study by Webb and Hyatt (1988) found that the street foods provide 15% of energy and 18% protein in the diet of secondary school students in Port-au-Prince, Haite, Oguntona and Kenya (1995) showed that the street foods contribute 25 % of the energy and 5-25 % of the protein intake of a group of urban adolescents in Nigeria. Sujatha *et al.,* (1997) showed that the street foods helped male urban workers in Hyderabad, India to meet their RDI. Consumption of fast foods was found to be a fashion, and popular among the adolescents (Mahajan and Chaturvedi (2007). In south India 51% of the girls consume instant foods 3-4 times a week, nearly 68 % reported daily consumption of bakery items and 48% consumed aerated drinks 1-2 times per week Rao *et al.,*(2007), Leena and Kumari (2009) remarked that the consumption of fast food 5 to 6 times a week, with the most popular items like cream biscuits, fried chips, soft drinks, noodles, samosa and the least preferred fast food items such as gulabjamun among adolescent girls in Ernakulam, Kerala, India.

Truswell and Darnton Hill (1981), Bull (1988) and Farthing (1991) in their studies stated that adolescents' fond of food products rich in sugar and/or fat and

low in Micro nutrients. In another study Bandini *et al.,* (1999) reported that, approximately, 20% to 27% of their total daily energy intake from chips, candy, soda, baked foods and ice cream. Parvin mirmiran *et al.,* (2006) observed among dietary behavior of Tehranian adolescents and the results showed that 85% have the habit of consuming soft beverages though they knew they were the cause for over weight and obesity Troiano *et al.,* (2000) observed in their study that most of the adolescents consume diets that were lower in fruits and vegetables than recommended. Present study correlates well with a study conducted by Pallavi and Habeeb (2005) in rural and urban school children that majority of the adolescents disliked raw vegetables as salads. In another study conducted by Kumari and Rita (2005) on the nutritional status of school children from Bihar reported that the intake of pulses, green leafy vegetables, other vegetables and fruits, meat and poultry and fish was slightly better with the girls than the boys as the cereals and fat intake was more among girls than the boys.

4.3.3 Dietary intake of the girls

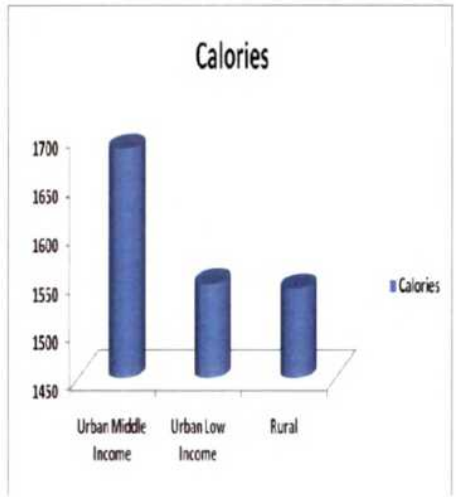
Dietary intakes of the girls (11-12 years and 13-14 years) are presented in the following tables.

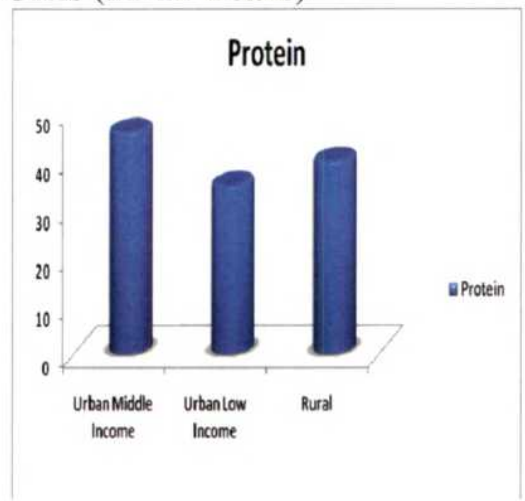
Table-20

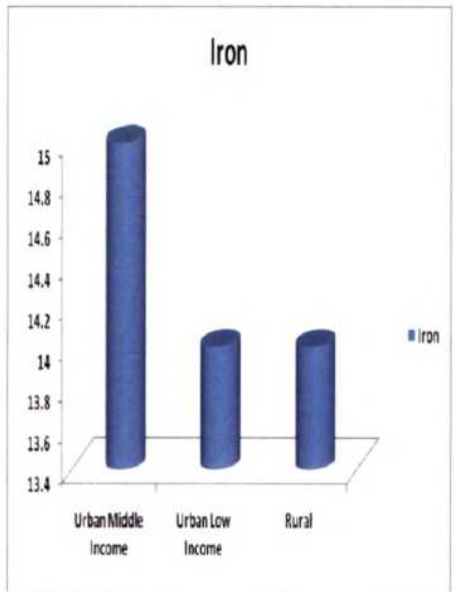
Nutrient intake of the girls (11- 12 years) in relation to income (N=489)

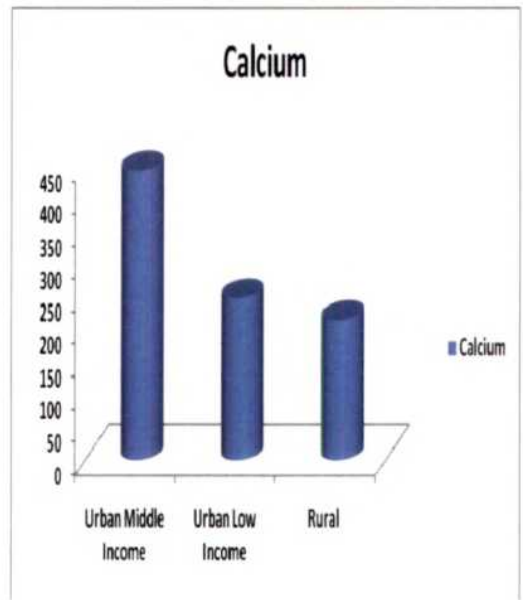
Nutrients	RDA	Urban Mean & SD	Urban poor Mean & SD	Rural Mean & SD	Mean (Overall)	Percent adequacy Ratio
Calories (kcal)	1970	1686± 140.2	1547± 105	1542± 135.5	1591.6	80.7
Protein(g)	57	46.5± 5.6	35.2± 3.6	40.0± 6.8	40.6	71.2
Iron(mg)	19	15.1± 2.9	14.5± 2.5	14.6± 3.0	14.7	77.5
Calcium (mg)	600	445± 20	248± 75	215.7± 10.2	302.9	50.5
VitaminA (µg)	600	260± 16.9	201± 16.8	160± 15.9	207	34.5
Fat(g)	22	25± 5.0	25.5± 4.2	25 ± 5.0	25.2	114.5

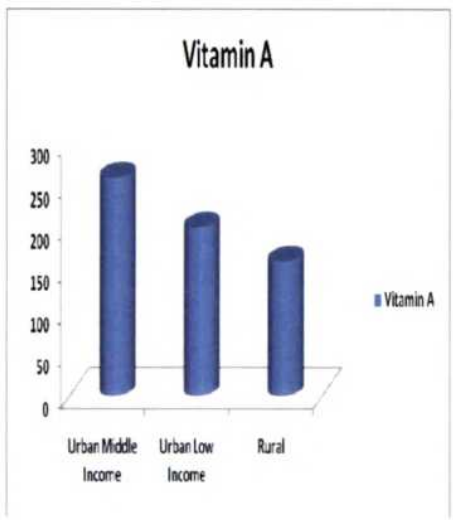
Figure-14
Nutrient Intake of the Girls (11-12 Years)











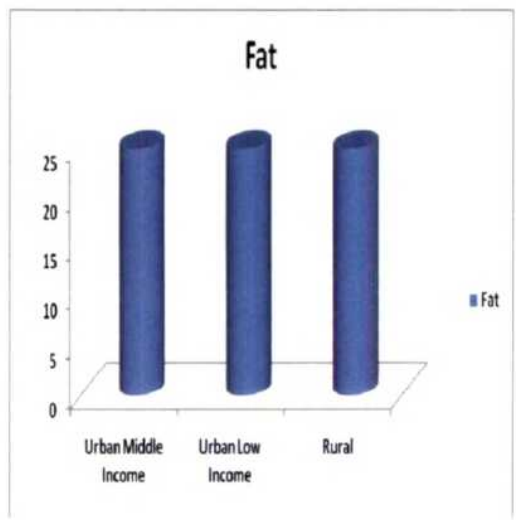


Figure-15

Dietary Intake of the Girls (13-14 Years)

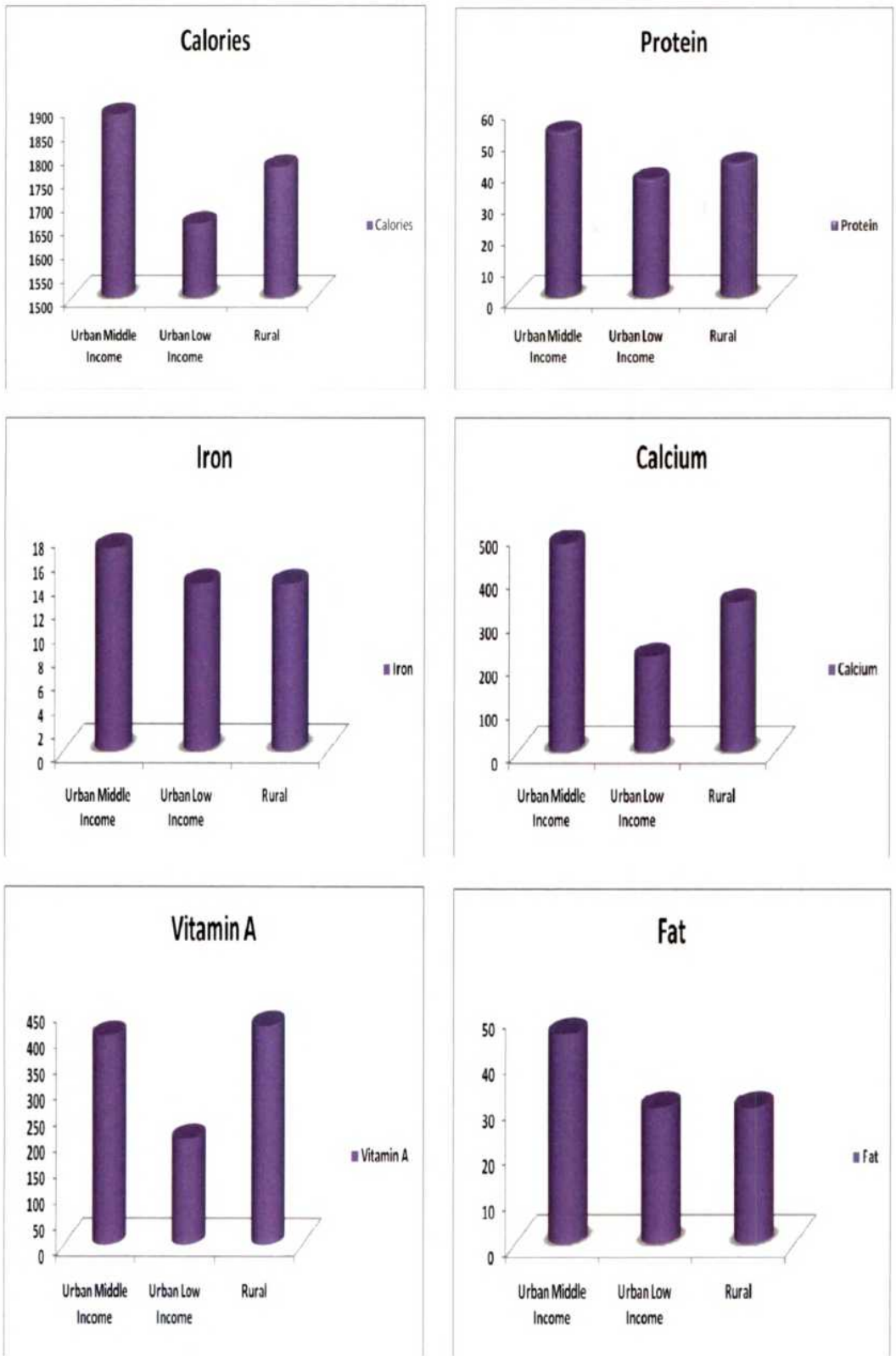


Table-21

Dietary intake of the girls (13- 14 years)

Nutrients	RDA	Urban middle Mean & SD	Urban poor Mean & SD	Rural Mean & SD	Mean (Over all)	Percent adequacy Ratio
Calories(kcal)	2060	1886± 165.5	1656± 28	1775± 148.1	1772.3	86.0
Protein(g)	65	53.2± 5.9	38± 2.0	43.5± 5.2	44.9	69.1
Iron(mg)	28	17.9± 3.2	14.5± 2.3	14.8± 3.1	15.7	56.1
Calcium(mg)	600	480.5± 241	220± 10.5	345.6± 121.7	348.7	58.1
VitaminA (µg)	600	403± 341.6	205± 19.0	422.5± 261.6	343.5	57.2
Fat(g)	22	46.1± 11.5	30± 5.5	30.8± 10.7	35.6	161.9

*Ref -ICMR, 2004

Mean intakes of 11 to 12 years urban (Middle income) girls related to calories, protein, iron, Calcium, Vitamin A and Fat were 1686 Kcal, 46.5gms ,15 mg, 445.5 mg, 260µg, and 25gms. The mean intake of the rural girls aged 11-12 years with regard to calories, protein , iron ,Calcium, Vitamin A and Fat were 1542 Kcal, 40.0gms and 14.6 mg, 215.7 mg, 160 µg and 25gm. The mean intake of the urban (Low income) girls aged 11 to 12 years with regard to Calories, protein, iron, Calcium, Vitamin A and Fat were 1547 kcal, 35.2gms, 14.5mg, 248 mg, 201 µg and 25.5gm. It is seen in the tables 21 and 22 that there was a difference in the mean intakes of calories, protein, iron, calcium, vitamin A and fat among girls from urban (Middle income, Low income) aged11 to 12 years and rural areas aged 13 to 14 years from urban (Middle income, Low income) and rural areas.

In the case of girls aged 13 to 14 years in the urban (Middle income) area, the mean calorie intake was slightly higher the than urban poor and rural area. The protein, calcium and vitamin A intake were also considerably higher among the urban girls. With an exception the fat intake by the girls in relation to place of residence was remarkably higher. In all the selected subjects when compared with the ICMR standards, the mean nutrient intakes was below the normal values.

The results showed a difference in the mean nutrient intake between the girls aged 11-12 years and 13-14 years and the RDA.

The present study is in line with the study conducted by Faruk Ahmed *et al.,* (1998) which showed that the diets of these girls were inadequate both in micronutrients and macronutrients and while another study on dietary status of children conducted by Aarthi Sankhala *et al.,* (2004) revealed that energy intake among the 10-12 years was little higher than the RDA and the average intake of protein was inadequate and reduced intake of all the dietary essentials.

Another study, on the diet quality of rural adolescent girls in India conducted by Anitha Malhotra and Santosh Jain Passi (2006) indicated that the energy and nutrient gap was found to be more pronounced in the case of the girls aged 10-15 years than the older subjects.

A study on the nutrient intake of the girls aged 10-16 years in Jaipur City, India assessed by Anuradha Goyle and Ira Yanendra (2009) showed that the nutrient intakes of the girls were much below the RDAs. The energy and protein intake were 55% - 56% and 56% to 61% of the RDAs respectively and a study on the food intake of 13-15 years girls assessed by Priya Goswami et.al (2009) indicated that the intake of energy and iron were lesser than RDA. Diet and nutrition surveys carried out in India and other developing countries have shown that the diets consumed by school children and adolescents are deficit in calories, proteins, vitamin A, riboflavin, folic acid and iron. Signs and symptoms of vitamin A deficiency and anemia due to deficiencies of iron and folic acid are widely prevalent among them (Swaminathan, 1997).

It was reported by Kamala Krishna Moorthy *et al.,* (2003) that, nutritionally, adequate diet should be consumed through a wise choice from a

variety of foods eating too little food during the vulnerable periods of life such as infancy and childhood. Adolescence can lead to harmful consequences as shown in a cross sectional study on the role of breakfast in nutrient intake conducted by Uma chitra and Radha (2007) showed that inadequate energy intake was reflected in a high incidence of malnutrition among 10-15 years girls. A study on calorie and protein intake and its determinants among the adolescent school girls in Delhi by Sharma *et al.,* (2005) indicated that the mean protein and calorie intake among girls from private school were 1.91 and 1.80 times higher than that of the government school girls, respectively. An inverse linear association was observed between monthly income of the family, family size and number of total siblings with respect to protein and calories intake. The mean protein intake of 298 students was 44.09 $\pm$ 20.9 gm. The protein intake on an average was 30% less than that recommended by Indian Council of Medical Research (ICMR). The deficit was more pronounced in the case of government schools students (50%) than the private school students (5%). This could be attributed to the poor economic status of the children studying in government schools. The above results coincide with the present study. It was also observed that the calorie protein intake was found to be higher among the urban girls than their counterparts in the present study.

4.3.4 Mean food Intake of the selected girls

Table 22

Mean food Intake of 11-12 year old girls

Food groups (g)	RDA	Urban Mean & SD	Urban poor Mean & SD	Rural Mean & SD	Mean (Over all)	Percent adequacy
Cereals	270	225.1±20.2	250.8±16.6	260.6±17.8	245.5	90.9
Pulses	30	25.3±3.7	20.2±2.3	15.1±3.2	20.2	67.3
Green leafy Vegetables	100	12.8±2.6	8.4±3.1	6.5±3.4	9.2	9.2
Other Vegetables	100	23.5±4.1	21.9±3.9	13.6±2.5	19.6	19.6
Roots and tubers	100	25.8 ± 2.3	17.3 ± 1.5	15.5 ± 1.7	19.5	19.5
Milk	500	300.9 ± 20.3	200.2 ± 18.7	175.7 ± 19.1	225.6	45.1
Fruits	100	30.4 ± 12.1	25.0 ± 9.7	20.3 ± 10.2	25.2	25.2
Fleshy foods	30	25.3 ± 3.3	15.7 ± 2.9	10.9 ± 3.1	17.3	57.6
Fats and Oil	25	25.7 ± 5.7	25.6 ± 4.7	25.3 ± 5.1	25.5	102
Sugar and jaggery	30	32.7 ± 5.1	29.8 ± 4.3	22.4 ± 4.1	28.3	94.3

The mean food intake of, various food stuff by urban middle income group and urban Low income group and the rural girls were presented in table 22. The mean intakes of all the food stuff among the three groups were found to be closer to each other. However, the mean intake of milk and green leafy vegetables consumption by urban middle income group was comparatively higher than the urban low income group and the rural subjects. Except fats and oils, all other food groups were inadequately consumed. Inadequate intake of milk and milk products, green leafy vegetables, fleshy foods and sugar and jaggery was also reported by Kumari and Singh (2001) in school children from Bihar while Sarupriya and Mathew (1988) from Rajasthan reported that intake of cereals was higher and the consumption of green leafy vegetables, fruits, pulses, roots and tubers was lower than the RDI in the diet of the adolescents. Similarly Rajini and Priti(2004) found cereal consumption was only 70 per cent of RDA with the girls aged 11-13 years from Madhya Pradesh while in the present study it was 90.9 per cent. With regard to pulses the percent adequacy ratio was 67 percent while the green leafy vegetable consumption was only 9.2 % in the adequacy ratio. On the whole the mean food intake was grossly inadequate with regard to in micro nutrients such as vitamins and minerals by the selected girls belonged to urban, urban poor and rural area.

Table 23

Mean food Intake of 13-14 years girls

Food items in (g)	RDA	Urban middle Mean & SD	Urban poor Mean & SD	Rural Mean & SD	Mean (Overall)	Percent adequacy
Cereals	300	275.3±15.8	260.8±16.6	280.3±16.3	272.1	90.7
Pulses	60	25.8±3.1	20.5±2.8	22.4±2.3	22.9	38.1
Green leafy Vegetables	100	16.4±3.1	8.3±2.1	17.7±3.0	14.1	14.1
Other Vegetables	100	25.1±2.7	30.0±3.1	18.1 ±1.9	24.4	24.4
Roots and Tubers	100	42.5±4.1	31.7±3.9	30.7±4.0	34.9	34.9
Fruits	100	40.0±10.1	25.6±8.3	23.4±9.1	29.6	29.6
Milk and Milk products	500	325.6±18.9	225.2±20.2	250.0±16.3	266.9	53.4
Fleshy foods	30	30.2±3.1	20.0±2.3	15.9±2.7	22.0	73.4
Fats and Oil	25	40.3±3.7	30.5±3.1	30.8±3.3	33.8	135.2
Sugar and Jaggery	30	33.7±6.3	31.7±5.7	25.0±4.2	30.1	100.3

The mean food intake of various food stuff by the urban middle income group, urban low income group and the rural girls were presented in table 23. It is evident from the table that the mean intake of all the food stuff among three groups were found to be closer to each other. However the mean intake of milk, green leafy vegetables, roots and tubers and fruits consumption by urban middle income group was comparatively higher than the urban low income group and rural subjects. Among the subjects of low income group, the consumption of milk, vegetables and fruits was very low and it was evidenced by Sharma (1993). On the whole the consumption of pulses was found to be far from satisfactory (per cent adequacy ratio-38.1). With respect to fat (135%) and sugar intake (100.3%) more than the amount recommended by ICMR was recorded. With regard to percent food adequacy for cereals was found to be highest followed by fleshy foods (73.4 %) and milk and milk products (53.4 %). Green leafy vegetables (14.1%) scored the lowest per cent in the food adequacy ratio. The results of the study is in line with a study conducted by Kaur *et al.*,(2002) on the nutritional status of rural adolescent girls, Ludhiana, India with an exception to the percent adequacy ratio for cereals with 49.8% whereas 90.7 % adequacy ratio for cereals was indicated in the present study.

Table 24

4.4. Clinical signs and symptoms of nutritional deficiency of the girls (N=489)

Sl.No.	Symptom of Nutritional Deficiency	Yes	%
1.	Pale conjunctiva	87	18
1.	Angular Stomatitis	23	5
2.	Mouth Ulcer	123	25
3.	Dental Carries	143	29
4.	Bleeding gums	77	16
5.	Phyrynoderma	34	7
6.	Pale Skin	84	17

The clinical symptoms of the nutritional deficiency diseases observed among the selected girls, are indicated in Table 24. Almost all the nutritional deficiencies were present; namely vitamin A, iron, riboflavin and vitamin C. Dental diseases were present comparatively in large percentage, as evident from the symptoms, than pale conjunctiva, mouth ulcer, angular stomatitis and bleeding gums.

In the present study 29 percent of the girls suffered from dental carries and 25 percent of the girls suffered from Mouth ulcer. Phyrynoderma is another problem faced by 7 percent of the girls. Angular stomatitis and glossitis are more common among the poor classes because of the poor or inadequate quantity and quality of diet. Raman (1990) has found an incidence of B complex deficiency among 6 to 15 per cent of the adolescent girls of all income groups. Parvathi Rau *et al.*, (1985) found the prevalence rate to be 15.5 per cent and 13.8 per cent among those living in the slums. In the present study, the incidence was 5 per cent for angular stomatitis and 25 per cent for mouth ulcer and bleeding gum was evidenced among 16 per cent of the girls which was the main symptom of vitamin C deficiency as Narasinga Rao (1989) has rightly pointed out that vitamin C is essential for the absorption of iron from the intestines as well as for collagen metabolism. Anaemia is the most common among all groups of adolescent girls to the tune of 20-25% irrespective of their social class (Sri Lakshmi, 2000). In the present study pale skin was evidenced among 17 per cent of the girls which was the main symptom of severe anaemia as Gopalan (1989) has rightly pointed out that anaemia is the most widespread nutritional deficiency state. Its clinical manifestations are not spectacular and, therefore, often ignored, though there are impairments of physical stamina, learning ability, immune competence and behavior.

4.5. Haemoglobin level of the selected girls (11-14 years) N=100

The following table (25) presents the Haemoglobin level of the selected subjects. Haemoglobin estimate was done by Cyanomethemoglobin method on a sub sample of pre pubertal and post pubertal girls, drawn by convenient sampling. The WHO cut off levels were taken as standards to classify the prevalence of anaemia among the selected girls.

Table 25

Prevalence of anaemia among the selected girls

Sl. No.	Prevalence of Anaemia	Pre pubertal N=50		Post Pubertal N=50	
		Number	Percentage	Number	Percentage
1	Mild 10-11.9g/dl	20	40	14	28
2.	Moderate 7-9.9g/dl	12	24	24	48
3.	Normal above 12g/dl	18	36	12	24
		50	100	50	100

It is evident from table-25 that among the post pubertal girls 76% of them were found to be anaemic. The remaining 24 per cent were normal. The severity of anaemia was assessed and found to be mild anaemia 28% (10-11.9g/dl) and moderate 48% (7-9.9g/dl). Among pre pubertal girls 64% of them were found to be anaemic. Majority of the post pubertal subjects were under the category of moderate level anemia. The results indicated that only 24% were normal in post pubertal category where as 36% were normal in pre pubertal category. The results of the present study correlates with a study on the prevalence of anemia among pre and post monarchial girls of Rural Tamil Nadu, India was assessed by Jolly Raja

Ratnam, *et al.,* (2000) which showed that the prevalence of anaemia was 41% in the pre menarcheal girls and 45% in the post monarchial girls. Health *et al.,* (2001) has also found that high menstrual blood loss was associated with increased risk of anaemia.

Table 26

Mean hemoglobin content of the selected pre and Post pubertal girls (over all)

S.No	Group & No	Mean& SD	't' -test
1.	Pre pubertal -50	10.88 ± 1.2	5.18**
2.	Post pubertal-50	9.52 ± 1.41	

** Significant 1 per cent level.

It is seen in table 26 that the hemoglobin content of the selected pre pubertal girls had a slightly higher value (10.88 ± 1.2) than the post pubertal girls (9.52 ± 1.41). The results showed a significant difference. The difference was significant at one per cent level.

Besides other vulnerable groups, such as infancy and early childhood, adolescence is placed at a high risk level for developing iron deficiency, which is because of the combination of menstrual losses in girls and a rapid physical growth (Fomon *et al.,* 2003).

Hypothesis 4: There will be a significant difference in the hemoglobin level of the selected pre and post pubertal girls. Based on the results the Hypothesis 4 was accepted.

Table 27

Anaemia in relation to income level of the subject

Sl. No.	Prevalence of Anaemia	Urban Middle Income N=35		Urban Low Income N=35		Rural N=30	
		Pre Pubertal No:17	Post Pubertal No:18	Pre Pubertal No:19	Post Pubertal No:16	Pre Pubertal No:14	Post Pubertal No:16
1	Mild 10-11.9g/dl	4 (11)	7 (20)	8 (23)	3 (9)	8 (27)	4 (13)
2.	Moderate 7-9.9g/dl	3 (9)	6 (17)	5 (14)	9 (26)	4 (13)	9 (30)
3.	Normal above12g/dl	10(29)	5(14)	6(17)	4(11)	2(7)	3(10)

Number in parenthesis represents percentage

Hemoglobin content in the blood of the adolescent girls were classified in to four groups (DeMaeyer 1989), as normal (>12 gHb/ dl of blood), mild (10-11.9 gHb/dl of blood), moderate (7-9.9gHb/dl of blood) and severe (<7 gHb/dl of blood).

Data revealed that out of 35 girls of pre (29%) and post pubertal status (14%) had mild to moderate anaemia. In the case urban poor, 37% of pre and post pubertal girls suffered from mild to moderate anaemia. With reference to rural girls, 40% and 43% of pre and post pubertal girls were having mild to moderate anaemia. The results revealed that the post pubertal girls had a lower hemoglobin level compared to pre pubertal girls due to growth spurt and the adolescent girls have the added burden of replacing iron lost with menstruation.

The results of the present study correlates well with a study conducted by Kaur *et al.,* 2006, indicating the prevalence of anaemia among the adolescent girls in rural wardha as 59.8%. A another study by Rana (1983) reported the similar results of 60% of Chaturvedi *et al.,* (1996), Kotecha *et al.,* (2000) and Agarwal (1998) who reported that the prevalence of 73%, 74.7% and 47.6% respectively. These differences in the prevalence of anaemia may be due to difference in the study area. WHO/UNICEF have suggested that the problem of anemia is of very high magnitude in a community in which the prevalence rate exceeds 40%. Parvathi Rau *et al.,* (1985) have found that the 65 per cent to 75 per cent of the adolescent girls studied had different grades of anaemia which necessitated iron supplement for this age group.

In another study on the prevalence of anaemia among girls aged 10-19 years assessed by Goel *et al.,* (2003) it was indicated that the prevalence of anaemia was the highest in the 10-13 year age group and Choudhary *et al.,* (2003) also showed a higher percentage of anaemia and Banerjee *et al.,* (2009) stated that it was possible because of lack of awareness on health and food habits.

4.6 Menstrual health problems of Pre pubertal and post pubertal girls.

Commonly observed health problems during menstruation in selected urban, urban poor and rural girls are explained in table 28.

Table 28

Menstrual health problems of adolescent girls (N=489)

Sl.No.	Problem related to pubertal age	Yes	%
1.	Pimples	121	25
2.	Stomach pain	201	41
3.	Sudden increase in body weight	50	10
4.	Leg Pain	196	40

Number in percentage represents multiple responses

Data revealed that 41% of the girls had stomach pain, 25% of the girls had pimple and 10% of the girls showed sudden increase in body weight and 40% of the girls had leg pain and menstruation brings a host of both physical and psychological problems for the girls. The girls experienced different problems during menstruation like pain in abdomen, backache, dizziness, headache and pain in legs. Acne vulgaris is highly prevalent among adolescents and it frequently begins in the pre pubertal or early adolescent period as increased adrenal androgens induce the increased sebum production (Lucky *et al.,* 1991, stewart *et al.,* 1992). Chronic abdominal pain is a common complaint among the teenagers and young adults. Recurrent headaches are a frequent problem among the adolescents accounting for numerous physicians visits and lost days at school (Lawrence *et al.,* 2008).

Mujamdar *et al.,* (1999) also reported, in their study conducted in Maharashtra state that 68.80% of urban adolescent girls were complaining of abdominal pain and headache before and after the onset of menarche. The following table presents the methods used to alleviate the menstrual pain by the selected girls.

Table 29

Methods to alleviate menstrual pain N=209

Sl.no	Methods	Percentage
1	Pain killers	52
2	Fruit juice	11
3	Butter milk	37

It is evident from the above table that 52 % of post pubertal girls were taking tablets, while 37 % of post pubertal girls have the habit of taking butter milk and only 11 % of post pubertal girls drink fruit juices to alleviate menstrual pain.

Few of the subjects have reported calm and quite surrounding as the best remedy to kill pain.

Table 30

Attitude of post pubertal girls towards menarche

Sl.No.	Attitude	Urban(164)		Rural(45)	
		Number	%	Number	%
1.	Felt boring	26	15.8	8	17.7
2.	Uncomfortable	64	39.0	3	6.6
3.	Undesirable because of customs and tradition	51	31.0	28	62.2
4.	Desirable	--	--	--	--
5.	Neither happy nor unhappy	23	14.0	6	13.3

It is evident from table 30 that irrespective of their residential area majority of girls reported negative attitude towards menarche. In the urban area 16 percent of the girls and in rural areas 18 percent of girls felt bored because of menstrual cycle. A total of 39 percentages of urban girls and 7 percentages of rural girls reported uncomfortable feeling during menses. Higher percentage of rural girls (62.2%) had negative attitude than urban girls (31%) because of customs and tradition. None of them recorded that it was desirable but 14% of urban girls and 13% of rural girls, recorded that neither they were happy nor they were unhappy because of the natural phenomenon. Similar results were shown by Varsha *et al.*, (2007) in their study among the girls from Marathwada region of Maharastra state, India. In a community based Urban slum cross-sectional study at Bijapur on knowledge and practices regarding menstruation among the adolescent girls for a period of one month revealed that the majority of girls had negative reaction to

menarche and this might be a reflection of taboos and prejudices in society about menstruation and also highlighted the fact that the girls had no previous knowledge about menstruation. Srinivas and Ghattargi found that 86.2% girls were scared at the onset of menarche and the other reactions were worry and sadness and only 15% felt calm.

Special foods given at the time of puberty

From time immemorial, knowingly or unknowingly people used to consume different kinds of foods in various physiological conditions to improve health condition. An attempt was made to find details regarding the consumption of special foods by the selected subjects and the results are presented below.

Table 31

Special foods given at the time of puberty

Sl.No.	Type of food	Urban(164)		Rural (45)	
		Number	%	Number	%
1.	Sweets	142	86.5	36	80
2.	Raw egg	115	70.1	29	64.4
3.	Ulundhu Kali	72	43.9	26	57.7
4.	Gingelly Oil	86	52.4	31	68.8
5.	Pongal	132	80.4	39	86.6

It is evident from the table that, irrespective of their residential area, special foods were given at the time of puberty. Eighty six per cent of the urban subjects and 80 percent rural girls were given sweets during the time of puberty and 70 percent of urban girls and 64 percent of rural girls reported that they consumed raw egg as a special food during their menarche. However, 44% of urban girls and 58% of rural girls were recorded that ulunthukali (made from black gram dhal) was given to them as a special food. Higher percentage of rural girls (68.8) had Gingelly oil than urban girls (52.4). Most of the urban girls (80%) and rural girls

(87%) recorded that they had pongal as a special food at the time of puberty. Garrow *et al.*, 2000 stated that the most important factor is the adequacy of the diet before and during puberty to sustain not only the normal pubertal growth spurts but also make up for previous inadequacy.

Table 32

Special Supplements consumed by post pubertal girls (N=209)

Sl.No.	Type of Supplement	Urban		Urban poor & Rural	
		Number	%	Number	%
1.	Multi Vitamin/Multi mineral	14	6.6	--	--
2.	Protein Supplement	--	--	--	--
3.	Iron Supplement	--	--	--	--
4.	Any other	--	--	--	--

Table- 32 shows the detail on special supplement for the post pubertal girls. Only 6.6 percent of urban post pubertal girls had multivitamin/multi mineral as a special supplement. None of the girls from urban poor and rural areas had supplements related to protein, iron or any other.

Menstrual Management

Menstrual hygiene and management is an issue that is insufficiently acknowledged and has not received adequate attention. A variety of factors are known to affect the behaviors. Age, culture, awareness and socio economical status are often found to exert profound influence on the behaviors and practices. Data regarding the awareness about menstruation before encompassing menarche among the pubertal girls revealed that 22 per cent, 14 per cent, 3 per cent of the girls belonged to urban middle, urban poor and rural subjects were aware and the most important source of information was mothers, while friends and television

also contributed to their information. An effort was made to evaluate the awareness on menstrual hygienic practices among the selected subjects.

The following table shows the pattern of use of sanitary napkins and personal hygiene of the post pubertal girls

Table 33

Pattern of use of sanitary Napkins and Personal Hygiene of the pubertal girls

Type of Managing	Urban Middle income (%) No:90	Urban Low Income (%) No:74	Rural (%) NO:45
Type of Material			
Disposal pads	81(90)	14(19)	5 (11)
Cotton cloth material	29(32)	72(97)	44(98)
Storage of Napkin			
Stored in cupboards or drawers	50(56)	-	-
Stored in dress cabinet	12(13)	-	-
Stored in bathroom	17(19)	60(81)	25(56)
outside the house	11(12)	14(19)	20(44)
Practice of Changing			
Once a day	-	8(16)	21(42)
Twice a day	10(11)	62(84)	26(58)
3 times a day	45(50)	-	-
More than 3 times	35(39)	-	-
Practice of changing			
At night	80(89)	74(100)	45(100)
At school	10(11)	-	-
Disposal of Napkins			
Disposed (Readymade pads)	70(78)	20(27)	6 (13)-
Disposed (Cotton Cloth)	10(11)	15(20)	-
Re use the cotton cloth	19(21)	50(67)	39(87)

Personal hygiene during menses			
Practice of bathing daily	75(83)	40(54)	5(11)
once in 2 days	15(17)	24(32)	35(78)
once in 3 days	-	10(14)	5(11)
Hand washing after changing napkin			
with water	38(42)	64(86)	45(100)
with soap and water	52(58)	10(14)	-

Number in parenthesis represents percentage

Table 33 highlights the pattern of use of sanitary napkins by girls according to place of residence. It can be perused that two-thirds of the selected girls (90% urbanmiddle, 19% urban poor, 11% rural poor) regardless of age used disposable pads and 32%urban middle, 97% urban poor and 98 % rural poor girls used cotton or cloth material. However, the use of both the disposable and non disposable materials by girls was also common, especially, among poor. With respect to storage of the sanitary napkins and the pattern of use, it was found that 56 % girls stored the clean (unused) pads in the cupboards or drawers, and 13% , 19 % ,12 % girls used dress cabinet and bathroom and outside the house respectively. The practice of changing pads, during nights was mentioned by 89 % by urban middle while changing in school or college was less common among the urban low income and rural girls. Majority (50% urban middle , 84 % urban low income and 58% rural) of the girls changed napkins twice a day followed by 11%, 16 % and 42 % 0f urban middle, urban low income and rural girls changed once a day.

Regarding the personal hygiene, most of the girls in both urban and rural areas had the practice of bathing daily, but only minimum number had the practice of bathing once in 2 days. It was also noticed that most of the girls had the practice of hand washing after changing napkin but in the urban area 58% of girls had the practice of hand washing with soap. Older girls had better hygienic practices than the younger ones. The data obtained in the present study are in line with a community-based cross-sectional study done in an urban field practice area of Shri BM Patil Medical College, Bijapur and the results revealed that out of 342

adolescent girls 324 (94.74%) were literates. Only 63 (18.42%) had the knowledge about menstruation prior to attainment of menarche and this association was found to be statistically significant.

4.7. Anxiety level of the girls

Menarche marks a transition in the risk of depression and anxiety among girls. There is much evidence that depression and anxiety become common during adolescence. Studies have shown that high rates of first onset of major depression in the early teens of female subjects with a family history of depression. In order to study the overall health and wellbeing of adolescent girls, an attempt was made to study the psychological status, particularly, Anxiety level using a standardized pretested questionnaire. The results are presented below.

Table 34

Association between level of Anxiety and selected demographic variables

Variable	Very low anxiety	Low anxiety	Moderate anxiety	Normal anxiety	High anxiety	Very high anxiety	Chi square
	Number	Number	Number	Number	Number	Number	
Age 11	6(5.4)	10(9.0)	28(25.2)	27(24.3)	31(27.9)	9(8.1)	28.0
12	7(5.4)	18(13.8)	28(21.5)	41(31.5)	25(19.2)	11(8.5)	0.021
13	14(11.5)	20(16.4)	30(24.6)	34(27.9)	17(13.9)	7(5.7)	*
14	0	16(12.7)	34(27.0)	45(35.7)	24(19.0)	7(5.6)	
Class 6th	6(5.2)	11(9.6)	29(25.2)	29(25.2)	31(27.0)	9(7.8)	38.6
7th	5(3.8)	17(12.9)	29(22.0)	39(29.5)	29(22.0)	13(9.8)	0.001
8th	16(13.4)	21(17.6)	29(24.4)	34(28.6)	13(10.9)	6(5.0)	**
9th	0	15(12.2)	33(26.8)	45(36.6)	24(19.5)	6(4.9)	
Birth Order							
Only Child	6(14.3)	3(7.1)	5(11.9)	8(19.0)	18(42.9)	2(4.8)	37.87
1st	13(4.8)	43(16.0)	69(25.7)	84(31.2)	46(17.1)	14(5.2)	0.001
2nd	7(4.8)	16(10.9)	39(26.5)	44(29.9)	29(19.7)	12(8.2)	**
3rd and above	1(3.2)	2(6.5)	7(22.6)	11(35.5)	4(12.9)	6(19.4)	
Residence							4.44
Urban	19(5.3)	52(14.4)	85(23.5)	111(30.7)	67(18.6)	27(7.5)	0.49
Rural	8(6.3)	12(9.4)	35(27.3)	36(28.1)	30(23.4)	7(5.5)	NS
Family income							
EWS	8(4.3)	24(13.0)	40(21.6)	58(31.4)	36(19.5)	19(10.3)	
LIG	7(5.4)	18(14.0)	38(29.5)	35(27.1)	23(17.8)	8(6.2)	33.17
MIG	4(24.3)	0	6(40.7)	14(78.6)	10(46.4)	0	**

*significant at 5 % level

**significant at 1% level

Anxiety is a state of emotional tension of uncertain or unknown cause which produces feelings of apprehension and fear. There are many factors leading to the cause of anxiety and one such reason maybe attainment of pubertal status. Menarche marks a transition in the risk of depression and anxiety in girls. Levels of depression and anxiety increased with the secondary school years and girls had significantly higher rates at each school year level.

Chi-square analysis (X2=28.0 significant at 5 % level) depicts a good association among age, class and anxiety level of the selected girls and the difference was significant at five per cent level. On the whole, with respect to normal anxiety level category 14 year old (35.7%) scored first followed by 12 year (31.5 %,) next 13 year old (27.9%) while 11 year old girls by 24.3%. The results indicated that as the age increases percentage of girls with normal anxiety level increases. As they go to higher classes especially girls face threats of physical harm, threats to one's self esteem and pressure beyond one's capabilities. It is also reported by post pubertal girls that worry, fear and peer pressures are the common problems which develops anxiety. The worry could be due to thought about future, lack of time to complete school work, fear of travelling alone and feeling of nervousness.

Other variables such as class, birth order and family income also showed a significant association with anxiety level in relation to pre and post pubertal status and the difference was significant at one per cent level.

In the case of Economical Status, 79% of girls belonged to middle income families were found with normal anxiety and 30% of girls from low income families were found with normal anxiety. In the comparison of high anxiety level 20% of low income family girls showed high anxiety level and only 10% of high income family girls showed high anxiety level. In the comparison of very high anxiety level 10% of low income family girls showed very high anxiety level and none of the high income family girls had very high anxiety.

A study on the relationship between birth order and anxiety conducted by Keder (1972) showed that there was a significant correlation between birth order

and anxiety. In another study on the mental health of 9th to 12th grade students conducted by VK Raj and Yadava (1993) indicated that the mental health and Socio economic status correlated positively and significantly.

A study on the Anxieties of the adolescent students of the higher and lower economic strata indicated that there were so many differences in the behaviors of children belonged to different economic status because of the differences in anxiety level. Results of the present study corroborates with a study by Patton *et al.,*(1996) on Menarche and the onset of depression and anxiety among secondary school students (12-17years) in Victoria, Australia, results revealed that levels of depression and anxiety increased with the secondary school years and girls had significantly higher rates at each school year level.

Hypothesis 5

There will be an association between age and class of the selected pre and post pubertal girls and the level of anxiety. Based on the results, Hypothesis 5 was accepted.

Table 35

Comparison of the Duration of physical activity and anxiety level of the selected subjects (290)

Variable	Very low anxiety	Low anxiety	Moderate anxiety	Normal anxiety	High anxiety	Very high anxiety	Chi square	'P' value
Physical Activity								
45min (N=82)	1(1.2)	3(3.6)	18(21.9)	28(34.21)	30(36.7)	2(2.4)	12.24	0.032*
90min (N=208)	6(2.9)	32(15.4)	63(30.2)	82(39.5)	20(9.6)	5(2.4)		

*Significant at 5 per cent level

Comparison of the Duration of physical activity and anxiety level of the selected subjects are shown in the above Table 35. It is evident from the table that of the 290 girls a total of 208 girls got involved (90mts) in long duration physical activity exhibiting a normal anxiety level (82 = 39.5%) with calm, cool and brisk

nature and minimum high anxiety 20 = 9.6% whereas among the remaining girls (82) normal level anxiety was 28 =34.21% and comparatively higher anxiety level was 30 =36.7%.

The results revealed that as the subjects involved in physical activity with different duration showed a significant association between the different degrees of anxiety level among the selected subjects. One of the ways to cope this problem by participating in various types of physical activities to get over stress and anxiety and there is growing evidence that physical activity protects and promotes mental health, in addition to physical health (Allison *et al.*,2005, De Moor *et al.*, 2006 and Gorczynski & Faulkner 2010).

Table 36

Association between anxiety level in relation to pre and post pubertal status of the subjects

variables	Levels of anxiety				X2 Chi Square Test
	Low anxiety	Moderate anxiety	Normal anxiety	High anxiety	
Post Pubertal (209)	36(17)	65(31)	37(18)	71(34)	30.51**
Pre pubertal (280)	85(30)	75(27)	80(29)	40(14)	

** Significant at 1 per cent level.

The results indicated that more number (80/280) of the pre pubertal girls are in normal anxiety level when compared to post pubertal girls (37 out of 209).Only 18 % of the post pubertal girls were having normal anxiety and 29% of pre pubertal girls were having normal anxiety. About 34% of post pubertal girls were with very high anxiety and 14 % of pre pubertal girls were with very high anxiety.

According to Hurlock (1992) common emotional patterns of pre pubertal children are anger, fear, jealously, curiosity, envy, joy, grief and affection. In the present study the data on various dimensions of anxiety such as fear, worries, curiosity and peer pressure are more common among post pubertal girls than pre pubertal girls. Thus, the level of anxiety was found to be higher among post pubertal girls than pre pubertal girls.

Chi-square analysis showed a good association(X2= 30.51**) between anxiety level and pubertal status. **Hence the hypothesis 6 which states that there will be a significant difference in anxiety level between pre pubertal and post pubertal subjects** was accepted.

4.8. Physical activity pattern of the girls

Health promotion, as one of the major components of preventive medicine, has emerged in the developed world as a concept for increasing an individual's control of their health. In the recent years physical activity has been one of the most emphasized topics with regard to health promotion and protection; however, people -especially young people have more sedentary lives, mainly as a result of development and dissemination of technology. Although there is a wide range of evidence that sedentary lifestyle has negative effects on the physical health, similar studieson mental health are rather new. Nevertheless, there is growing evidence that physical activity protects and promotes mental health, in addition to physical health (Allison *et al.,* 2005; De Moor *et al.,* 2006; Gorczynski and Faulkner 2010). Several mechanisms have been proposed to describe physical activity's positive effects on mood, including the hyperthermic model (Daley 2002).

Physical activity has many positive effects on children and young people's health. Similarly, lack of exercise has many negative health impacts. Regular physical activity is essential for normal growth, functioning and development among children and young people. Therefore, an effort was taken to study the physical activity pattern among the selected subjects and the results are presented in the following table, 37 and in figure.

Table37

Physical Activity pattern of the selected girls

Variable	Number	Percentage
Physical Activity		
Involvement		
Yes	290	59
No	199	41
Type		
Indoor	180	62
Out door	110	38
Duration(beyond school hours)		
Less than Half an hour	98	34
Half an hour to 1 hour	130	45
More than 1 hour	62	21
Time alloted in School per week		
45 min	82	28
90 min	208	72

The results indicated that nearly 59% of girls were involved in physical activity. Among this 62 percent of girls involved in indoor activities and 38 percent of girls got engaged in out door activities. Regarding the duration of play, 34% of the girls spent less than half an hour per day, 45% of the girls spent half an hour to 1 hour per day and 21 percent of girls spent more than 1 hour per day. During physical education class 28% of the girl's spent 45 minutes and 72% of the girls utilized 90 minutes in physical activity, which includes throw ball and running. It is depressed to note that 41% of the selected girls did not involve in any physical activity. They spent most of the free time in chatting with friends and watching television at home. Such a low level of physical activity also found in various studies. (Parizkova 1996, Anderson *et al.*, 1998, Gordon Larsen *et al.*, 1999 and Janssen *et al.*, 2005). In the Swedish study the time spent in inactivity by adolescents was 9 -10 hours per day (Bratteby *et al.*, 1997).

Figure-16

Physical Activity Pattern of the Girls

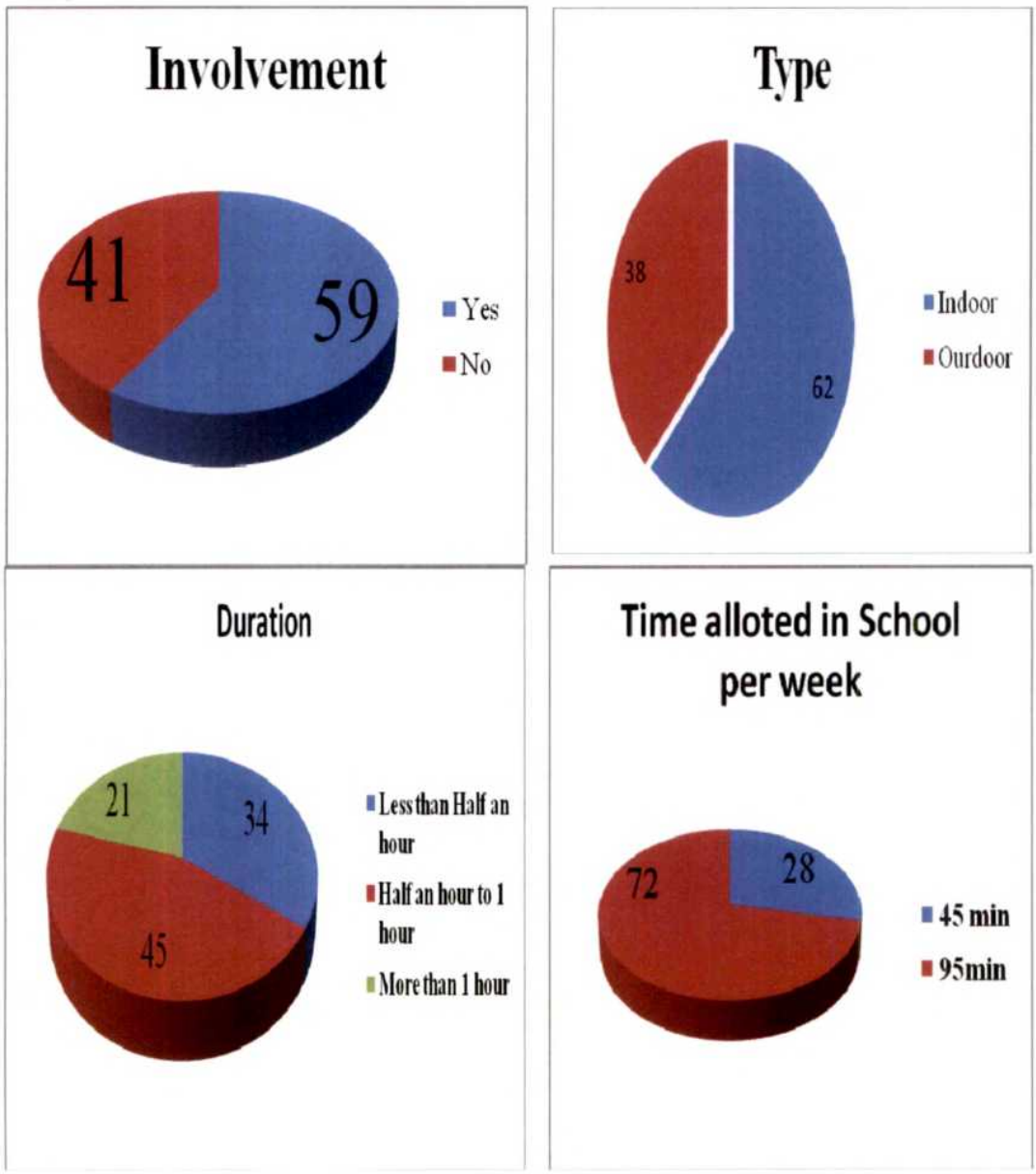


Table 38

Effect of age and physical activity in different economical status of the pre pubertal girls

Age	MIG	LIG	EWS	Total	Chi square
11	30	32	22	84(42)	16.82Ns
12	24	30	13	67(33)	
13	7	8	18	33(16)	
14	-	7	11	18(09)	

Ns-Not significant

Totally 202 girls were involved in physical activity among the pre pubertal category. It is seen in the above table that 42% of the subjects belonged to the age group of 11 years practicing physical activity followed by 33% and 16% of 12 year and 13 year old group while only 9% belonged to 14 year age group involved in physical activity. Chi-square analysis showed no association between age and physical activity in relation to pre pubertal status. The results indicated the physical activity did not differ in relation to age of the selected pre pubertal girls.

Hypothesis 7: There will be a significant association between participation in physical activity by pre pubertal girls in relation to age and income level. Based on the results Hypothesis 7 was rejected.

Table 39

Effect of age and physical activity in different economic status of post pubertal girls

Age in years	MIG	LIG	EWS	Total	Chi square
11to12 years	19	--	--	19(21)	46.39**
13	21	2	11	34(39)	
14	2	20	13	35(40)	

** Significant at 1 per cent level.

Totally 88 girls were involved in physical activity under post pubertal category. It is clear from table 39 that 40% of the subjects belonged to 14 year group take part in physical activity followed by 39% and 21% of 13 year and 11 to 12 year old girls. Chi-square analysis was carried out to check whether there is any association between age of the subjects and physical activity. Chi-square value = 46.39** showing an association, which is significant at one per cent level.

Hypothesis 8: There will be a significant association between participation in physical activity by post pubertal girls in relation to age and income level. Based on the results Hypothesis 8 was accepted.

The modes of transport to school by the selected subjects are presented below (Table 40).

Table 40

4.8.1. Mode of Transport to School (489)

Mode of Transport	Number	Percentage
Active means (Walking/Cycling)	203	42
In active means (Bus/Two Wheeler)	286	58

The results indicted that 42% of girls were having active means (Walking/Cycling) as a mode of transport to school and 58% of girls were having inactive means (Bus/Two wheeler) as a mode of transport to school.

Table 41

4.8.2. Watching Television/Video Games

Duration	Number	Percentage
Less than Half an hour	62	13
Half an hour to 1 hour	167	34
More than 1 hour	260	53

Regarding the duration of watching television/video games, the results indicated that nearly 13% of the girls spent less than half an hour per day, 34% of the girls spent half an hour to 1 hour per day and 53% of the girls spent more than 1 hour per day.

A study on extensive television viewing and the development of attention and learning difficulties during adolescence conducted by Johnson *et al.*, (2007)

concluded that frequent television viewing during adolescents may be associated with the development of attention problem, learning difficulties and adverse long term educational outcomes.

4.9. Attitudes of the selected girls towards Food habits

Knowledge alone does not necessarily translate into healthful eating behaviors. Knowledge may provide the information to improve a behavioral change but it is the individual attitude or belief that ultimately determines.

Table 42 shows the attitude towards food habits of the selected girls.

Table 42

Frequency distribution of attitude towards food habits (N=489)

Score	Number	Percentage
Below 10	--	--
11-20	57	12
21-30	312	63
31-40	120	25
41-50	--	--

- Total score=50

Data on attitude towards food habits revealed that majority (63%) of the girls had undecided attitude on various aspect of food habits followed by 25% had positive attitude while only 12% had negative attitude towards food habits. It is encouraged to note that one fourth of the selected subjects had a favorable attitude. Attitude towards food habits was assessed by the responses of the girls on ten points related to seasonal fruits consumption, amount of consumption of pungent taste, vegetables, water, greens, Bottled drinks, sources of vitamin B12 and missing meals.

Table 43

4.9.1. Percentage of different levels of attitudes among the selected girls towards Food habits.

	Strongly Agree in percentage	**Agree** in percentage	**Uncertain** in percentage	**Disagree** in percentage	**Strongly Di Agree** in percentage
Consumption of Seasonal fruits	49	36	11	2	2
Excessive Pungent taste	8	17	18	38	19
Bottled Drinks	14	14	21	32	19
Vegetable Cutting	20	22	32	18	8
Consumption Of greens	57	29	7	5	2
Vegetable Consumption	49	30	10	8	3
Water Consumption	20	12	12	26	30
Amount of Consumption	28	20	24	17	11
Sources of Vitamin B12	10	11	50	17	12
Missing Meals	16	12	20	29	23

A total of 85% of the girls were having good attitude, regarding the seasonal fruits consumption. Regarding the excessive consumption of pungent taste 18% of the girls were with uncertain attitude. About 21% of the girls were with uncertain attitude and 28% of the girls were with negative attitude regarding the consumption of cool drinks. Another 42% of the girls were having good attitude regarding loss of nutrients while cutting the vegetables. A majority 86% of the girls were having good attitude regarding consumption of greens, Only 12% of the girls were with uncertain and 56% of the girls were having negative attitude towards the intake of water. Nearly 20% of the girls were having good attitude regarding the source of Vitamin B12 and only 52% of the girls were having good attitude regarding the importance of meals.

Table 44

4.9.2. Correlation between Attitude towards food habits and Selected socio economic variables

Variable	Mean	Standard Deviation	Kruskal Wallis test	P value
Age 11	25.7	5.6	28.9	0.000**
12	26.0	5.7		
13	27.4	4.4		
14	29.0	4.3		
Class 6th	25.4	5.6	35.6	0.000**
7th	26.0	3.4		
8th	27.7	4.1		
9th	29.1	4.2		
Father's Education:			19.0	0.001**
Illiterate	25.0	6.6		
Primary	24.7	5.3		
High school	26.8	5.3		
Higher Secondary	27.3	5.0		
College	28.0	4.7		
Mother's Education:			11.7	0.02*
Illiterate	26.4	5.8		
Primary	25.4	5.3		
High school	27.4	5.0		
Higher Secondary	27.4	5.3		
College	27.5	4.9		
Family income			15.8	0.007**
EWS	26.7	5.3		
LIG	28.2	4.4		
MIG	27.2	4.9		
Birth Order			0.81	0.846 NS
Only Child	26.6	4.9		
1st	27.0	5.1		
2nd	27.1	5.3		
3 and >3	27.4	6.0		
Residence			25439.0	0.089 NS
Urban	27.3	5.1		
Rural	26.3	5.2		
Religion			0.42	0.807 NS
Hindu	27.0	5.1		
Christian	26.5	6.2		
Muslim	27.2	5.5		

*Significant at 5 per cent level ** Significant at 1 per cent level

NS - Not significant

It was noticed from the results that age, class, father's education, mother's education and Economical status were the variables having significant correlation with attitudes of the girls towards food habits. The 'P' value showed non significant correlation with variables such as Birth order, Residence and Religion. As age increases the mean attitude towards food habits score also increases. Related to the education status of the parents, children whose parents studied up to college had highest mean score of attitude towards food habits. The mean attitude towards food habits score of all the girls lies between 25 to 29 and all the girls were having undecided attitude as per the likert scale.

It was observed that, among the girls aged 11 to 14 years, the girls aged 11 were having minimum mean value (25.7) and 14 years girls were having maximum mean value. In the case of Father's education, the children whose fathers studied up to college education had maximum mean score (28.0) and the children whose fathers studied up to primary education had minimum mean score. Related to mother's education, the children whose mothers studied up to college education had maximum mean score (27.5) and the children whose mothers studied up to primary education had minimum mean score. With regard to residence, the girls from urban areas were obtained a higher mean attitude score than girls from rural areas.

An attempt was made to find the correlation between the attitude towards food habits and Pre, post pubertal Status of the selected girls and the results are presented in table 45.

Table 45

4.9.3. Correlation between Attitude towards food habits and Pre, Post pubertal Status of the selected girls

Variable	Mean	Standard Deviation	Kruskal Wallis test	P value
Pubertal status	28.1	4.5	35018.0	0.000**
Pre Pubertal status	26.2	4.0		

** Significant at 1 per cent level.

It is evident from the results that there is a direct correlation between pre and post pubertal subjects and attitude towards food habits. The high mean score shows a better attitude towards food habits. Data on Mean attitude score of pubertal girls (28.1) was found to be higher than the pre pubertal girls (26.2).

Hypothesis 9: There will be a direct correlation between attitude towards food habits and pubertal status of the selected girls. Based on the results Hypothesis 9 was accepted.

4.10. Nutrition knowledge and Health awareness

Adolescence is the time to learn and adopt healthy habits to avoid many health and nutritional problems later in life. Adolescents have more easy access to health and nutrition information through schools, recreational activities, and mass media than they have later in their lives. Particularly, health and nutrition knowledge and healthy habits of female adolescents will have critical roles to play in maintaining future family health and nutrition. Nutrition knowledge might be one of the key factors to improve eating behaviours among adolescent girls. Adequate Nutrition is essential for growth and development, health and overall wellbeing. Poor eating behaviour could lead to many chronic diseases. Several studies have found a positive association between Nutrition knowledge and eating behavior. So, an attempt was made to understand the Nutrition knowledge and awareness among the selected subjects. A total of 25 questions related to food, nutrients, sources, functions and deficiencies and RDA values were included to test the existing knowledge. The scores obtained by the subjects were analyzed and presented in the following table.

Table 46

4.10.1 Frequency distribution of Nutrition Knowledge

Score	Number	Percent
Up to 12	329	67
13 to 18	156	32
19 to 25	4	1

Maximum score=25

Majority of the girls (67%) had inadequate knowledge followed by 32 percent with moderately adequate knowledge and 1 percent had good knowledge. The results indicated that only 1 percent had adequate knowledge related to nutrition.

Table 47

4.10.2 Nutrition knowledge obtained by selected girls (N=489).

Sl.No.	Items	Correct response	
		Number	Percentage
Q1.	Meaning of Nutrition	180	36.8
Q2.	Need of Food	447	91.4
Q3.	Meaning of food group	346	70.7
Q4.	Uses of food group	211	43.1
Q5.	Meaning of balanced diet	156	31.9
Q6.	Main function of carbohydrate	159	32.5
Q7.	Main Function of Protein	142	29.0
Q8.	Function of Vitamins and Minerals	106	21.6
Q9.	Function of Calcium	318	65.0
Q10.	Function of Iron	152	31.0
Q11.	Function of Vitamin A	304	62.2
Q12.	Sources of Cereals	287	58.6

Q13.	Sources of Protein	105	21.4
Q14.	Sources of Fat	366	74.8
Q15.	Sources of Calcium	272	55.6
Q16.	Sources of Iron	241	49.2
Q17.	Sources of Vitamin A	206	42.1
Q18.	Sources of Vitamin B	134	27.4
Q19.	Sources of Vitamin C	167	34.1
Q20.	RDA of cereals	212	43.3
Q21.	RDA of pulses	181	37.0
Q22.	RDA of greens	89	18.2
Q23.	RDA of Fruits	109	22.2
Q24.	RDA of Vegetables	93	19.0
Q25.	RDA of Water	59	12.0

Table 47 shows the responses related to nutrition knowledge. Most (91%) of the girls have good knowledge about the need of food. Most (88%) of the girls have inadequate knowledge about the RDA of water and 82% of the girls have inadequate knowledge about RDA of greens and nearly 80% of the girls have inadequate knowledge about RDA of vegetables. Half the numbers (40-50%) of the girls have some knowledge about uses of food groups, sources of iron, vitamin A and RDA of Cereals and pulses.

Similar results, such as Nutrition knowledge among the adolescents was inadequate, also was found in various other studies (Richert 1996, Thakur N *et al.*, 1999, Sameeh-Al-Almaie 2005, and Nurual Alam *et al.*, 2010).

Table 48

4.10.3 Correlation between Nutrition Knowledge and selected socio economic variables.

Variable	Mean	Standard Deviation	Kruskal Wallis test	P value
Age				
11	8.0	4.1		
12	9.7	3.5	59.0	0.000**
13	11.3	4.2		
14	11.8	4.2		
Class				
6th	7.9	4.0		
7th	9.8	3.4	67.5	0.000**
8th	11.3	4.1		
9th	12.0	4.2		
Father's Education				
Illiterate	9.1	3.8		
Primary	9.3	4.0	17.17	0.002**
High school	9.4	4.0		
Higher Secondary	10.8	4.0		
College	11.0	4.1		
Mother's Education				
Illiterate	9.1	3.8		
Primary	9.2	3.9	15.85	0.003**
High school	9.7	4.4		
Higher Secondary	10.9	4.3		
College	11.0	4.2		
Family income				
EWS	10.8	4.1	10.91	0.053 NS
LIG	10.0	4.3		
MIG	10.8	4.8		
Birth Order				
Only Child	10.4	3.6		
1st	10.2	4.4	1.42	0.700 NS
2nd	10.1	4.1		
3 and >3	11.0	3.7		
Residence				
Urban	10.3	4.1	23837.0	0.593 NS
Rural	10.1	4.5		
Religion				
Hindu	10.4	4.2	3.63	0.162 NS
Christian	9.0	2.2		
Muslim	9.3	4.4		

** Significant at 1 per cent level NS – Non Significant

Table 48 shows the correlation between nutrition knowledge and selected demographic variables. It was observed from the results that the mean nutrition knowledge increases as the age increases and there was a significant correlation between nutrition knowledge and class, father's education and mother's education. The 'P' value showed a non significant correlation between nutrition knowledge and other variables. The nutrition knowledge differs due to various factors

Among the girls aged 11 to 14 years, the girls aged 11 were having minimum mean score of nutrition knowledge (8.0) and 14 years girls were having maximum mean score of nutrition knowledge (11.8). In the case of fathers education, children whose fathers studied up to college education had mean score (11.0) and the children, whose fathers were illiterates had minimum score (9.1). Regarding mother's education, children whose mothers studied up to college education had maximum mean score (11.0) and the children, whose mothers were illiterates, had minimum score (9.1). With regard to residence, the girls from urban area were got higher score (10.3) than the girls from rural areas. Shaaban 2009 stated that the deficient nutritional knowledge is likely to have a negative impact on their nutritional status as future mothers as well as the nutritional status of their children yet to be born. A study, on fruit and vegetables as adolescent food choices in Newzealand among 13-16 years teenagers showed that the teenagers had little knowledge of what vitamins and minerals did in the body.

Hypothesis 10, there will be a direct correlation between nutritional knowledge and age, class, father's education, mother's education of the selected girls. Based on the results Hypothesis 10 was accepted.

Table 49

4.10.4 Correlation between Nutrition Knowledge and pubertal Status

Variable	Mean	Standard Deviation	Kruskal Wallis test	P value
Pubertal Status				
Pubertal	11.8	4.0	40104.0	0.000**
Pre Pubertal	9.1	4.0		

** Significant at 1 per cent level.

Table 49 shows the correlation between Nutrition Knowledge and pubertal Status. It is evident from the result that the mean nutrition knowledge score of pubertal girls (11.8) was found to be higher than the pre pubertal girls (9.1).

Hence the hypothesis 11 which states that there will be a significant difference in mean score on nutrition knowledge between pre pubertal and post pubertal girls is accepted.

Table 50

4.10.5 Health Awareness –I (Underweight) of the selected girls

Sl.No.	Items	Correct response	
		Number	Percentage
Q1.	General health problems of pre pubertal and post pubertal girls	169	35
Q2.	Meaning of underweight	205	42
Q3.	Causes of underweight	99	20
Q4.	Prevention of underweight	102	21
Q5.	Consequences of underweight	181	37

Table 50 shows the responses related to underweight with 65%of the girls who were not aware of the problems related to their age. Nearly 60% of the girls

were not aware the meaning of under weight and nearly 80% of the girls were not aware of the factors to prevent underweight and 63% of the girls were not aware the consequences of under weight.

Table 51

4.10.6 Health Awareness –I (obesity) of the selected girls (N=489)

Sl.No.	Items	Correct response	
		Number	Percentage
Q6.	Meaning of obesity	161	33
Q7.	Causes of obesity	157	32
Q8.	Prevention of obesity	182	37
Q9.	Consequences of obesity	113	23

Table 51 shows the responses related to obesity. More than 60% of the girls were not aware of the meaning of obesity, causes of obesity and points to prevent obesity. About 77% of the girls were not aware the consequences of obesity.

Table 52

4.10.7 Health Awareness –I (Anaemia) of the selected girls (489).

Sl.No.	Items	Correct response	
		Number	Percentage
Q10.	Meaning of Anaemia	168	34
Q11.	Causes of Anaemia	163	33
Q12.	Prevention of Anaemia	97	20
Q13.	Consequences of Anaemia	190	39

Table 52 shows the responses related to anaemia. More than 60% of the girls were not aware of the meaning and causes of anameia. It is shocking to note that 80% of the girls were not aware of the points to prevent anaemia and 60% of the girls were not aware of the consequences of anaemia.

Table 53

4.10.8 Health Awareness –I (Anorexia nervosa) of the selected girls (489).

Sl.No.	Items	Correct response	
		Number	Percentage
Q14.	Meaning of Anorexia nervosa	96	20
Q15.	Causes of Anorexia nervosa	78	16
Q16.	Prevention of Anorexia nervosa	56	11
Q17.	Consequences of Anorexia nervosa	57	12

Table shows the responses related to anorexia nervosa. More than 80% of the girls were not aware of the meaning, causes of anorexia nervosa and nearly 90% of the girls were not aware of the points to prevent anorexia nervosa and consequences of anorexia nervosa.

Table 54

4.10.9 Health Awareness –I (Menstrual Hygiene) of the selected girls (N=489)

Sl.No.	Items	Correct response	
		Number	Percentage
Q18.	Meaning of Menstrual hygiene	121	25
Q19.	Consequences of poor Menstrual hygiene	67	14
Q20.	Prevention of urinary tract infection	63	13

Table 54 shows that 75% of the girls were not aware of the meaning of menstrual hygiene. More than 85% of the girls were not aware the consequences of poor menstrual hygiene and prevention of urinary tract infection. All the girls are having poor awareness about their age related problems, like under weight, obesity, anaemia, anorexia nervosa and menstrual hygiene. Menstruation is a normal physiological process that is managed differently according to various

social and cultural understandings. Healthy practices are important for health and well being of the individuals. Menstrual period is one such time when the females are expected to adopt hygienic practices. On the whole, it was depressed to note that the knowledge on menstrual hygiene and management was far from satisfactory.

Table 55

4.10.10 Correlation between Health awareness- I (related to age group problems) and selected demographic variables

Variable	Mean	Standard Deviation	Kruskal Wallis test	P value
Age 11	4.4	3.8	12.2	0.007**
12	4.5	3.5		
13	5.4	4.4		
14	6.2	4.5		
Class 6th	4.1	3.6	17.5	0.001**
7th	4.5	3.5		
8th	5.3	4.2		
9th	6.5	4.7		
Father's Education			7.6	0.107 NS
Illiterate	3.9	3.1		
Primary	4.5	3.2		
High School	4.5	3.7		
Higher Secondary	5.4	4.4		
College	5.8	4.5		
Mother's Education			5.44	0.245 NS
Illiterate	5.4	3.7		
Primary	4.8	3.9		
High School	4.4	3.6		
Higher Secondary	5.4	4.3		
College	5.7	4.5		
Family income			6.1	0.287 NS
EWS	5.2	3.7		
LIG	4.8	4.5		
MIG	6.0	4.2		
Birth Order			4.4	0.218 NS
Only Child	5.2	3.3		
1st	4.9	4.2		
2nd	5.4	4.1		
3rd and above	5.9	4.1		
Residence			24183.5	0.430 NS
Urban	5.3	4.3		
Rural	4.7	3.5		
Religion			3.16	0.205 NS
Hindu	5.2	4.1		
Christian	6.1	4.4		
Muslim	4.1	3.8		

**Significant at 1% level.

Table 55 shows the correlation between health awareness related to age group problems and selected demographic variables. It was noted from the results that there was a significant correlation between age, class and health awareness related to age group problems. The remaining demographic variables have a non significant correlation with health awareness.

Girls from higher classes (8^{th} and 9^{th}) showed higher mean health awareness score than the girls from lower class (6^{th} and 7^{th}). As the father's educational status increases, the mean health awareness score of the girls also increases. The girls from higher family income showed maximum health awareness score with regard to residence. The girls from urban areas got higher mean health awareness score than the girls from rural areas.

Table 56

4.10.11 Correlation between Health awareness- I (related to age group problems) and pubertal status

Variable	Mean	Standard Deviation	Kruskal Wallis test	P value
Pubertal Status				
Post Pubertal	6.3	4.5	37413.0	0.000
Pre Pubertal	4.2	3.6		

Mean health awareness score of the post pubertal girls (6.3) was found to be higher than the pre pubertal girls (4.2).

Hence the hypothesis 12 which states that there will be a significant difference in mean score on health awareness- 1 between pre pubertal and post pubertal girls is accepted.

Knowledge and awareness on Communicable and non communicable diseases

There is a need for increasing awareness about the growing number of young women who are the silent victims of the HIV/AIDS epidemic in India. Adolescent girls, who thus far have largely been left out of HIV/AIDS initiatives,

have a tremendous need for information on HIV/AIDS transmission and prevention. As the adolescents are a valuable resource for the future of a country, it is imperative that they be equipped with ample amount of information so as to protect themselves and their counterparts from falling a prey this still-an-incurable killer disease. Therefore, an attempt was made to identify the level of awareness and Knowledge on the causes, treatment and prevention of communicable, non communicable and degenerative diseases of the subjects and the details obtained are presented in the following table.

Table 57

4.10.12 Health Awareness –II (Communicable diseases) of the selected girls (N=242).

Sl.No.	Items	Correct response	
		Number	Percentage
Q1.	Meaning of communicable diseases	118	49
Q2.	Example of communicable diseases	99	41
Q3.	Causes of communicable diseases	93	38
Q4.	Points to prevent and over come communicable diseases	98	40

Pubertal girls are very cautious about communicable (respiratory disorders, AIDS / HIV) and non communicable diseases like cancer, diabetes and other dreadful diseases. It was reported that the source of information mostly from peers and close friends, health providers followed by media.

Table-57 shows the responses related to communicable diseases and the results indicated that 51 % of the girls were not aware of the meaning of communicable diseases and 59% of the girls were not aware of the examples for communicable diseases. About 62 % of the girls were not aware of the causes of

communicable diseases and 60% of the girls were not aware the factors to prevent and overcome the communicable diseases.

Table 58

4.10.13 Health Awareness –II (Non communicable diseases) of the selected girls (N=242)

Sl.No.	Items	Correct response	
		Number	Percentage
Q5.	Meaning of Non communicable diseases	75	31
Q6.	Example of Non communicable diseases	68	28
Q7.	Causes of Non communicable diseases	62	26
Q8.	Points to prevent and overcome Non communicable diseases	76	31

Table 58 shows the responses related to non communicable diseases. Most of the girls 69% were not aware the meaning and points to prevent and overcome the non communicable diseases and more than 70 % of the girls were not aware the incidence and causes of non communicable diseases.

Knowledge and awareness on Degenerative diseases

Table 59

4.10.14 Health Awareness –II (Degenerative diseases) of the selected girls

Sl.No.	Items	Correct response	
		Number	Percentage
Q9.	Meaning of Degenerative diseases	29	12
Q10.	Example of Degenerative diseases	34	14
Q11.	Causes of Degenerative diseases	25	10
Q12.	Points to prevent and overcome Degenerative diseases	45	19

Table 59 shows the responses related to degenerative diseases. More than 85% of the girls were not aware of the meaning and example of the degenerative diseases and 90% of the girls were not aware of the causes of degenerative diseases and 81% of the girls were not aware of the factors to prevent and overcome the degenerative diseases.

Table 60

4.10.15 Correlation between Health awareness- II (related to general health problems) and selected demographic variables

Variable	Mean	Standard Deviation	Kruskal Wallis test/Mann-whitney U test	'P' value
Age				
13	2.8	2.2	8.06	0.018*
14	3.9	2.8		
Father's Education				
Illiterate	1.7	2.7		
Primary	3.0	2.5	8.743	0.068 NS
High	3.3	2.6		
Higher Secondary	3.4	2.4		
College	3.6	2.7		
Mother's Education				
Illiterate	2.4	2.4		
Primary	3.2	2.1	4.60	0.331 NS
High	3.0	2.6		
Higher Secondary	3.2	2.4		
College	3.8	3.0		
Birth Order				
Only Child	3.9	3.1		
1st	3.4	2.7	0.812	0.847 NS
2nd	3.2	2.4		
3rd and above	3.5	2.1		
Residence				
Urban	3.5	2.6	57456.5	0.094 NS
Rural	2.8	2.4		
Religion				
Hindu	3.4	2.7	0.132	0.936 NS
Christian	3.4	2.3		
Muslim	3.2	1.9		
Pubertal Status				
Post Pubertal	3.6	2.7	7059.0	0.013*
Pre Pubertal	2.6	2.2		

*Significant at 5% level.

Table 60 shows the correlation between health awareness related to general health problems and selected demographic variables. It was noticed from the results that most of the demographic variables were not having significant

correlation with health awareness. Age and pubertal status were significant to health awareness.

The above table indicated that the mean health awareness score of the girls aged 14 years (3.9) was found to be higher than the mean health awareness score of the girls aged 13 year (2.8). As the father's educational status increases, the mean health awareness score of the girls also increases. With regard to residence, the girls from urban areas were got higher mean health awareness score than girls from rural areas. The mean health awareness score of post pubertal girls (3.6) was found to be higher than the pre pubertal girls (2.6).

Table 61

4.10.16 Comparison between knowledge on Health awareness and income level

Variable	Mean	Standard Deviation	Kruskal Wallis test/Mann-whitney U test	'P' value
1.Economically weaker section &Low income 2.Middle income	2.7 3.1	2.4 2.6	5868.5	0.007**

** Significant at 1% level.

It is evident from the above table that the girls from higher family income showed the maximum health awareness score related to degenerative diseases.

Phase-2

4.11 Impact of Nutrition Intervention

Nutritional problems like under nutrition, anemia, vitamin-A deficiency, iodine deficiency and overweight are common among adolescents. For prevention of these problems, WHO has emphasized that the mass information and awareness programmes should be organized to alert government and communities about the importance of health and nutrition. In the present study an Intervention program was conducted for a period of three months, on a sub sample of 100 post pubertal girls, using the lecture method supplemented by charts, posters, models, pamphlets and folders. The results of pretest and post test scores were compared and presented in the following tables.

In order to determine the significant difference between the pre test scores and post test 1 and 2 scores Benferroni multiple comparison test, for repeated measures, was computed and the results were as follows.

Table 62

4.11.1Comparison of Pretest and Post test Nutrition knowledge score among girls

Nutrition Knowledge	Mean	SD	ANOVA Repeated measure 'F' Value	'P' value	Bonferroni multiple comparisons test for repeated measure.
Pre test(at the beginning of the study)	13.3	2.7	119.17	0.000	Pretest Vs Post test 1 Post test 2
Post test -1 (after 15 days)	19.0	2.6			
Post test -2 (after 3 months)	18.3	3.1			

The mean score and Anova F- Value for nutrition knowledge indicated that the post test scores (19.0, 18.3) were significantly more than pre test (13.3) score. Hence the increase in nutrition knowledge among the selected girls.

The results of the present study are in concurrence with the study of Chawla (1992) who reported significant improvement in knowledge and attitude of the females of Ludhiana towards good nutrition. After imparting nutrition education, these females tried to practice the same knowledge in their day-to-day life. The study of Jain and Chawla (1999) also found positive impact of nutrition education on school going adolescent girls of Kanpur.

Figure-17

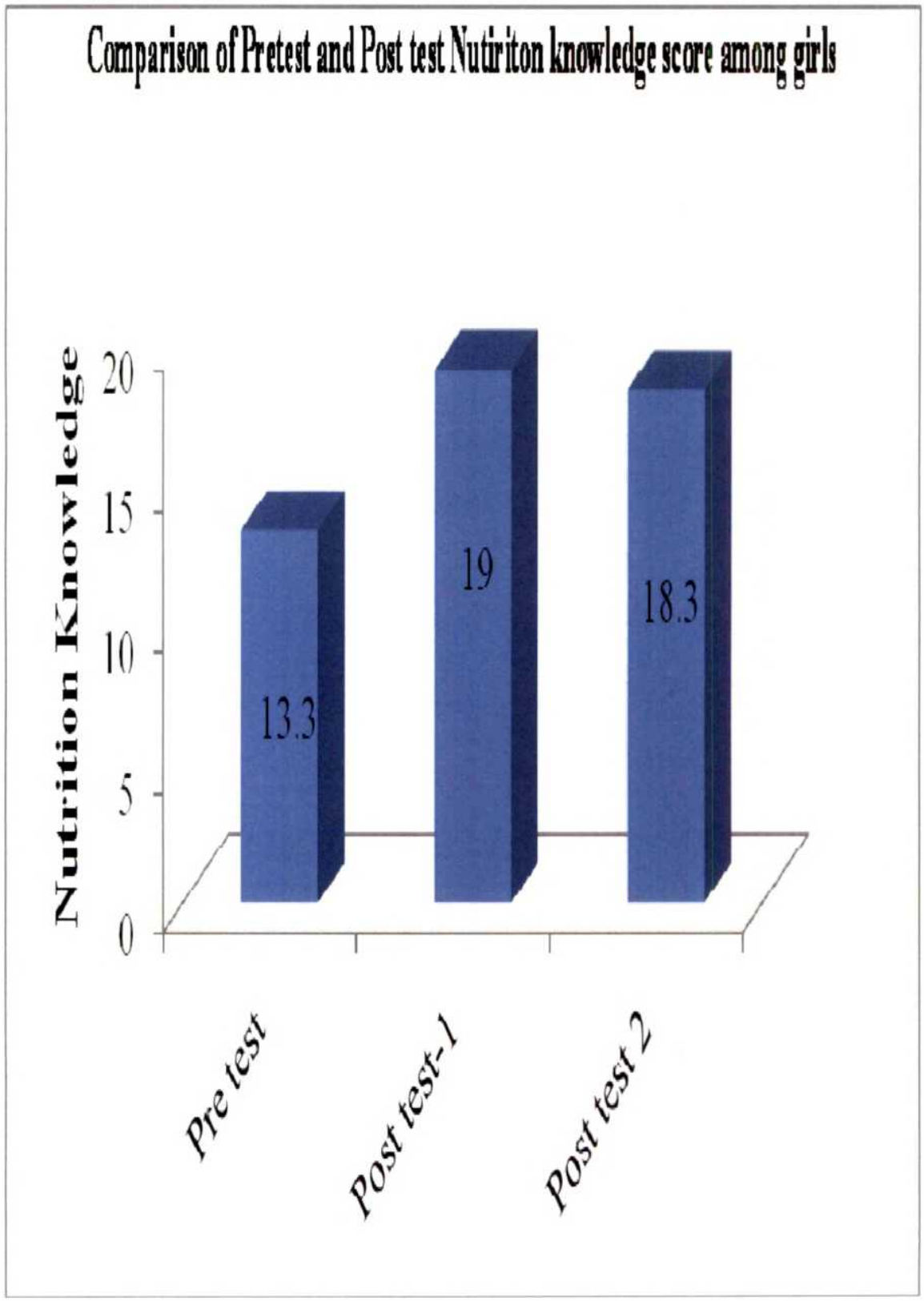

Comparison of Pretest and Post test Nutiriton knowledge score among girls
Nutrition Knowledge
20
15
10
5
0
13.3
19
18.3
Pre test
Post test-1
Post test 2

Table 63

4.11.2Comparison of Pretest and Post test attitude towards food habits score among girls

Attitude towards food habits	Mean	SD	ANOVA Repeated measure 'F' Value	'P' value	Bonferroni multiple comparisons test for repeated measure.
Pre test	25.8	5.8	8.81	0.000	Pretest Vs Post test 1
Post test -1	28.3	5.2			
Post test – 2	28.8	4.6			Post test 2

The mean score and Anova F- Value for attitude towards the food habits indicated that post test scores (28.3, 28.8) were significantly more than pre test (25.8). Hence there is gain in attitude towards food habits among the girls.

Figure-18

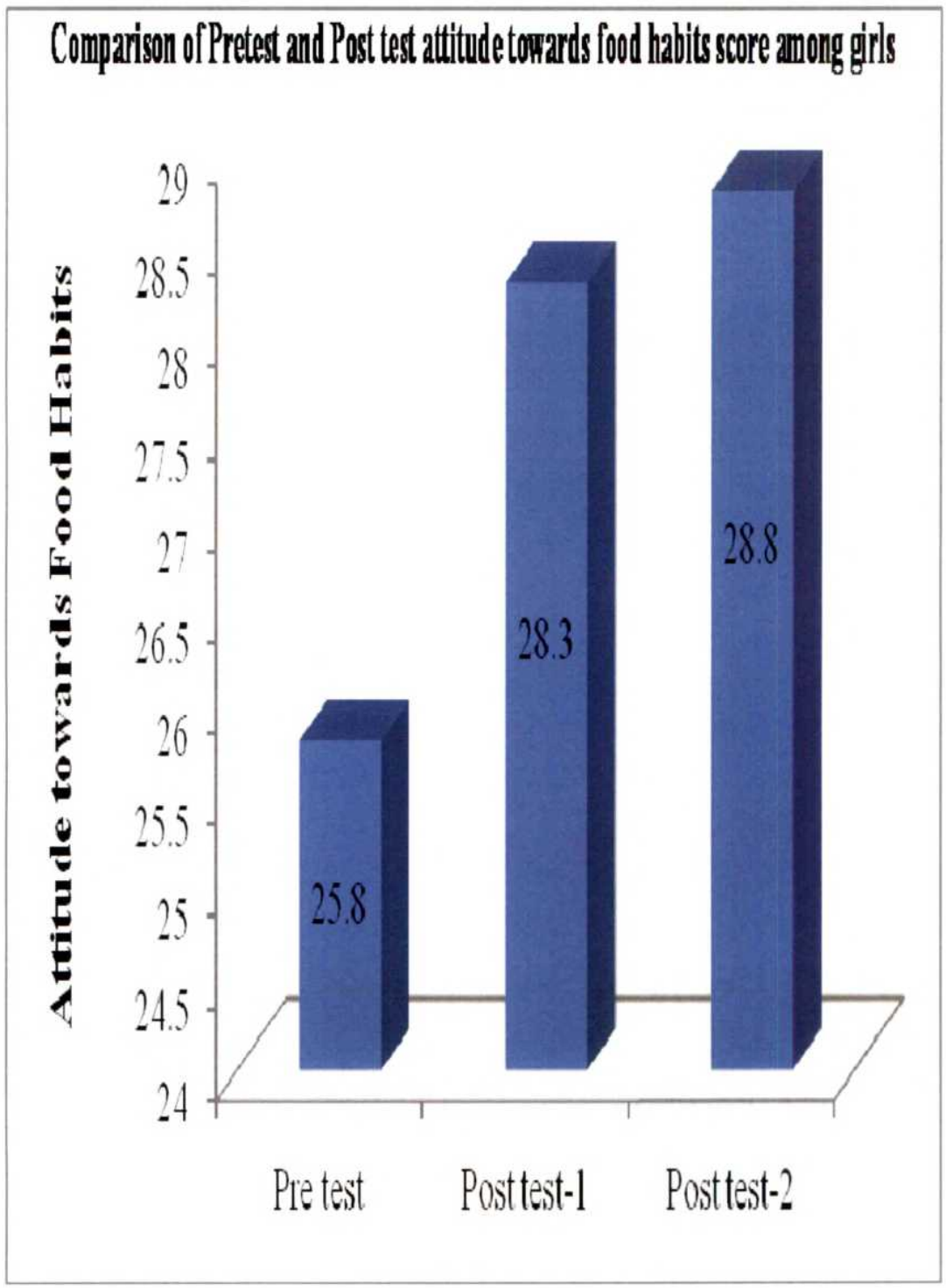

Comparison of Pretest and Post test attitude towards food habits score among girls
Attitude towards Food Habits
29
28.5
28
27.5
27
26.5
26
25.5
25
24.5
24
25.8
28.3
28.8
Pre test
Post test-1
Post test-2

Table 64

4.11.3Comparison of Pretest and Post test Health Awareness-I score among girls

Health Awareness-I	**Mean**	**SD**	**ANOVA Repeated measure 'F' Value**	**'P' value**	**Bonferroni multiple comparisons test for repeated measure.**
Pre test	7.0	3.6	203.7	0.000	Pretest Vs Post test 1
Post test -1	16.3	3.4			
Post test – 2	14.7	4.4			Post test 2

The mean score and Anova 'F' value for health awareness-I indicate that post test scores (16.3, 14.7) were significantly more than the pre test (7.0). Hence the gain in health awareness-I among the girls.

Figure-19

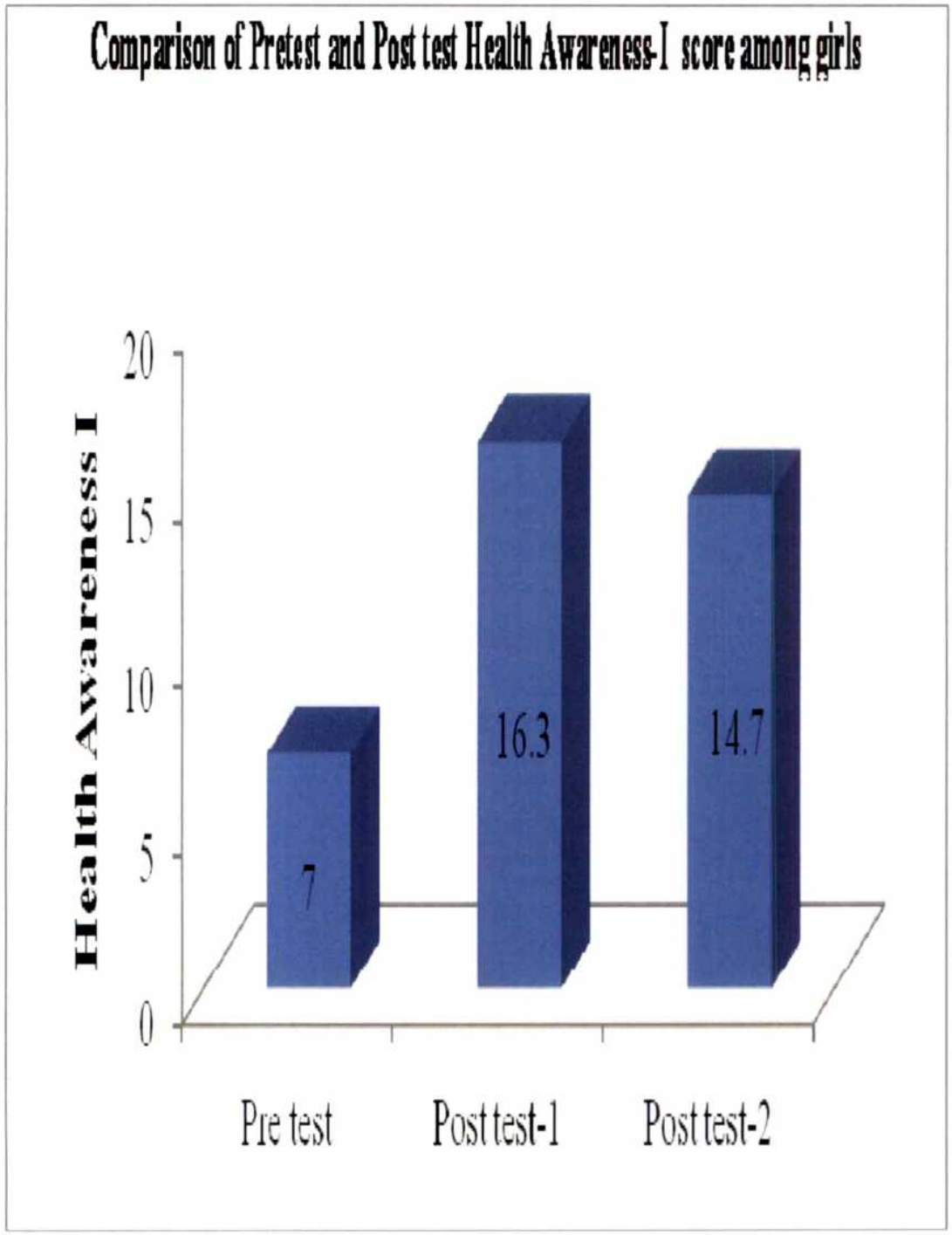

Comparison of Pretest and Post test Health Awareness-I score among girls
Health Awareness I
20
15
10
5
0
7
16.3
14.7
Pre test
Post test-1
Post test-2

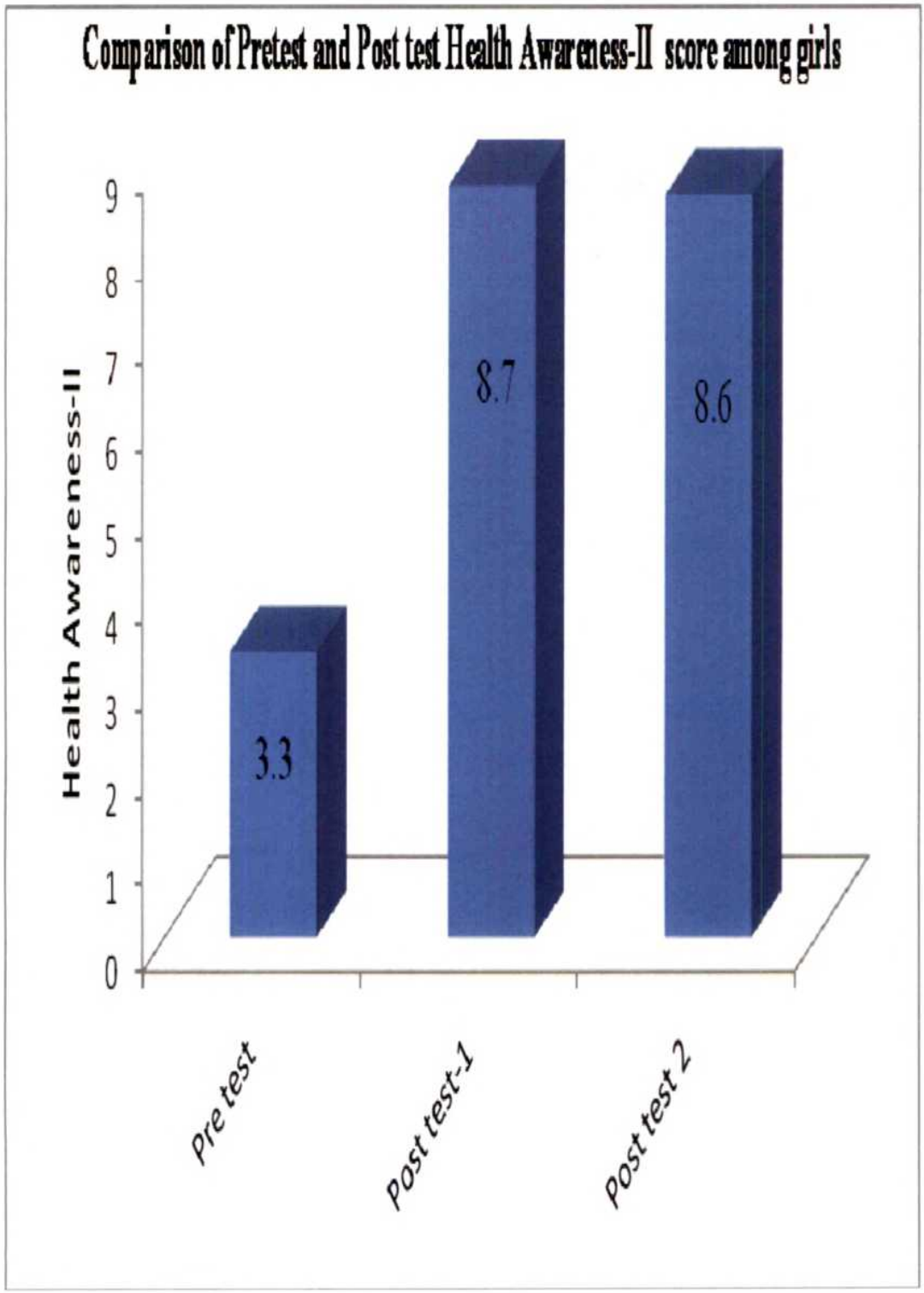
Table 65

4.11.4 Comparison of Pretest and Post test Health Awareness-II score among girls

Health Awareness-II	Mean	SD	ANOVA Repeated measure 'F' Value	'P' value	Bonferroni multiple comparisons test for repeated measure.
Pre test	3.3	2.4	126.4	0.000	Pretest Vs
Post test -1	8.7	2.3			Post test 1
Post test – 2	8.6	2.7			Post test 2

The mean score and Anova 'F' value health awareness-II indicate that post test scores (8.7, 8.6) were significantly more than pre test (3.3). Hence there is gain in attitude towards health awareness-II among the girls.

Figure-20


Comparison of Pretest and Post test Health Awareness-II score among girls
Health Awareness-II
0
1
2
3
4
5
6
7
8
9
3.3
8.7
8.6
Pre test
Post test-1
Post test 2

The Anova 'F' value for all post test results were significant and following hypotheses were found to be true, hence accepted.

There will be a significant difference in the mean nutrition knowledge score between the pre test and posttest score of the selected girls.

There will be a significant difference in the mean score on attitude towards the food habits of the selected girls between the pretest and post test.

There will be a significant difference in the mean score on health awareness score I of the selected girls (age group problems) between the pre test and post test.

There will be a significant difference in the mean score on health awareness II (Communicable, non Communicable and degenerative diseases) of the selected girls between the pre test and post test.

The results of the present study corroborate with various studies conducted with nutrition intervention. A study, on the effect of nutrition supplement education among the high school students conducted by Little *et al.,* (2002), showed that a short term nutrition education program can significantly improve the nutrition knowledge among high school students and a study on Nutrition education alone improves the dietary practices but not hematologic indices of adolescent girls in Iran and a study conducted by Mani and Soflaei (2006) showed that the scores for nutrition knowledge were significantly higher and the nutrition education can improve the knowledge of health, nutrition and life style choices.

In another study on the efficacy of the two different nutrition education tools in improving the nutrition knowledge the girls in 10-19 years age group in Hyderabad, India conducted by Raghunatha Rao *et al.,* (2007) showed that the nutrition education given by the science teacher's result in significant improvement in nutrition knowledge levels of the girls and a study on the role of nutrition education in improving the nutritional awareness among girls in the age group of 13-16 years in Kurukshetra District, Tamil Nadu conducted by Neetu Gupta and Kochar (2009) showed a significant improvement in their nutrition knowledge after nutrition education.

In the present study after providing nutrition education, a significant improvement in their nutritional knowledge was viewed and the quantum of improvement was 1.4 times. The analysis of data also inferred that the selected subjects obtained considerable and favorable score after nutrition intervention cum counseling sessions. The study was successful in identifying certain gaps in their knowledge, attitude and practices before imparting nutrition education and concluded that such awareness programmes should be organized at regular intervals.

SUMMARY AND CONCLUSION

CHAPTER-V

SUMMARY AND CONCLUSION

The status of a girl child anticipates the status of a woman in a society. The peril of neglect, poor health care and inadequate food begins right from her young age. When she grows up to be an adolescent, she is groomed to be a wife and mother and socially conditioned to take up her future role. Adolescence is a period of transition from childhood to adulthood. Most adolescent girls are not adequately aware of their increased nutritional needs for growth (especially increasing their food intake to meet the calorie demands of pubertal growth) resulting in their underweight and short stature. Adolescent girls face more problems than boys, largely, due to socio-cultural factors. They are deprived of adequate health care, good nutrition and opportunity for schooling. Adolescents, mostly go through adolescence with little or no knowledge of the body's impending physical and physiological changes, besides health issues and problems.

The aim of the present study was a holistic approach to understand the anthropometric measurements, food intake, biochemical assessment for hemoglobin content, nutrition and health awareness and physical activity pattern among the pre pubertal and post pubertal school children.

The study was designed with the following objectives.

1. To assess the nutritional status of the pre pubertal and post pubertal girls.
2. To describe the nutritional knowledge and health awareness of the selected subjects.
3. To determine the Anxiety level of the selected girls.
4. To ascertain the physical activity pattern of the selected subjects.
5. To study the relationship of demographic variables with level of anxiety, attitude towards food habits, nutrition knowledge and health awareness among the selected girls.
6. To appraise the impact of nutrition intervention through pretest and post test.

The study was planned in two phases. In phase I of the study, a descriptive correlation design was selected. In phase-2, the research design selected was one group, pre test – post test experimental design which aims to test the effectiveness of the intervention program in improving nutrition knowledge, health awareness related to their age group problems and other general health problems.

A total of 489 female subjects comprising both pre pubertal and post pubertal girls (from VIth to IXth standard) were enrolled from three different schools. A questionnaire was used as a tool for the study to collect data from the girls with information like general back ground details, assessment on body height, body weight, food and nutrient intake, Anxiety level, Nutrition knowledge, Health awareness and physical activity pattern.

General details of the selected girls

Of the total number of girls the results indicated that 23% belonged to the age group of 11 years, 26% belonged to the age group of 12 years, 25% belonged to the age group of 13 years and 26% belonged to the group of 14 years. Among the selected girls 24% was studying in sixth standard, 27% was studying in seventh standard, 24% was studying in eighth standard and 25% was studying in ninth standard.

It was noticed that 9% of girls were the only daughters in their family. About 55% of the girls belonged to first birth order category, 30% belonged to second and 6% belonged to third and fourth birth order category. Most (74%) of the girls were coming from urban areas and only 26% were coming from rural areas. Regarding religion 90% of girls belonged to Hindu community, 2% of girls belonged to Christian religion and the remaining 8% of girls belonged to Muslim community. Among the selected girls 43% were Post pubertal girls and 57% were pre pubertal girls. The girls belonged to both joint and nuclear family system. Majority of the subjects (84 percent) belonged to nuclear family and the remaining 15 percent belonged to joint family system and a meager 0.2 percent belonged to separated family. Maximum numbers (80%) of the selected subjects have less than five family members and 20% of the subjects have more than five members in the family.

Out of 489 parents it was observed that 4% of the fathers and 6% of the mothers were illiterates, 13% of fathers and 19% of mothers had up to primary school education, 25% of fathers and 25% of mothers had up to high school education 18% of fathers and 19% of mothers had up to higher secondary school education and 40% of fathers and 31% of mothers studied up to college level.

About 38% of the girls belonged to economically weaker section, while 37% of the girls belonged to middle income group and the remaining 25% of the girls belonged to low income group.

Menarcheal age of the selected girls

Distribution of girls (pre and post pubertal status) in relation to different economical status showed 39 per cent, 37 per cent and 16 per cent of the girls belonged to the age group of 12, 11, 13 years while a small percentage belonged to 14 years category. In relation to post pubertal category, 50percent, 36percent and 11percent of the girls belonged to the age group of 14, 13 and12 years while a small percentage belonged to 11 years category. A majority (71%) of the subjects from the rural category had attained menarche in 14 years. A large percentage of the subjects of urban poor also had attained menarche in 14 years, with reference to urban area 58 percentage attained menarche in 13 years, 23 percent and 8 percent had attained menarche in the age of 12 years and 11 years respectively. However, no one from rural and urban poor category had attained menarche in 11 years and only 3 % of the subjects from urban poor area had attained menarche at the age of 12 years. The mean age of menarche of urban poor, rural girls and urban girls were 13.76, 13.7 and12.7 respectively. The mean age of menarche, in the case of urban girls (daughters) and their mothers, were 12.72±0.761 and 13.8±0.77 years respectively. With reference to urban low income subjects, (daughters13.76 ± 0.495 mothers14.906±0.706) the rural daughters' mean age was13.71±0.455 and mothers' mean age was 14.84±0.474years.

Mean body height and body weight

The mean body height, and body weight of the subjects obtained in the present study, when compared with ICMR standard, was almost closer to each

other whereas the values were far below the standards given by NCHS. The mean body height and weight of pre pubertal and post pubertal girls were 136.6cm, 33.5kgs and 146.6cm, 44.4kgs respectively. In the case of BMI the pre pubertal girls had a lower BMI than the post pubertal girls. In relation to the degree of malnutrition among the selected girls, 19 percent girls were in normal level, 30 % girls were in mild grade mal nutrition, 90 girls (18 %) were in moderate grade mal nutrition and only 11 girls (2%) were in severe grade mal nutrition and 31% of the girls were in the over weight category.

Dietary pattern and food & nutrient intake

Regarding the Type of diet, 11 percent of the girls were Ova Vegetarian, 67 percent of the girls were non vegetarian and 22 percent of the girls were vegetarian. Data pertaining to the food likes and dislikes of the girls revealed that 98 percent preferred ice creams. Surprisingly, fruits were preferred by 94 percent of the girls. Most of the adolescent girls (82%) liked cool drinks. Among all the items vegetable salad was the most disliked one.

The mean intake of the urban (Middle income) girls aged between 11 and 12 related to calories, protein, iron, Calcium, Vitamin A and Fat were 1686 Kcal, 46.5gms ,15 mg, 445.5 mg, 260µg, and 25gm respectively. The mean intake of rural girls aged between11-12 related to calories, protein, iron, Calcium, Vitamin A and Fat were 1542 Kcal, 40.0gms and 14.6 mg, 215.7 mg, 160 µg and 25gm respectively. The mean intake of urban (Low income) girls aged between 11 to 12 related to Calories, protein , iron ,Calcium, Vitamin A and Fat were 1547 kcal, 35.2gm, 14.5mg, 248 mg, 201 µg and 25.5gm respectively. The mean intake of urban (Middle income) girls aged between 13 to 14 related to Calories, protein, iron, Calcium, Vitamin A and Fat were 1886 Kcal, 53.2gm, 17.9 mg, 480mg, 403 µg and 46gm respectively. The mean intake of the rural girls aged between 13 and 14 related to Calories, protein , iron, Calcium, Vitamin A and Fat were 1775 Kcal, 43.5gm , 14.8 mg, 345.6mg, 422.5 µg and 30.8 gm respectively. The mean intake of urban (Low income) girls aged between 13 and 14 related to Calories, protein, iron, Calcium, Vitamin A and Fat were 1656 Kcal, 38gm, 14.5mg, 220mg, 205 µg and 30gm respectively.

The mean intakes of all the food stuff among the three groups (Urban, Urban poor and rural, and 10-12 years girls) were found to be closer to each other. However, the mean intake of milk and green leafy vegetables consumption by urban middle income group was comparatively higher than the urban low income group and the rural subjects. And the mean intake of all the food stuff among three groups (Urban, Urban poor and Rural, 13-14 years girls) were found to be closer to each other. However, the mean intake of milk, green leafy vegetables, roots and tubers and fruits consumption by urban middle income group was comparatively higher than the urban low income group and rural subjects. Among the subjects of low income group, the consumption of milk, vegetables and fruits was very low.

Clinical Examination

On observing the clinical symptoms in the present study 29 percent of the girls suffered from dental carries and 25 percent of the girls suffered from Mouth ulcer. Phyrynoderma is another problem faced by 7 percent of the girls.

Biochemical analysis-hemoglobin level

In the present study among the post pubertal girls 76% of them were found to be anaemic. The severity of the anaemia was assessed and found to be 28% and 48% respectively as mild anaemia (10-11.9g/dl) and moderate (7-9.9g/dl). Among pre pubertal girls 64% of them were found to be anaemic. The severity of the anaemia was assessed and found to be 40% and 24% and categorized as mild anaemia (10-11.9g/dl) and moderate (7-9.9g/dl) anaemia respectively. Majority of post pubertal subjects were under the category of moderate level anemia. The results indicated that only 24% were normal in post pubertal category where as 36% were normal in pre pubertal category.

Menstrual problems and management

Data on menstrual health problems of adolescent girls revealed that 41% of the girls had stomach pain, 25% of the girls had pimples and 10% of the girls showed sudden increase in body weight and 40% of the girls had leg pain.

It is evident from the results, that the methods used to alleviate menstrual pain 52 % of post pubertal girls were taking tablets, while 37% of post pubertal girls have the habit of taking butter milk and only 11 % of post pubertal girls drink fruit juices. Few of the subjects have reported calm and quite surrounding was the best remedy to kill pain with regard to special foods given at the time of puberty 86 % of the urban subjects and 80 % rural girls were given sweets during the time of puberty and 70 % of urban girls and 64 % of the rural girls reported that they consumed raw egg as a special food during their menarche. However, 44% of the urban girls and 58% of the rural girls reported that ulunthukali (made from black gram dhal) was given to them as a special food. Higher percentage of rural girls (68.8) used Gingelly oil than urban girls (52.4). Most of the urban girls (80%) as well as the rural girls (87%) recorded that they had pongal as a special food at the time of puberty.

Regarding the special supplement for the post pubertal girls, only 8.5 percent of the urban post pubertal girls had multivitamin/multi mineral as a special supplement. None of the girls from urban and rural areas had supplements related to protein, iron or any other.

Menstrual management

Results on menstrual management showed that two-thirds of the selected girls (90% urban middle, 19% urban poor, 11% rural poor) regardless of age used disposable pads and 32% of the urban middle, 97% of the urban poor and 98 % rural poor girls used cotton or cloth material. However, the use of both the disposable and non disposable materials by girls was also common, especially, among the poor. With respect to storage of the sanitary napkins and the pattern of use, it was found that 56 % girls stored the clean (unused) pads in the cupboards or drawers, and 13% , 19% ,12% girls used dress cabinet and bathroom and outside the house respectively. The practice of changing pads during night was mentioned by 89 % by urban middle while changing in school or college was less common among the urban low income and rural girls. Majority (50% urban middle , 84 % urban low income and 58% rural) of the girls changed napkins twice a day followed by 11%, 16 % and 42 % of urban middle, urban low income and the rural girls changed once a day. Regarding the personal hygiene, most of the girls in both

urban and rural areas having a practice of bathing daily but only minimum number of girls, having a practice of bathing once in 2 days and most of the girls having a practice of hand washing after changing napkin but only in urban middle income families 58% of girls having a practice of hand washing with soap.

Anxiety level of the selected girls

On analyzing the anxiety level it was seen that as age increases the percentage of high anxiety decreases. It is not age alone but class also had an association with the anxiety level. Other variables, having significant association with anxiety level were birth order and pubertal status. With regard to Economical Status and anxiety level 79% of girls from middle income families and 30% of girls from Low income families had normal anxiety level. The comparison showed 20% from low income family girls and 10% from high income family girl's high anxiety level. On comparison it was found that 10% of the girls from low income family showed very high anxiety level and none of the girls from high income family had very high anxiety. It is evident from the results that a long duration physical activity results in higher number of normal anxiety (N=93) and lower number of high anxiety and very high anxiety among the selected girls. The results indicated that more number (80/280) of the pre pubertal girls are in normal anxiety level when compared to post pubertal girls (67 out of 209). About 32% of the post pubertal girls were having normal anxiety and 29% of pre pubertal girls were having normal anxiety. Only 9% of the post pubertal girls were with very high anxiety and 25% of pre pubertal girls were with very high anxiety.

Physical Activity pattern

On analyzing physical activity pattern of the selected girls the results indicated that nearly 59% of girls were involved in physical activity. Among this 62 % of girls involved in indoor activities and 38 percent of girls engaged in out door activities. Regarding the duration of play, 34% of the girls spent less than half an hour per day, 45% of the girls spent half an hour to 1 hour per day and 21 percent of girls spent more than 1 hour per day. During physical education class 28% of the girls spent 45 minutes and 72% of the girls utilized 90 minutes in physical activity. The activity includes throw ball and running. It is depressed to

note that 41% of the selected girls did not involve in any physical activity beyond the school hours.

Totally, 202 girls were involved in physical activity among pre pubertal category. Of the 202 girls 42% of the subjects belonged to 11 year old group, 33% belonged to 12 years and 16% belonged to 13 year old group while only 9% belonged to 14 year old girls involved in physical activity. Totally, 88 girls were involved in post pubertal category. Of the total 40% of the subjects belonged to 14 year old age group followed by 39% and 21% of 13 year and 11 to 12 year old girls respectively involved in physical activity.

Data on mode of transport to school indicated that 42% of girls were having active means (Walking/Cycling) as a mode of transport to school and 58% of girls were having inactive means (Bus/Two wheeler) as a mode of transport to school. Regarding the duration of watching television/video games, the results indicated that nearly 13% of the girls spent less than half an hour per day, 34% of the girls spent half an hour to 1 hour per day and 53% of the girls spent more than 1 hour per day.

Attitudes towards food

Data on attitude towards food habits revealed that majority (63%) of the girls had undecided attitude on various aspect of food habits followed by 25% had positive attitude while only 12% had negative attitude towards food habits . It is encouraged to note that one fourth of the selected subjects had a favorable attitude.

Most of the girls (85%) were having good attitude regarding the seasonal fruits consumption. Regarding the excessive consumption of pungent taste 18% of the girls were with uncertain attitude. About 21% of the girls were with uncertain attitude and 28% of the girls were with negative attitude regarding the consumption of cool drinks. A total of 42% of the girls were having good attitude about loss of nutrients while cutting the vegetables. Most of the girls (85%) were having good attitude regarding consumption of greens. Only 12% of the girls were with uncertain and 11% of the girls were having negative attitude towards the intake of water. Only 20% of the girls were having good attitude regarding the

source of Vitamin B12 and 52% of the girls were having good attitude regarding the importance of meals.

It was noticed from the results that age, class, father's education, mother's education and pubertal status were the variables having significant correlation with attitudes of the girls towards food habits. It is evident from the results that there is a direct correlation between pre and post pubertal subjects and attitude towards food habits. The high mean score shows the better attitude towards food habits. Data on Mean attitude score of pubertal girls (28.1) was found to be higher than the pre pubertal girls (26.2).

Nutrition knowledge

The results on nutrition knowledge revealed that majority of the girls (67%) had inadequate knowledge followed by 32 percent had moderately adequate knowledge and only 1 percent had adequate knowledge related to nutrition.

A large section of the girls (91%) have good knowledge about the need for food groups. About 88% of the girls have inadequate knowledge about the RDA of water and 81% of the girls have inadequate knowledge about RDA of greens and 80% of the girls have inadequate knowledge about RDA of vegetables. Nearly half the number (40-50%) of the girls has some knowledge about the use of food groups, sources of iron, vitamin A and RDA of Cereals and pulses. It was observed from the results that the mean nutrition knowledge increases as age increases and there was a significant correlation between nutrition knowledge and class, the father's education and the mother's education. It is evident from the result that the mean nutrition knowledge score of pubertal girls (11.8) was found to be higher than the pre pubertal girls (9.1).

Health awareness

The responses related to health awareness are summarized in the following paragraphs. Health awareness –I (Under weight) of the selected girls showed that 65% of girls were not aware of the problems related to their age group. 60% of the girls were not aware the meaning of under weight and nearly 80% of the girls were

not aware of the factors to prevent underweight and 63% of the girls were not aware of the consequences of under weight.

Health awareness –I (Obesity) of the selected girls showed that more than 60% of the girls were not aware of the meaning of obesity, causes of obesity and methods to prevent obesity. About 77% of the girls were not aware of the consequences of obesity.

Health awareness –I (anaemia) of the selected girls showed that more than 60% of the girls were not aware of the meaning and causes of anameia. It is shocking to note that 80% of the girls were not aware of the ways to prevent anaemia and 40% of the girls were not aware of the consequences of anaemia.

Health awareness –I (anorexia nervosa) of the selected girls showed that more than 80% of the girls were not aware of the meaning, causes of anorexia nervosa and nearly 90% of the girls were not aware of the factors to prevent anorexia nervosa and consequences of anorexia nervosa.

Health awareness –I (menstrual hygiene) of the selected girls showed that 75% of the girls were not aware of the meaning of menstrual hygiene. More than 85% of the girls were not aware of the consequences of poor menstrual hygiene and prevention of urinary tract infection. The result indicate that all the girls have poor awareness about their age related problems like under weight, obesity, anaemia, anorexia nervosa and menstrual hygiene. The mean health awareness score of post pubertal girls (6.3) was found to be higher than the pre pubertal girls (4.2).

Health awareness-II(Communicable diseases) of the girls showed that 51 % of the girls were not aware of the meaning of communicable diseases and 59% of the girls were not aware of the examples for communicable diseases. About 62 % of the girls were not aware of the causes of communicable diseases and 60% of the girls were not aware of the points to prevent and overcome communicable diseases.

Health awareness-II (Non communicable diseases) of the girls showed that 69% of the girls were not aware of the meaning and points to prevent and

overcome the non communicable diseases and more than 70% of the girls were not aware of the example and causes of non communicable diseases.

Health awareness-II (Degenerative diseases) of the girls showed that more than 85% of the girls were not aware of the meaning and example of degenerative diseases and 90% of the girls were not aware of the causes of degenerative diseases and 81% of the girls were not aware of the factors to prevent and overcome the degenerative diseases.

Phase-2

On analyzing the phase-2 results, the mean score and Anova F- Value for nutrition knowledge indicate that the post test scores (19.0, 18.3) were, significantly, more than that of the pre test (13.3). Hence, there is a gain in nutrition knowledge among the girls. The mean score and Anova F- Value for attitude towards food habits indicate that the post test scores (28.3, 28.8) were significantly higher than the pre test score (25.8). Definitely there is gain in attitude towards the food habits among the girls. The mean score and Anova 'F' value for health awareness-I indicate that the post test scores (16.3, 14.7) were, significantly, more than that of the pre test (7.0). There is improvement in knowledge and health awareness -I among the girls. The mean score and Anova 'F' value health awareness -II indicate that the post test scores (8.7, 8.6 post tests) were significantly higher than that of the pre test (3.3). There is an improvement of awareness among the girls which results in favorable attitude towards health awareness -II.

The present study assessed the nutrition status, anxiety level, dietary intake, nutrition knowledge and health awareness of pre pubertal and post pubertal girls and found that these girls had poor dietary habits, inadequate nutrition knowledge and health awareness. On the whole girls from urban were found to be better than urban poor girls and economically weaker section from rural area. Adolescent girls must be encouraged to eat nutritionally adequate diet to overcome nutritional deficiency disorders and to maintain good nutrition status. Prevention of obesity among children is easier than the adults. Based on the findings of this study, it is

recommended that the children should be encouraged to do increased physical activities like outdoor games, walking and cycling. Healthy practices are important for health and well being of the individuals. Menstrual period is one such time when the females are expected to adopt hygienic practices. This study concludes that there are unhygienic practices and misconceptions among the girls about the menstrual period and health care professionals need to take action.

It is the responsibility of those around the girls – parents, teachers, elder siblings and friends, community leaders, health care providers – to provide guidance on what to expect and what is expected of the adolescents and opportunities to learn in various formal and informal ways. When guidance and learning opportunities are offered effectively, the adolescents have a greater chance of becoming healthy, informed and responsible adults and later become parents, acquiring life skills, take participation and play a useful role as a citizen with a tendency to be an economically productive member of the family and the society. The study concluded that the nutrition intervention was effective in improving nutrition knowledge and health awareness of pre pubertal and post pubertal girls.

Societal implications

Adolescence is the only time, after infancy, when the rate of growth actually increases. Sudden growth spurt is associated with hormonal cognitive and emotional changes that make adolescence a vulnerable period of life. The present study findings have indicated that majority of pre pubertal post pubertal girls have improper food intake, less physical activity and inadequate knowledge related to Nutrition and various diseases.

There is a need to develop nutrition intervention for the pre pubertal and post pubertal girls, because these girls are future mothers and they are responsible for the health status of the entire family. Hence equipping the girls with adequate knowledge about Nutrition and various health aspects, would be useful in creating awareness in the entire society.

Recommendations

1. A comparative study can be conducted among the various age groups of children.
2. A comparative study can be done between the adolescent girls and boys.
3. A qualitative study may be conducted to determine the anxiety level of adolescents.
4. There is a need to develop a systematic and validated tool on Health awareness of the adolescents.
5. A similar study can be done by using other teaching strategies. i.e., Video teaching, comic books and audio cassette, etc.
6. Nutrition work shops can be conducted for the adolescents with cooking demonstrations for the preparation of low cost nutritious foods using the locally available ingredients and also be encouraged to respect and retain the traditional food habits.
7. Fast food restaurant, soft drinks, prepared baked or fried snacks should be banned in the Educational Institutions and alternate foods including milk, vegetables and fruits intake should be promoted.

BIBLIOGRAPHY

BIBLIOGRAPHY

Aarthi Sankhala., Sankhla AK., Bhavna Bhatnagar and Alpana Singh (2004).'Dietary status of children of Udaipur District, India, Anthropologist, 6(4), 257-259.

Abera,Y., (2004).Menstruation related Problems and Practices among Adolescent High School Girls in Addis Ababa, Thesis of Master degree, Addis Ababa University, 9.

Abraham, Mercy, and Prasanna K Baby., (1983). "Asian Journal of Psychology and Education', 11(4), 45-51.

ACC/SCN (2000). 4th report on the World Nutrition Situation – Nutrition Throughout the life Cycle, United Nations Administrative Committee on Nutrition (ACC/SCN) in Collaboration with International Food Policy Research Institute (IFPRI), PP: 4-12.

Acharya A., Reddaiah P., and Baridalynel., (1990). Nutritional Status and Menarche in Adolescent Girls in Urban Resettlement Colony of South Delhi. American J of Epidemiology, 132(5),953-961.

Agarwal DK., Khare BB., Mehta S., Pereria P., Agarwal KN., Satyavati K., (1981) Study of menarcheal age in Indian girls, Indian Journal of Preventive and Social Medicine,4 , 173-176.

Agarwal KN., (1998). "Assessment of prevalence of anemia and iron stores in response to daily/weekly iron- folate supplementation in adolescent girls from urban slums of North East, Delhi. UNICEF Contract No.,95/0075.

Agarwal KN., Sharman S., and Kapur D., (2003). 'Effectiveness of nutrition education, iron supplementation or both on iron status in children', The Indian journal of paediatrics, 40 (12), 1131-44.

Agudello GM., (2003). 'Prevalence of iron deficiency anemia in school children and adolescents', The American journal of Clinical Nutrition, 13(6), 76-86.

Ahluwalia N., (2002). 'Intervention strategies for improving iron status of young children and adolescents', The Nutrition Review, 60 (5), 1157.

Ahmed F Khan., (2000). Anemia and iron deficiency in adolescent girls in peri-urban Bangladesh, The journal of Clinical Nutrition 54(8), 678-883.

Ahmed F Zareen M., Khan Mr., Banu CP., Haq MN., Jackson AA., (1998). 'Dietary pattern, nutrient intake and growth of adolescent school girls in urban Bangladesh', Public Health Nutrition, 1, 83-92.

Alexander., and Susan Germain., (1996). "A study of Adolescent Anxiety', Clinical Psychology, 299.

Allison KR., Adlaf EM., Irving HM., (2005). Relationship of vigorous physical activity to psychological distress among adolescents, J Adolesc Health, 37,164-166.

Al-Nuaim AR., Al-Rubeaan., al-Mazrou., al-AHAS O., al-Gaghari N., Khoja T., (1996). High prevelance of overweight and obesity in Saudi Arabia, International Journal of Obesity and Related Metabolic Disorder, 20, 547-52.

Anand K., Kant S., Kapoor SK., (1999). Nutritional Status of Adolescent school children in Rural North India, Indian Pediatrics, 36, 810-815.

Anderson JJB., (1991). The status of adolescent nutrition, Nutrition Today, March/April 7-10.

Anderson RE., CJ Crespo., SJ Bartlett., LJ Cheskin M Pratt., (1998). Relationship of Physical activity and television watching with body weight and level of fatness among children results from the third National Health and Nutrition Examination Survey. The Journal of American Medical Association, 279, 938-942.

Anderson SE., Dallal GE., Must A., (2003). Relative weight andrace influence average age at menarche: results fromtwo nationally representative surveys of US girls studied25 years apart. Pediatrics 111: 844-850.

Anita Malhotra., and Santosh Jain Passi., (2007). 'Diet quality and Nutritional Status of rural adolescent girl beneficiaries of ICDs in North India', Asian Pacific Journal of Clinical Nutrition ,16 ,8-16.

Anuradha Goyle., and Ira Yanendra., (2009). 'Nutrient intakes of young girls studying in a government school in Jaipur City, India, Journal of Human Evolution, 25(2) ,127-132.

Archana., and Ramachandran k., (2008)."Predictors of Anxiety among college students", Journal of Indian Health Psychology,2(2),24.

Aronosn M., (1993). Does excessive television viewing contribute to the development of dementia? Medical Hypothesis, 41 (5), 465-466.

Ashima K Kant., (2003). Reported consumption of Low Nutrient Density Foods by American children and Adolescents, Archives of Pediatrics and Adolescent Medicine ,157, 789-796.

Bagga A., Kulkarni S., (2000). Age at menarche and secular trend in Maharashtrian (Indian) girls, Acta Biologica Szegediensis , 44 (1-4), 53-57.

Bai KI., Vilajayalakshmi B., (1973). Sexual maturation of Indian girls in Andhra Pradesh, Hum Biol 45,695-707.

Baljit and Sukhpalkaur., (2010). Life Style diseases related risk factors among school children, Nightingale Nursing Times 5 (12), 57-59, 65-66.

Bandini LG., Musta VUD., Cyr H., Gold berg A., and Dietz WH., (1999). "Comparison of high calorie, low-nutrient density food consumption among obese and non-obese adolescence, Obes Res, 7, 438-443.

Banerjee I., Chakraborty S., Bhattacharya NG., Bandopadhyay S., Saiyed HN., Mukherjee D., (2007). A cohort study of correlation between body mass index and age at menarche in healthy Bengali girls, Journal of the Indian Medical Association,105 (2),75-8.

Banerjee SR., Chakrabraty S., Vasulu TS., Bharati S., Sinha D., Banerjee., and Bharati., (2009). "Growth and Nutritional status of Bengali Adolescent Girls",Indian Journal of Pediatrics, 76.

Bar OR., Foreyt J., Borwnell KD., Dietz WH., Ravussin E., Salbe AD., Schewenger S., JeorS., & Torun B., (1998). Physical activity, genetic and nutritional

considerations in Childhood Weight Management, Medicine and Science in Sports and Exercise , 30, 2-10.

Barkey CS., Gardner JD., and Frazier AL.,(2000). Relation of childhood diet and body size to menarche and adolescent growth in girls, American Journal of Epidemiology, 152, 146-452.

Barlow SE., & Dietz WH .,(1998). Obesity evaluation and treatment expert committee recommendations, Pediatrics, 102, E 29.

Bartoline .,(1998). Young people and anaemia, The journal of School Health,53(4), 23-27.

Berger J and Dillon JC., (2002). Control of iron deficiency in developing countries, Sante, 12, 22-30.

Bhalla M., Srivastav J R., (1974). A retrospective study of the age of menarche in Kanpur girls, Indian Pediatrics, 11,7.

Bharati D., Deshmukh PR., Garg BS., (2008). 'Correlates of overweight and obesity among school going children of Wardha City, Central India, Indian Journal of Medical Research 127(6), 514-5.

Bhaskaran P., (2001). The cycle of malnutrition and women's health nutrition news 22, 1-6.

Biing-Hwanlin., Joanee Guthrie., Elizabeth Frazao., (2001). 'American Children's Diets not making the Grade', Food Review 24(2), 8-17.

Binay KS., (2002). 'A study to determine the prevalence of anaemia in adolescent Nepalese girls in a semi-urban setting', The journal of Clinical Nutrition, 32(4), 132-36.

Birch L., (1999). "Development of food preferences", Annu Rev Nutr,19, 41-62.

Biro FM., Lucky AW., Simbartl LA., Barton BA., DanielsSR., Striegel-Moore., Kronsberg SS., Morrison JA., (2003). Journal of pediatrics, 142 , 643. Bodzsar EB, Zsakai A (2002). Coll Antropol, 26 ,477.

Bolton G frank., (1982). The pregnant adolescent problems of premature parenthood, sage publications, Beverly hills, London,17-169

Bourguignon J P., (1988). Linear growth as a function of age at onset ofpuberty and sex steroid dosage, therapeutic implications, EndocrinolRev, 9, 467-488.

Bowman SA., (2002). Beverage choices of young females; changes and impact on nutrient intakes, Journal of American Dietetic Association, 102, 1234-1239.

Brabin L., Barbin BJ., (1992). The cost of successful adolescent growth and development in girls in relation to iron and Vitamin A status, American Journal of Clinical Nutrition, 55, 955-8.

Brasel J ., (1982). Changes in Body composition during Adolescence. In: Adolescent Nutrition, Winick M., (Ed.). John Wiley and Sons, New York.

Bratteby LE., Sandhagen B., Lotborn M., and Samuelson G., (1997). Daily energy expenditure and physical activity assessed by an activity diary in 374 randomly selected 15 year adolescents. European Journal of Clinical Nutrition, 51, 592-600.

Brett glawe., Jayalakshmi Asokan JS., Thasian T., and John KR., (2008). Nutritional profile of rural adults from Vellore district of Tamilnadu, Indian Journal of Nutrition & Dietetics, 45, 236.

Bronzalf., Arline L Epstein., Gild (1982). 'Test anxiety, sex and ordinal position", Journal of Social Psychology, 87(1).

Brown JD., (1998). The mass Media and American Adolescents Health, proceedings of the health future of youths, path way to adolescent health conference, Annapolis, 14, 98-109.

Bull N L., (1986). Studies of dietary habits, food consumption and nutrient intake of adolescents and young adults, world review of nutrition and dietetics, 57,24-74

Bull NL., (1988). "Studies of the dietary habits food consumption and nutrient intakes of adolescents and young adults", World Rev.Nutr.Diet,57, 24-74.

Cape Girardeau., (2007). Growth and development Television and children, South east hospital.com/index.

Carrol Lutz ., Karen Przytulski., (2010). Nutrition and Diet therapy, 4th Edition, Jaypee Pharma Customised imprints (P) Ltd., 250-253.

Channon M., Patricia., (1995). Child and development TMH edition, New Delhi. , MCGraw-hill publishing company Limited,17.

Chaturvedi S., Kapil U., Gnanasekaran N., Sachdev HPS., Pandey RM., and Bhanti T., (1996). "Nutrient intake amongst girls belonging to poor socio-economic group of rural of Rajasthan, Indian Pediatrics, 33, 197-202.

Chawla S., (1992) .Effect of Nutritional Status on Physical work capacity of school going girls M. Sc. Thesis submitted to Dept., PAU, Ludhiana.

Child in India (1985). Government of India, Ministry of Family Welfare, P 25.

Chitra., Uma and Reddy C Radha., (2007). The role of breakfast in nutrient intake of urban school children'. Public Health Nutrition, 10(1), 55-58.

Choudhary S., Mishra CP., and Shukla KP., (2003). "Nutritional status of adolescent girls in rural area of Varans, Indian Journal Prevention of Social Medicine, 34, 55-61.

Chu NF., (2001). Prevalence and trends of obesity among children in Taiwan-The taipei children Heart study, International Journal of Obesity and Related Metabolic Disorder, 25, 170-6.

Coyne SM., (2004) Cruel intentions on television and in real life: can viewing indirect aggression increase viewers, subsequent indirect aggression, Journal of child Psychology, 88 (3), 234-53.

Crjnlein T., (2007). Association between television viewing and insomnia during early adolescence, American Academy of pediatrics, 34 (1), 59-61.

Croll JK., Newmark SD., and Story M., (2001). Healthy eating, What does it mean to adolescents, journal of nutritional education, 33, 193-198.

Dasagupta A., and Sarkar., (2008). 'Menstrual Hygiene: How Hygienic is the adolescent Girls?, Indian journal of Community Medicine,1(33).

De La Eva Rc., Baur LA., Donaghue K., WatersKA., (2002), Metabolic correlates in obstructive sleep apnoea, The Journal of Pediatrics , 140, 654-659.

De Moor MHM., Beem AL., Stubbe JH., (2006). Regular exercise, anxiety,depression and personality, A population-based study, Prev Med, 42, 273–279.

Deheeger M., Roll and Cachera ML., and Fontvieille AM., (1997). Physical activity and body composition in 10 year old French children linkages with nutritional intake, International Journal of Obesity, 21, 372-379.

DeMayer EM., Dallman P., Gurney JM .,Hallberg L., Sood SK ., and Srikantia SG., (1989).Iron DeficiencyAnaemia.Aguide for heath administers and programme managersWHO(Geneva),25.

Den Van Bulck., (2004). Energy intake associated with television viewing in adolescents a cross sectional study, Journal of Appetite, 43 (2), 181-184.

Dietz WH., and Robinson T.N., (1998). Use of body mass index as a measure overweight children and adolescents, Journal of Pediatrics, 132, 191-193.

Dietz WH., and Robinson TN., (1998). "Use of bodymass index as a measure of overweight children and adolescents, Journal of Pediatrics, 132, 191-193.

Duffy VB., and Bartoshuk LM., (2000). "Food acceptance and genetic variation in taste", Journal of American Dietetic Association, 100, 647-655.

DuyerJ., (1981). Nutritional requirements of adolescence , Nutrition review, 39(2), 56-72.

E.N.Whitney, S.R.Rolfes., (1999). Understanding Nutrition, An International Thomson Publishing Cjo., Belmont, CA, pp.181-522.

Elaheh Ainy., Yadolah Mehrab., and Fereidoun Azizi., (2007).Comparison of menarche age between two generations (Tehran lipid and glucose study), Pak J Med Sci , 4(23), 523-525.

Elizabeth B Hurlock., (1998). "Developmental Psychology', Tata Mc Graw Hill publishing Co.Ltd., New Delhi,39.

Elizabeth KE., (2001), A novel growth assessment chart for adolescent, Indian Pediatrics 38, 1061-1064.

Elsie M Taveras., Catherine S., Berkey., Shery L.Rifas-Shiman., David S Ludwig., Helaine RH., Rockett., Alison E Field., Graham A Colditz., and Matthew Gillman W., (2005). "Association of consumption of Fried Food away from home with body mass index and diet quality in older children and Adolescents', Pediatrics ,4(116), e518-e524.

Epstein LH, Saelens BE, Myers MD, Vito D (1997). Effects of decreasing sedentary behaviors on activity choice in obese children, Health Psychology, 16, 107-113.

Epstein LH., Saelens BE., O'Brien JG., (1995). Effects of reinforcing increases inactivity versus decreases in sedentary behavior in obese Children,International Journal of Behavioral Medicine, 2, 41-50.

Ersoy B., Balkan C., Gunay T., A and Egemen., (2005). The factors affecting the relation between the menarcheal age of mother and daughter, Care, Health and Development, 3(31), 303–308.

Eveleth, P B., and Tanner JM., (1990). Worldwide Variation in HumanGrowth. Cambridge Univer-sity Press, Cambridge, 1990.)

Fahlman MM., Dake JA., MC Caughtry N., and Martin J., (2008). "A pilot study to examine the effects of a nutrition intervention on nutrition knowledge behaviors and efficacy expectations in middle schoold children", Journal of School Health, 78(4), 216-22.

Farthing MC., (1991). "Current eating patterns of adolescents in the United States, Nutrition Today, 35-39.

Fletcher MS., Jason., (2006). Social interactions in adolescent Television viewing, Archives of pediatric and Adolescent Medicine, 160 (4), 383-386.

Foerster SB., Heimendinger J., Disogralk and Pivonka E., (1997). The National 5 A day for Better Health Program: an American Nutrition and Cancer prevention initiative. In implementing Dietary Guide lines for Health Eating, 447-479.

Fomon S.,Druli J.,Nelson S.,Serfass R.,Woodhead J and Ziegler E .,(2003).inevitable iron loss by human adolescents, with calculations of the requirement for absorbed iron,J.Nutr,133,167-172.

Frazao E Lin BH., (1999). Away-From-Home foods increasingly important to quality of American diet. Washington D.c. United States Department of agriculture, Economic Research Service.

Freed Man DS., Dietz WH., Srinivasan SR., Berenson GS., (1999). The relation of overweight to cardiovascular risk factors among children and adolescents, The Bogalusa Heart Study, Pediatrics, 103, 1175-1182.

Freidman MA., Wilfley DE., Pike KM., Streigel Moore RH., Rodin J., (1995). The relationship between weight and psychological functioning among adolescent girls, Obesity Research , 3, 57-62.

French S., Harnack L., Jeffery RW., (2000). Fast Food restaurant use among women in the pound of prevention study; dietary, behavioral and demographic correlates, International Journal of Obesity , 24, 1353-1359.

French SA., Story M., New Mark-Sztainer D., Fulkerson JA., and Hannan P., (2001). Fast food restaurant use among adolescents, associations with nutrient intake, food choices and behavioural and psychosocial variables, International journal of obesity, 25, 1823-1833.

French SA., Story M., Perry CL., (1995). Self esteem and obesity in children and adolescents a literature reviews, Obesity Research, 3, 479-490.

Gardon-Larsen P., MC Murray G., Popkin BM., (1999). Adolescent Physical activity and inactivity vary by ethnicity, The national Longitudinal study of adolescent Health, The Journal of Pediatrics, 135, 301-306.

Garnett SP., Cowell CT., BaurLA., Fay RA., Lec J., Coakley J., Peat JK., Boulton TJ., (2001). Is birth size related to abdominal fat in childhood? International Journal of Obesity and Related Metabolic Disorder, 25, 1667-1673.

Garrow JS., James WPT., and Ralph A., (2000). Human Nutrition and Dietetics, 10th edition, Churchill living stone publication, Newyork, 461.

Gates L.Lineberger (1998). "Department of Psychology", University of South Mississippi, Hattiesburg, (1),325-328.

Ge X., Conger RD., and Elder GH., (1996). "Coming of age too early: Pubertal influences on girl's vulnerability to psychological distress, Child Development 67, 3386-3400.

Ghalib J Haboubi., and Rixwana B Shaikh., (2009). A comparison of the Nutritional Status of Adolescents from selected schools of South India and UAE: A Cross – Sectional Study", Indian Journal of Community Medicine, 2(34)

Ghosh D., Kochhar., Khan SD., (1973). Study of puberty and after in 557 Indian school girls at Poona, J Obst Gyan, 23.

Goel S BP., Gupta., (2007). "Low Anemia prevalence among adolescents of an urban Hilly Community", Indian Journal of Community Medicine, 1(32),15.

Gold Blatt PB., Moore ME., Stunkard AJ., (1995). Social factors in Obesity The Journal of American Medical Association, 191, 1039-1044.

Gopalan C., (1989). Gorwth of affluent Indian Girls during adolescence, Scientific Report Series NO.10, Nutrition Foundation of India, PP 1-49.7.

Gopalan C., (1989). Women and nutrition in India general considerations, editors Gopalan C and surminder Kaur,NFI Series, 1-14

Gopalan C., (1992). Nutrition challenge for Asia, progress in Food and Nutrition Science 16, 51-84.

Gopalan C., (1993). "Women and Nutrition in India: Some practical consideration, problems and policies, Editors, C.Gopalan and Harvinder Kaur, NFI, Special Publication, Series-9, p-47, 53.

Gopaldas T., (2002). "Iron deficiency anaemia in young working women can be reduced by increasing the consumption of cereal based fermented foods and nutrition education", The Food Nutrition Bulletin, 23:1, 94-105.

Gorczynski P.,and Faulkner G., (2010). Exercise therapy for schizophrenia. Cochrane

Gordon-larsen P., MC Murray RG., Popkin BM., (1999). Adolescent physical activity and inactivity vary by ethnicity,The national longitudinal study of adolescents, Health J.Pediatrics, 135,301-306.

Grover VL. , (1998). Final report on a study of reproductive health awareness and sexual behaviour among adolescents in Delhi, Report submitted to ICMR: Delhi.

Hallal PC., Victoria CG., Azevedo MR., Wells JC., (2006). Adolescent physical activity and health: a systematic review, Sports Medicine, 36(12), 1019-30.

Hancox RJ., and Poulton R., (2006). Watching Television is associated with childhood obesity but is it clinically important, International Journal of Obesity, 30 (1), 171-175.

Harnack L., and Stang J., (1999). Soft drink consumption among children and adolescents: Nutritional consequences, Journal of American Dietetic Association, 99, 436-441.

Harold Varley., (1988). Practical clinical Biochemistry, Fourth Edition, CBS publishers & Distributors, 585—586.

Harold varley.,(1988). Practical clinical Biochemistry, fourth edition, CBS publications & Distribution, Delhi, India, 585-586.

Harsha DW., (1995). The benefits of Physical activity in childhood , American Journal of Medical Sciences, 310, S113-S119.

Health AL., Skeaff CM., Williams S., and Gibson RS., (2001). "The role of blood loss and diet in women", Public Health Nutrition, 4(2), 197-206.

Heaney R., Matkovit V., (1995). Inadequate peak bone mass In: Riggs B, Melton L Eds. Osteoporosis: Etiology diagnosis and management, 2nd Edition, Newyork, Raven Press,28.

Heath GW., Pratt M., Warren CW., Kann L., (1994). Physical activity patterns in American high school students, Results from 1990 youth risk behavior survey, Archives of Pediatrics and Adolescent Medicine, 148, 1131-1136.

Hertzter S R., Bao Chau H I., Saviano D A., (1996). How much lactose is low lactose? Journal of American Dietetic Association, 96, 243-246.

Hitendra G., Thakor., Pradeepkumar., VikasK desai Ratan K., srivastava., (2004). Physical growth standards for Urban Adolescents (10-15 years) from South Gujarat, Indian Journal of Community Medicine, 2(25), 1-9.

Hulecki .,and Mary Beth., (1988). "Psychological Abstracts", Ball State University, 119.

ICMR (1989). Growth and physical development of Indian infants and children, Technical report series, (18) New Delhi, 34-96

ICMR ., (2001). Micro nutrient deficiency disorders in 16 districts of India, ICMR Task force study district, Nutrition project, ICMR, New Delhi.

ICMR.,(1989). Growth and physical development Indian Infants and children, Technical report series No.18, Indian Council of Medical Research New Delhi.

Improvement of Nutritional Status of Adolescents, Report of the Regional Meeting Chandigarh, India 17-19 September (2002). WHO, Regional Office for South East Asia, New Delhi.

India Nutrition profile, New Delhi (1998). Government of India ministry of Human resource development, Department of Women and child development, 1-25.

Indian Council of Medical Research., (1972). Growth and physical development of Indian infants and children, Technical Report Series, 18, New Delhi.

Islam N., (2005). Obesity an epidemic of the 21st Century, The Journal of Pakistan .Medical Association, 25-26.

Iyer UM., Venugopal S., Gandhi HI., (2006). Obeisty in school children. Magnitude and risk factor analysis. ICMR funded Project report, Department of Foods and Nutrition. WHO collaborating centre for diet related non-communicable diseases and anemia control, MS University of Baroda, India

Jagmeet Madan., Anoop Misra., Priyalishah., Seema Gulati., Madhuri Nigudkar., Bhavikasha and Shwetajain., (2009) "Childhood obesity in India – Need for intervention programmes" ,Nutrition society of India, 41st National Conference, programme proceedings and abstracts, NIN, ICMR, Hyderabad.

Jaishree P., Jondhale., Snehalatha Reddy N., Vijaya M., and Nalwade., (2001). Nutritional Status of school going Adolescent girls of Parbhani , The Indian Journal of Nutrition and Dietetics, 38, 262-267.

Janssen J., KatzmarzykPT., Boyce WF., Vereecken C., Mulvihill C., Roberts C., (2005). The Health Behaviour in school aged children obesity working Group, Comparison of overweight and obesity prevalence in school aged youth from 34 countries and their relationships with physical activity and dietary patterns, Obesity Research , 6, 123-132.

Jaya Sudha Udipi ., (2003). Adolescent Nutrition, Nutrition, National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, 2(37), 2-31.

Jeffcoate T M., (1957). Principles Of Gyanocology, Butterworth London, 82.

Jelliffee DB., (1966). The assessment of nutritional status of the community, WHO monograph series, no.53, WHO. Geneva, 1966.

John T., Cherian A., (2001). Depressive disorders in the child and adolescent population, Indian Pediatrics, 38, 1211-1216.

Johnson A O., Semenya G., Buchows M S., (1999. Adaptation of Lactose mal digestion to continued milk intakes; American Journal of Clinical Nutrition, 58, 879-881.

Johnson G Jeffrrey., (2007). Extensive television viewing and the development of attention and learning difficulties during adolescence, Achieves Pediatric Adolescent Medicine 161 (5), 480-486.

Jolly Rajaratnam ., Rajaratnam Abel ., Asokan JS and Paul Jonathan(2000). "Prevalence of Anaemia among adolescent Girls of Rural Tamilnadu". Indian Pediatrics, 37, 532-536.

Joshi N., and Singh RR., (2002). Development and evaluation of educational materials for nutrition education, Indian journal of Nutrition and Dietetics, 39, 373.

Judith Ann Allender., Barbara Walton Spradlery.,(2005). Community Health Nursing promoting and protecting the public's Health, 6th edition, Lippincott Williams and wilkins, Pag No.656-660.

Judith Ann Allender., Barbara Watton Spradlery., (2005). Community Health Nursing promoting and protecting the Public's Health, 6th edition. Lippincott Williams and Wilkins, 656-660.

Judy Buttrise., Sara Stanner., Brigid Mc Kevith., Anne Nugenl., Colette Kelly., Frankie Phillips., Hannah Theobald., (2004). "In a critical review of the psychosocial basis of food choice and identification of tools to effect positive food choice, British Nutrition Foundation, 1-49.

K.Glanz., M.Basil., E.Maibach .,J. Goldberg, D.Snyder, (1998). Journal of American Dietetics Association 98 , 1118-1126.

Kalita B., Chaudhury PK., and Deka K., (2009). 'Prevalence of mental health problems in primary school children', Indian Journal of Psychiatry, Official Publication of the Indian Psychiatric Society, 51, 102.

Kalpana CA., and Lakshmi UK., (2009). Nutritional profile of selected overweight and obese school going children of Coimbatore City, Indian Journal of Nutrition & Dietetics, 46, 91.

Kalyan Bagchi ., (1999). The urgent need to uplift the health of Adolescent girls, The Indian Journal of Nutrition and Dietetics, 36, 127-130.

Kalyan Bagchi., (1999). "The urgent need to uplift the health of Adolescent girls, The Indian Journal of Nutrition and Dietetics, 36, 127-130.

Kamala Krishna moorthy.,Bhaskaran P., Bhat RV., Ghafoorunissa,Raghuram TC., Raghuramulu Siva Kumar B., and Vijayaragavan K., (2003). A Nutritionally adequate diet should be consumed through a wise choice from a variety of foods, Dietary guidelines for Indians, National Institute of Nutrition ,1—10.

Kannan A.T., (1995). Adolescent Health Issues and Concerns in India, Health for the Millions, May-June, Pg-29.

Kannan AT., (1995). "Adolescent Health issues and concerns in India, Health for the Millions, 29.

Kapil U., Singh P., Pathak P., Dwivedi SN., and Bhasin S., (2002). Prevalence of obesity amongst affluent adolescent school children in Delhi, Indian Pediatrics, 39, 449-452.

Kapil.U., Bhasin S., and Manocha S., (1991). Knowledge amongst adolescent girls about nutritive value of foods and diet during diseases, pregnancy and Lactation, Indian Pediatrics, 28(10), 1135-1139.

Kaur S., Deshmukh PR., and Garg BS., (2006). "Epidemiological correlates of Nutritional Anaemia in adolescent girls of Rural Wardha, Indian Journal of Community Medicine, 4(31).

Kavita Bisht and Rita S. Raghuvanshi ., (2007). "Effectiveness of Nutrition education on Vitamin A through comic book' and Audio Cassette". The Indian Journal of Nutrition and Dietetics 44, 391-396.

Kedar., and Singh Prasad., (1972). "Anxiety and Birth order", Journal of Psychological Researches, 16(2)..

Kirchengast., and Bauer MS., (2007). Menarche and Body composition,Coll Antropol, 31,419—425.

Kotecha P., Patel RZ., and Nirupam S., (2000). "Prevalence of anemia among adolescent school girls, Vadodara District, Vododara Government Medical College, Vadodara.

Krekoukia M., Nassis GP., Psara G., Skenderi K., Chrousos GP., Sidossis., (2007). Elevated total and central adiposity and low physical activity are associated with insulin resistance in children, Metab. Clin. Exp,6, 206-213.

Kulin HE., Bwibo N., Mutie D., and santher SJ., (1982). "The effect of chronic childhood malnutrition on pubertal growth and development, American Journal Clinical Nutrition , 36, 527-536.

Kumar AR., Yadav N., Gupta AK., Parvin K., Tripathi U., and Verma V., (2006). Influence of family's vegetable cultivation on prevalence of anaemia among adolescent girls, Indian journal of Nutrition and Dietetics, 43, 32-28.

Kumari S., and Singh S.,(2001).Nutritional status of children(6-12 years)belonging to schedule caste. A study in Samastipur district of Bihar, Indian Journal of nutrition and dietetics, 38,428-436.

Kundan Mittal., and Manish Kumar Goel., (2010) Knowledge Regarding Reproductive Health among Urban Adolescent Girls of Haryana, Indian Journal of Community Medicine , 35(4), 529–530.

Kurniawan YA., Muslimatun S., Achadi EL and Sastra S Midjojo.,(2006). Anemia and iron deficiency anemia among young adolescent girls from the peri urban coastal area of Indonesia, Asian Pacific Journal of Clinical Nutrition, 15,350-356.

Kurz K.M., and C. Johnson – Welch (1994). The Nutrition and Lives of Adolescents in Developing Countries: Findings from the Nutrition of Adolescent Girls Research Program, International Centre for Research on Women, Washington, DC.

Kurz KM., (1996). Adolescent nutritional status in developing countries, Proceeding of the Nutrition Society, 55.

Kurz KM., Johnson-Welch C., (1994). The nutrition and lives of girls in developing countries, Findings from the nutrition of adolescent girls research program. Washington, DC: International center for Research on Women.

Lawrence S., Neinsein Catherine M., Gordon Debra K Katzman ., David S Rosen., Elizabeth R and Woods., (2008).Adolescent health care, A Practical Guide Lippin Cott Williams &Wilkins 346,508.

Leena L., and Kumari KS., (2009) Fast food consumption among adolescent girls in Ernakulam, Research Reach, J H Sci , 1(8), 9-18.

Leon A., Myers M., and Connett J., (1997). Leisure time physical activity and the 16-year risks of mortality from Coronary Heart Disease and all causes in the multiple Risk Factor Intervention Trial (MRFIT). Internatioal Journal of Sports Medicine, 18 ,S208-215.

Leupker RV., Perry CL., MC Kinlay SM., Nader PR., Parcel GS and Stone EJ (1996). 'Out comes of a field trial to improve children's dietary patterns and physical activity',The Journal of American Medical Association 275, 768-776.

Lissner L., & Heitmann BL., (1995). Dietary fat and obesity evidence from epidemiology,European journal of Clinical Nutrition ,49,79-90.

Little JC., Perry DR., and Volpe SL., (2002). "Effect of nutrition supplements education on nutrition supplement knowledge among high school students from a low-income community", Journal of community Health, 27 (6), 433-50.

Lucky AN., and Biro FM Huster., Acne Vulgaris in early adolescent boys, Correlations with pubertal maturation and age, Archives of Dermatology, 127,210.

Ludwig DS., Peterson KE., Gortmaker SL., (2001). Relation between consumption of Sugar – Sweetened drinks and childhood Obesity: a prospective, observational analysis, Lancet, 357: 505-508.

.Lulinski B ., (2001). Eating challenges During the Adolescent Years, 2nd edition, Wolf Rinke Associates Inc., Clarksville, MD.

Mahajan BK and Gupta MC., (2003). Text Book of preventive and social medicine, 4th edition, New Delhi, Jaypee Publishers, 354, 358-9.

Mahajan S.,and Chaturvedi s.,(2007).Fast food consumption pattern of 13-18 year old children:Impact of school related factors, Parents and media.souvenir and Scientific Abstracts ,XI annual National convention Of IDA, Kottayam, India.

Mahshid Pirouznia., (2001). 'The influence of nutrition knowledge on eating behavior and the role of grade level', Nutrition & Food science, 2(31), 62-67.

Mani R., and Soflari M., (2006). "Nutrition education alone improves dietary practices but not hematologic indices of adolescent girls in Iran", Food Nutrition Bull, 27(3), 26-4.

Marshall WA., and de Limongy., Y (1976). Skeletal maturity and prediction
Matters R D., (1998). Dietary compensation by humans for supplemental energy provided as ethanol or carbohydrate in fluids, Physiology & behaviour , 59, 179-187.

Mckinley., (2005). 'Anaemia', The journal of Nursing, midwifery and paediatrics, 13 (2), 172-76.

Meera M., and Sreedevi V., (2009). "Nutrition education for Adolescents through Games", Nutrition society of India, 41st National Conference Programme, proceedings and Abstracts, NIN, ICMR, Hyderabad.

Merzenich H, Boeing H, Wahrendorf J (1993). Dietary fat and sports activity as determinants for age at menarche, American J of Epidemiology,138(4),217-224.

Merzenich H., Boeing H., Wahrendorf., (1993. Dietary fat and sports activity as determinants for age at menarche, American J of Epidemiology,138 (4),217-224.

Mitchell HS., (1964). Protein Limitations and Human Growth, American journal of Dietetic Association, 44, 165-72.

Moisan J., Meyer F., and Gingras S., (1991). Leisure physical activity and age at menarche, Med Sci Sports Exerc, 23(10), 1170-5.

Monge Rojas., (2005). 'Bio chemical indicates of nutritional status and dietary intake in costa Rican Cabecar Indian Adolescents', The food Nutrition Bulletin, 17(1), 3-16.

Morton J F., (1998). Changes in Children's total fat intake and their food group sources of fat 1989-91 versus 1991-95. Implications for diet quality, Family Economics & Review (Nutrition), 11, 44-57.

Muinck Keizer SM, Mul D.,(2001). Trends in pubertaldevelopment in Europe. Hum Reprod Update 7, 287-291.

Must A., Strauss A., (1999). Risks and consequences of childhood and adolescent obesity, International Journal of Obesity and Related Metabolic Disorder, 23, S2-S11.

Nair P., Grover V., and Kannan A.,(2007). Awareness and practices of menstruation and pubertal changes amongst unmarried female adolescents in a rural area of East Delhi, Indian Journal of Community Medicine, 32(2), 156.

Nakazato K., and Shimonka Y., (1989). "The STAI: age and sex differences", Department of Psychology, Tokyo Metropolitan, 62(2), 611-617.

Narasinga Rao., (1985) "Nutrient Requirement of Adolescents, Proceedings of NSI, 41-59.

Narasinga Rao., (1996). "Indian Nutrition profile Nutrition reviews, 5(60), 228-229.

Narasingarao BS., (1989). Nutrient requirements and RDA of girls and women in India, C.Gopalan and surminder Kaur, NFI Spl. Publications series 5,63-104.

Narayan K ., (2001). Puberty rituals, reproductive knowledge and health of adolescent schoolgirls in South India, Asia Pacific Population Journal, 16(2), 225-238.

Narayanan,Aruna,Srivatsva, Sushila (1993). Nutritional status, physical fitness and health,among rural and urban adolescent girls in Coimbatore district, NSI XXVI Annual conference abstracts NIN,Hyderabad.

Nassis GP., Papantakou K., Skenderi K., Triandafillopoulou M., Kavouras SA., Yanna Koulia M., (2005). Aerobic exercise training improves insulin sensitivity without changes in body weight, body fat, adiponectin and inflammatory markers in overweight and obese girls, Metab clin Exp, 54, 1472-1479.

National Nutrition Monitoring Bureau, prevalence of micro nutrient deficiencies (2003) National Institute of Nutrition Hyderabad.

National Restaurant Association., (2007). Restaurant Industry packet Fact Book. http//www.restaurant.org/store/c1660.html.2007 n.pag.

Neetu Gupta., and G.K.Kochar., (2009). "Role of Nutrition education in improving awareness among adolescent girls". The Internet journal of Nutrition, 1 (17).

Nelly., (1996). Anaemia and iron deficiency in adolescent students, The Journal of Clinical Nutrition, 9(7), 585-58.

Neutzling MB., Jaddei JA., Rodrigues EM., Sigulem DM., (2000). Overweight and obesity in Brazilian adolescents, International Journal of Obesity and Related Metabolic Disorder, 24, 869-74.

Niveditha., and Kumar AR., (1996). Nutritional status of hill primary school children, Souveniar and abstracts of scientific presentation in XXIX Annual National Conference of Indian Dietetic Association, Ludhiana, 101.

NNMB National Nutrition Monitoring Bureau., (2002). Diet and Nutritional status of rural populations ,Technical Report, No 21.

Noreen E Mohan., Adela Yarcheski Thomas., Yarcheski J., (2003). 'Anger, Anxiety and Depression early adolescents from intact and divorced families'. Journal of Pediatric Nursing, 18 (4) ,14.

Nurual Alam., Swapan Kumar Roy., Tahneed Ahmed and Shamsir Ahmed AM., (2010). 'Nutrition status, Dietary intake and relevant knowledge of Adolescent girls in rural Bangladesh, J Health Popul Nutr, 28(1), 86-94.

Nutrition Network News Letter (2001) update on Anaemia, No.6.

Oguntona CRB., and Kanye O., (1995).Contribution of street foods to nutrient intake by Nigerian Adolescents,Nutri.Health, 10, 165-171.

Olson C.M., (1987). Pregnancy in adolescents, A Cause for nutritional concern?, Professional Perspectives.

Omidvar Shabnam., (2010). Factors influencing hygienic practices during menses among girls from South India, A cross sectional study, International Journal of Collaborative Research on Internal Medicine & Public Health, (December).

OMS/WHO., (1998). Obesity preventing and managing the global epidemic Geneva. World Health Organization.

Padmavati V., Poosha DVR., Busi BR., (1984). A note on age at menarche and its relationship to diet , economic class , sibshipsize and birth order in 300 Andhra girls, Man in India, 2, 64,175-180.

Paeratakul S., Ferdirand D P., Champagne CM., Rijan DH., Blag G (2003). Fast Food consumption among children and adolescents. Dietary and nutrient intake profiel Journal of American Dietetic Association, 24, 1353-1359.

Pallavi G., and Roshan Habeeb., (2005)."Trends in food habits of rural and urban adolescents in the changing scenario", Indian Journal of Human Science 2(001), 106-115.

Parizkova J., (1996). Nutrition, Physical activity and Health in Early life. Boca Raton FL CRC Press.

Park K., (2003). "Park's text book of preventive and social medicine, 17th edition, Jabal Pur M/s.Banarsidas Bhanot Publishers, 12, 169, 422-24, 620.

Parvathi Rau,Leela raman, Visweswara rao., (1985). Procedings of Nutrition society of India, (31) NIN, Hyderabad,77-86

Parvathi Rav., Leela Raman., Visweswara Rao., (1985). Proceedings of Nutrition society of India NIN, (31), 77-86.

Parvin Mirmiran., Leila Azad., and Fereidowm Azizi., (2006). "Dietary behaviour of Tehranian adolescents does not accord with their nutritional knowledge, Public Health Nutrition.

Patton G C., M E Hibbert., J Carlin., Q Shao., M Rosier., J Caust, and G Bowes(1996). Menarche and the onset of depression and anxiety in Victoria, Australia, J Epidemiol Community Health, 50 (6), 661–666.

Paul D., (2007).A Report of an ICMR Funded Research Project, Knowledge and Practices of Adolescent Girls Regarding Reproductive Health with special Emphasis on Hygiene during Menstruation, New Delhi, National Institute of Public Cooperation and Child Development (NIPCCD).

Pereira M., Kartashov A., Ebbeling Certificate., Slattery M., Jacobs D., (2003). Fast Food meal frequency and the incidence of obesity and abnormal glucose homocostasis in young black and white adults: The Cardiac study: Miami FL: American Heart Association Annual Meeting: 69-73.

Pereira P ., Mehta S , (1983). Physical growth in adolescent girls of upper soico-economic group in Varanasi, Indian Journal of Medical Research, 77, 839-844.

Perry CL., Kelder SH., & Kleep K1., (1994), The rationale behind early prevention of Cardiovascular disease in young people . European Journal of Public Health 4, 156-162.

Peterson K E., and Gort Maker SL., (2001). Relation between consumption of sugar sweetened drinks and childhood obesity, Prospective, observational analysis, Lancet, 357, 505-508.

Pozo J., Argente J.,(2002). Delayed puberty in chronic illness. BestPract Res Clin Endocrinol Metab 16: 73-90.

Prabhakara GN., (2002) "Short text book of preventive and social medicine, 1st edition, New delhi, Jaypee Publishers, 123-4.

Prashant K., and chandan Shaw., (2009). Nutritional status of Adolescent girls from an urban slum Area in South India, Indian Journal of Pediatrics, 76, 59-62.

Prashanth Nayak .,(2010).Prism's Nursing practice Vol.5, Number 3 Page 105-108.

Priya Goswami., Rita Jain and Mridula D., (2009). Nutritional status of Punjabi adolescent girls from High Socio economic group, Indian journal of Nutrition and Dietetics, 46,118.

Raghunatha Rao D., Vijaya Pushpam T.,, Subha Rao GM., AntonyGM., and KVR Sarma.,(2007). 'Dietary habits and effect of two different educational tools on nutrition knowledge of school going adolescent girl in Hyderabad, India, European Journal of Clinical Nutrition ,61, 1081-1085.

Rajeswari K .,and Vijaya Lakshmi V., (2006). Nutritional Status of Pre adolescents by anthropometry J.Res.Angrau., 34, 32-36.

Rajni B., and Priti VT., (2004).Dietary intake of tribal girls of Dhar district of Madhya Pradesh, Scientific

Rajni Dhingra., Anil Kumar., and Manpreetkove., (2009). Knowledge and practices related to menstruation among Tribal (Gujjar) Adolescent girls, Ethno Medicine, 3(1), 43-48.

Ramachandran AM., and Snehalatha C., (2002). Prevalence of overweight in Urban Indian adolescent school children, Diabetic Research and Clinical Practice,57, 185-90.

Raman L ., (1990). Nutritional problems of adolescent girls, Proc Nutr Soc India , 36, 24-13.

Raman L.,(1990).Nutritional problems of adolescent girls, proceedings of nutrition society of India,36,34-42

Rana T., (1983). Age at Menarche – Nutritional status and other associated factors in urban Hyderabad girls, Ph.D Thesis submitted to National Institute of Nutrition, Hyderabad.

Rao DR., Vijayapushpam T., Subha Rao GM., Antony GM., and Sarma KV., (2007). "Dietary habits and effect of two different educational tools on nutrition knowledge

of school going adolescent girls in Hyderabad, India". European Journal of Clinical Nutrition 61(9), 1081-5.

Rao KM., Laxmaiah A., Venkaiah K., and Brahman GN., 2006, Diet and nutritional status of adolescent tribal population in nine states of India, Asian Pacific Journal of Clinical Nutrition,15(1): 64-71.

Rao RD, Vijaya pushpam T., Rao GMS.,(2007).Dietary habits of two different educational tools on nutritional knowledge of school girls in Hyderabad, India, European Journal of Clinical Nutrition, 61 (9), 1081-1085.

Rao Shobha., Kande Asawari., and Joshismita., (1993). "Height, Weight and menarcheal age of rural Indian girls, Indian Journal of Nutrition and Dietetics, 5(35), 117-128.

Report of the Regional meeting India 17-19, Sep-2002 WHO, Regional Office for South East Asia New Delhi, December 2002.

Report of the working Group on Adolescents for Tenth Five Year Plan (2002-2007) Planning Commission Government of India.

Richert V1., (1996). Adolescent Nutrition Assessment and Management, Newyork; Chapman & Hall,21.

Riddler MC., Thijssen HHJ., Veer PV., Dicruroe VR.,(1991). Dietary habits,Sexual maturation and plasma harmones-a longitudinal study, American journal of clinical nutrition, 54(5),805

Riddoch C., Savage J., Murphy N., Cran G., and Boreham C., (1991). Long term implications of fitness and physical activity patterns, Archives of Disease in Childhood, 66, 1426-1433.

Riet van t .,Ap den Hartog ., Am Mwang., RKN Mwadime., DWJ Foeken and WA van Staveren., (2001).The role of street foods in the dietary pattern of two low in come groups in Nairobi, European Journal Clinical Nutrition, 55,562-570.

Riley AP., Samuelson J.L., & Huffman S.L., (1993). The relationship of age at menarche and fertility in undernourished adolescents, In Gray, R.Leridon H., & Spira A., (eds) Biomedical Determinants of Reproduction, Clarendon Press, Oxford, pp.50-61.

Rokade SA Mane., (2009). A Study Of Age At Menarche, The Secular Trend And Factors Associated With It, The Internet Journal of Biological Anthropology ,2(3),17-21.

Rossander L.,(1979). Absorption of Iron from breakfast meals, American Journal of clinical Nutrition , 32, 2484-9.

Sadana B., Khanna M., and Mann Sk., (1997). Consumption patterns of fast Food among teenagers, Applied Nutrition, 22, 14-17.

Saibaba A., Mohan Ram M., Ramana Rao GV., Uma Devi and Syamala TS., (2003). "Nutritional status of Adolescent girls of urban slums and the impact of IEC (Information, Education and Communication) on their nutritional knowledge and practices". Indian journal of community Medicine ,28, 151-156.

Sameeh-A1 – Almaie., (2005). 'Knowledge of healthy diets among adolescents in eastern Saudi Arabia, Annuals of Saudi Medicine, 4(25), 294-298.

Santosh Jain Passi., and Anita Malhotra., (2005). Nutrition, Health and Developmental needs of adolescent girls, Press Information Bureau Govt. of India, Pg.1-3.

Sarma KVR, Udaykumar P, Balakrishna N, Vijayaraghavan K and Sivakumar B. Effect of micronutrient supplementation on health and nutritional status of school children: Growth and morbidity. Nutrition 2006; 22: S8-14.

Sarupriya S., and Mathew S., (1988).Nutritional status of tribal adolescents of village Goyunda,Rajasthan,Indian journal of Nutrition and Dietetics,25,281-287.

Satyanarayana K ., Naidu AN ., Swaminathan MC ., Rao BSN ., (1981). Effect of nutrition deprivation in early childhood on later growth – A community study without intervention, American Journal of Clinical Nutrition, 34, 1636-1637.

Savitha N., and Aruna Narayanan AC., (2007). Food Consumption pattern and Nutrient contribution of fast foods in school and college going girls, The Indian Journal of Nutrition and Dietetics, 44, 189-196.

Scholl T.O., M.L.Hediger., and A.G. Ances ., (1990). Maternal growth during pregnancy and decreased infant birth weight, American Journal of Clinical Nutrition 51, 790-793.

Seal AJ., (2005). Iron deficiency in African refugees, The journal of Nutrition, 135 (4), 808-13.

Serap S., Funda K., Devrim T K., Mehmet Z., Özgür S., (2009) . Factors affecting onset of puberty in Denizli province in Turkey, The Turkish Journal of Pediatrics, 51(1), 49-55.

Seshadri S, Sharma K, Saiyed F, Iyer U, Sharma S, Jumar JP, *et al.* Studies on Nutritional Anaemia in pre-adolescent and adolescent children (6-15 y) of upper income groups from three urban centers in India. Project report jointly from Department of Foods and Nutrition, MS University of Baroda, Lady Irwin College, New Delhi and Women's Christian College, Chennai, 1999.

Shaaban SY., Nassar MF., Ab d Elhamid DM., El-Batrawy SR., and Lasheen RA., (2009). 'Nutritional Knowledge and attitude of adolescent school girls living in Cairo, Research journal of Medicine and Medical Sciences, 4 (2), 421-427.

Shanthy A., Bowman., Steven L., Gort Maker., Cara B.Ebbeling., Mark Peneira and David S., Ludwig., (2004). "Effect of Fast-Food consumption on Energy intake and Diet quality among children in a National House Hold Survey', Pediatrics, 1(113), 112-118.

Sharma A K., Shukla D., Kannan AT., (2005). Calorie and Protein Intake and its Determinants among Adolescent School Girls in Delhi, Indian Journal of Community Medicine, 30(1) , 8-10.

Sharma M, Talwar G and Sharma N (1989). Age at menopause in relation to adult body size and physique, Human Biology, 15(6), 348.

Sharma I., (1998) 'Trends in the intake of ready to eat food among urban school children in Nepal'. SCN News, 16, 21-22.

Sharma S., (1993) "Food consumption pattern of adolescent girls belonged to HIG residence during in various parts of Bikaner, NSI XXVI Annual Conference Abstracts, NIN, Hyderabad, 50.

Shastree US., Malhotra KC., Kanhere GM., (1974) . Trend of menarche in seven Maharashtrian endogamous groups, Hum Popul Gen in India, 1, 240-250.

Shehab DK., (2005). Non specific low back pain in kuwaiti children and adolescents associated factors, Journal of Adolescence Health, 36 (1), 32-35.

Sheila John and Vidya Narasimhan., (2008). "Impact of Breakfast pattern on the nutrient intake, physical, cognitive and Academic performance of school children", The Indian Journal of Nutrition and Dietetics, 45, 54-62.

Shrine TW., Chapman., kabau DP., & Balluz., (2005). Associations of Self reported anxiety symptoms with health related quality of life ad health behaviors. Social Psychiatry and Psychiatric Epidemiology, 40, 432-438.

Shubhangna Sharma. , Shipra., and Goldy Chopra., (2009). Health Awareness of Rural Adolescent Girls: An Intervention Study, J Soc Sci, 21(2), 99-104.

Siddiq Osmani., and Amartyasen., (2003). "The Hidden penalties of Gender in equality Fetal origins of Ill-health, Economics and Human Biology, 1, 105-21.

Sidhu LS., and Grewal R., Age of menarche in various categories of Indian sportswomen (1980). British Journal of Sports Medicine,14,199-203.

Simon D. Puberty in chronically diseased patients.Horm Res 2002; 57: 53-56.

Singh GMP., (1986). Onset of menarche in girls of Ludhiana, Indian Pediatrics, 23, 263.

Singh N., Mishra CP., (2001). "Nutritional status of adolescent girls of a slum community of Varanasi, Indian Journal Public Health, 45, 128-134.

Skinner JD., Carruth BR., Moran Houk K., Schmidhammer J., Reed A., Coletla F., Cotter R., and Ott D., (1998). "Toddler's food preferences concordance with family members preferences", Journal of Nutrition Education, 30, 17-22.

Skjelbakken., (2005). Haemoglobin and anaemia in a gender perspective, The European journal of Haematology, 74 (5), 381-8.

Soekarjo S depee DD., Bloem MW., Tijiong R Yip R., Schreurs WHP.,and Muhilal (2001). 'Socio-economic status and puberty are the main factors determining anaemia in adolescent girls and boys in East Java, Indonesia', European journal of Clinical Nutrition, 55, 932-939.

Somna Sang., (1996) 'Report for scientific committee for food" 31st Serier Bruxelles Commission of the European Communities, 248.

Srihari G., Eilander A., Muthayya A., Kurpad AV., and (2007). Nutritional Status of Affluent Indian School Children: What and How Much Do We Know? Indian Pediatrics,199-203.

Srihari G., Eilander A., Muthayya S.,. Kurpad AV., and Seshadri S., (2007). Nutritional status of affluent Indian schoolchildren What and how much do we know, Indian Pediatrics ,44,199-203.

Srilakshmi B., (2000). Dietetics, published by New Age international (P) Ltd., New Delhi, 91-92.

Srinivasan R.,(1991). Rural nutrition demands special attention, journal of rural development,10,(5),460.

Staples FR., and Walters HR., (1981). "Anxiety, Birth order and susceptibility to social influence", Journal of Abnormal and social Psychology, 3(62),716-719.

Steptoe A., and Butler N., (1996). Sports participation and emotional well being in adolescents, Lancet, 347, 1789-1792.

Stewart ME., Downing DT., Cook JS., (1992). Sabaceous gland activity and serum de hydro epi andro sterone sulfate levels in boys and girls, Archives of dermatology, 128, 1345.

Storey KE., Forbes LE ., Fraser SN ., Spence JC ., Plotnikoff RC ., Raine KD ., Hanning RM ., McCargar LJ ., (2009). Diet quality, nutrition and physical activity among adolescents, the Web-SPAN (Web-Survey of Physical Activity and Nutrition), Project, Public Health Nutrition 12(11), 17.

Striegel MR., (1997). Risk factors for eating disorders In: Jacobson, M.S. Rees, J.M., Golden N, Irwin C (eds). Adolescent Nutritional Disorders: Prevalence and treatment, New York, Annals of the New York Academy of Sciences, 98-109.

Subha Rao GM., Raghunatha Rao D., Venkaiah K., Anil K Dube and Rameshwar Sarma KV.,(2006) "Evaluation of the Food and Agriculture organization's global school based nutrition education initiative, Feeding Minds, Fighting Hunger (FMFH) in schools of Hyderabad, India, Public Health Nutrition 9 (8), 991-995.

Sue Rodwell Williams., (1994). Essentials of Nutrition and Diet therapy, 6th Edition, New Delhi, Mosby Company, 152-154.

Sujatha T., Shatrugna V and Narasimha RaoGV., Chenna K., Reddy G.,Padmavathi KS and Vidyasagar P., (1997).Street food: an important source of energy for the urban worker,Food and nutrition Bull, 18, 318-322.

Sumati R., Mudambi and Rajagopal M V., (2005). Fundamentals of Foods and Nutrition, 246, Published by New Age International (P) Ltd., New Delhi.

Sunitha Kumari., and Sushila Sing., (2003). "Nutritional status of scheduled caste adolescents from deprived section society". Indian Journal of Nutrition and Dietetics, 40, 147-152.

Suraj Gupta MD., (2004). The short text book of pediatrics, 10th edition, New Delhi Jaypee brothers Medical Publishers (P) Ltd.

Swaminathan M., (1998). Advanced text-book on Food & Nutrition Volume-I, Published by the Bangalore printing and publishing Co.Ltd,361-371, 557.

Swaminathan M., (2005). Hand book of Food and Nutrition, The Bangalore Printing &Publishing Co.,Ltd, 181.

Tazeem Saeed Ali., and Syeda Naghma Rizvi., (2010). Mestrual Knowledge and Practices of female adolescents in Urban Karachi, Pakistan, 531-541.

Thakur ND., Amicof., (1999). "Relationship of nutrition knowledge and obesity in adolescence, Family Medicine, 31(2), 122-7.

Theresal Mendonca., Patsysera Castelino., (2010). Assessment of nutritional status and life style practices of the adolescents in selected high schools, Mangolore. Prism's Nursing Practice 3(5), 97-100.

Tiwari H OU., Tiwari R., (2006). Knowledge, attitudes and beliefs about menarche of adolescent girls in Anand district, Gujarat. East Mediterr Health journal, 12(3-4) , 428-33.

Tonesk and Tilford S., (1994). Health education in schools, In Health Education Effectiveness efficiency and equity, London Chapman & Hall, 121.

Tontisirin K., (2005). "Asian workshop on nutrition education – sharing expertise, "The Indian Journal of food science and Nutrition, 9(12), 16.

Troiano RP., Briejel RR., Carroll MD., and Bialostosky K., (2000) "Energy and fat intake of children and adolescent in the United States, Data from the National Health and Nutritional Examination Surveys, American Journal of Clinical Nutrition, 72, 1343-1353.

Troiano RP., Flegal KM., Kuczmasski RJ., Campbell SM., Johnson CL.,(1995), Overweight prevalence and trends for children and adolescents. Archives of Pediatrics and Adolescent Medicine, 149: 1085-1091.

Truswell As., Darnton.Hill I., (1981). "Food habits of adolescents, Nutr Rev 39(2), 73-88.

Turconi G., Guarcello M., Maccarini L., Cignoli F., Setti S., Bazzano R and Raggi C (2008). "Eating habits and behaviors, physical activity, nutritional and food safety

knowledge and beliefs in an adolescent Italian population", Journal of American College of Nutrition, 27(1), 31-43.

U.S. Department of Health and Human Services (1992). Physical Activity and Health A report of the surgeon General centers for disease control and prevention, National center for chronic disease prevention and Health promotion.

U.S.Department of Health and Human Services centers for Disease control and prevention, National center for chronic disease prevention and Health promotion. The president's Council on Physical Fitness and Sports.

Umbreit J., (2005). Iron deficiency: a concise review, The American journal of Hematology, 78(3), 225-31.

Usha Chandrasekar., (1997). Prevalence of anaemia inselected rural and urban areas of Coimbatore, The journal of nutrition and dietetics, 30(2), 29-36.

Varsha Z., and Rohini D., (2007). Effect of family income on nutritional status of selected adolescent girls of Marathwada Region, The India journal of Nutrition and Dietetics, 44, 356-366.

Varsha Zanvar., Rohini Devi., and Asha., (2007). "Height, Weight and Menarchial age and its associated problems among selected adolescent girls of Marathwada Region, Asian Journal of Home Science , 1&2(2), 46-51.

Varsha Zanvar., Rohini Devi., Asha Arya., and Nerlekar JP., (2007). 'Prevalence of Anaemia among selected adolescent girls of Marathwada Region'. The Indian journal of Nutrition and Dietetics, 44, 559-571.

Venkaiah K., Damayanthi KD., Nayak MV and Vijayaraghavan K., (2003). Diet and nutritional status of rural adolescents in India, Nutrition News, National institute of Nutrition 24, 1-4.

Venkaiah K., Damayanti K., Nayak MV., and Vijayaraghavan K., (2002). Diet and Nutritional status of rural adolescents in India, Eureopean Journal Clinical Nutrition, 56, 1119-1125.

Verma A., Rawal VS., Kedia G., Kumar D., Chauhan J., (2004). "Factors influencing Anaemia among girls of school going age (6-18 years) from the slums of Ahmedabad City,' Indian Journal of Community Medicine,1(19),25.

Verma M., Chhatwal J., Kaur G., (1998). Prevalence of anemia among urban school children of Punjab. Indian Pediatr 35, 1181-1186.

Vijaraghavan K., Darshan Singh., Swaminathan MC., (1971). Heights and weights of well-nourished Indian school children, Indian Journal of Medical Research, 59, 648-54.

Vijaya Pushpam T., Menon KK., Reghunatha Rao D., and Maria Antony G., (2003). A qualitative assessment of Nutrition Knowledge levels and dietary intake of school children in Hyderabad.

Vijayapushpam T., Menon KK., Rao DR., Antony GM., (2003). A qualitative assessment of nutrition knowledge levels and dietary intake of school children in Hyderabad. Public Health Nutr 6, 683-688.

Vijayata Sengar., Kavitha Sharma., Uma Iyer., and Saumya Dave., (2009). Assessment of the nutritional determinants of malnutrition among rural adolescent school children along with development of health eating index and a food behaviour checklist to assess the quality of their diet. Nutrition society of India 41st National Conference 20-21 Nov, Programme, Procedings & abstracts, NIN, ICMR, Jamai Osmania P.O.Hyderabad.

Villani S., (2001). Impact of Media on children and adolescents a 10 year review of the research, journal of American Academy of child and Adolescents Psychiatry, 40 (10) ,1124.

VK Rai., and VC Yadava., (1993). 'A study of mental health of Higher Secondary Students in relation to Socio-Econimic status', Journal of Psychological Researches, 1(37), 39-46.

Webb RE., and Hyatt SA., (1988). Hatian street foods and their nutritional contribution to dietary intake ,.Ecol. Food. Nutri,21, 199-209.

WHO (2001). The World Health reports 2001 Mental Health, New understanding new hope, Geneva, The World Health Organization.

WHO (2002). The World Health Report, Pg.13.

WHO ., (2003). Adolescent Nutrition in South East Asia, A Review of the current situation, Draft World Health Organization, Geneva, Regional Office of South-East Asia, New Delhi.

WHO, 1998, Adolescence, The Critical Phase, The Challenges and the Potential, WHO, Regional Office of the South East Asia, New Delhi.

WHO.,(2000). The World Health Report 2000 Health Systems, Improving performance Geneva, World Health Organization.

Wiecha JL., (2006). Impact of television viewing on dietary intake in youth, Archives pediatric Adolescence Medicine, 160 (4), 436-442.

World Health Organization., (1998). Nutrition status of adolescent girls and women of reproductive age,Report of Regional consultation, Geneva, World Health Organization, SE A/NUT/141,3.

World Health Organization., (1998). Obesity Preventing and Managing the Global Epidemic Report of a WHO consultation on obesity Geneva, World Health Organization (WHO/NUT/NCD/98.1).

Yegammai and Gandhimathy., (1993). "Impact of iron fortified supplementation and nutrition education in selected anaemic adolescent girls', The Indian journal of nutrition and dietetics, 31 (1) 21-24.

Yustina Anie., Indriastuti Kurniawan., Sitimuslimatun Endang L achadi and Soemilah Sastromidijojo., (2006). Anaemia and Irondeficiency anaemia among young adolescent girls from peri urban coastal area of Indonesia' Asian Pacific Journal of Clinical Nutrition, 15(3) 350-356.

APPENDICES

Permission Le.

From

A. Anbu malar,
Lecturer in N&O,
Rani meyyammai College of Nursing,
Annamalai University

To

The Head master
Venus matriculation Higher
- Secondary school
chidambaram.

Respected Sir.,

I request you to kindly permit me to collect data for my research study (Ph.D) from the students of your school.

Yours sincerely
A. Anbumalar.

Chidambaram.
22.08.07.

Permitted

PRINCIPAL,
VENUS MATRICULATION
HIGHER SECONDARY SCHOOL
CHIDAMBARAM.

From

A. Anbumalar,
Lecturer in N&O,
Rani meyyammai college of Nursing,
Annamalai University.

To

The Head Master
Govt. girls higher secondary school,
Chidambaram.

Respected Sir.,

I request you to kindly permit me to collect data for my research study (Ph.D) from the students of your school.

Thanking you Sir.

Yours sincerely
A. Anbumalar

Permitted
17.8.08
தலைமை ஆசிரியர்,
அரசு மகளிர் மேனிலைப்பள்ளி
சிதம்பரம் - 608 001.

From

A. Anbumalar
Lecturer in NED
Rani meyyammai College of Nursing
Annamalai University

To The Principal
Kamaraj Matriculation Hr. Sec. School.
Chidambaram.

Respected Madam,

I request you to kindly permit me to collect data for my research study (Ph.D) from the students of your school.

Thanking you Madam.

Yours sincerely

A. Anbumalar
14/10/09.

Chidambaram
14.10.09.

G. Shanthi
14/10/09
PRINCIPAL
KAMARAJ MATRICULATION
HIGHER SECONDARY SCHOOL
CHIDAMBARAM - 608 001.

QUESTIONNAIRE TO ASSESS NUTRITION STATUS, ANXIETY LEVEL AND HEALTH AWARENESS AMONG PRE PUBERTAL AND POST PUBERTAL GIRLS

Part – A: Background information **Reg.No.**

1. Name of the Student :
2. School Name :
3. Age & Date of Birth :
4. Educational Status : VI/ VII/ VIII/ IX
5. Residential Status : Hostler / Day Scholar
6. Educational status of father
   a) Illiterate
   b) Primary
   c) High School
   d) Higher secondary
   e) College Education
7. Educational status of mother
   a) Illiterate
   b) Primary
   c) High School
   d) Higher Secondary
   e) College Education
8. Occupation
   Father :
   Mother :
9. Family income (monthly)
10. Total number of members in the family :
11. Birth order (place) in the family : Only child / 1st/ 2nd /3rd and above
12. Type of family : Nuclear/joint/separated family

13. Place of residence

    a) Urban

    b) Rural

14. Religion

    a) Hindu

    b) Christian

    c) Muslim

    d) Any other (specify)

15. Have you attained menarche? Yes/No

    If yes, at what age?

    At---------- years

16. What is the menarcheal age of your mother? ----------

17. From whom you got first information about menarche? ----------

2.1 Part B – Nutritional Status Assessment

1. Height in Cm :
2. Weight in kg :
3. BMI (Weight in kg/Height in m^2) :

2.2 Food habits

a) Vegetarian

b) Non Vegetarian

c) Ova Vegetarian

2.2.1 Food Recall Method

Instruction:

1. Kindly mention the amount in cups/gms or in Number for each item. For e.g. idly/dosai in number, Rice in Cup
2. Consider 1 cup= 100gms, ½ cup = 50gms, ¼ cups = 25 gms.

	Day 1	Day 2	Day 3
	One day of the Week	Last Saturday	Last Sunday
Early morning 6-7 am			
Breakfast			
Lunch			
Evening			
Dinner			
Bed time			

2.2.2 Food likes and dislikes

As per your likes and dislikes tick (✓) each item

Sl. No.	Food items	Liking food	Disliking food
1	Ice cream		
2	Sweet		
3	Snacks with chilli taste		
4	Cool drinks		
5	Vegetables		
6	Fruits		
7	Greens		
8	Sundal		
9	Vegetable Salad		
10	Bakery foods		

2.3. Deficiency Diseases

Sl. No.	Clinical Symptoms	Yes	No
1	Pale conjunctiva		
2	Angular Stomatitis		
3	Mouth Ulcer		
4	Dental Caries		
5	Bleeding gums		
6	Phrynoderma		
7	Pallor		

2.3.1 Hemoglobin level :

2.4 Health Problems

2.4.1. Health Problems related to Puberty

Sl. No.	Clinical Symptoms	Yes	No
1	Development of Pimples		
2	Stomach Ache		
3	Increase in body weight/sudden growth		
4	Muscle pain (in legs)		

2.4.2. Methods to alleviate menstrual pain

Sl. No.	Methods	Yes	No
1	Tablets		
2	Fruit Juice		
3	Butter Milk		
4	Any other		

2.4.3. Attitudes towards Menarche

Sl. No.	Attitude	Yes	No
1	Felt boring		
2	Uncomfortable		
3	Undesirable because of customs and tradition		
4	Desirable		
5	Neither happy nor unhappy		
6	Any other		

2.4.4. Special Foods given at the time of puberty

Sl. No.	Type of food	Yes	No
1	Sweets		
2	Raw egg		
3	Ulundhu Kali		
4	Gingelly Oil		
5	Pongal		

2.4.5. Special Supplements for Post Pubertal girls

Sl. No.	Type of supplement	Yes	No
1	Multi Vitamin/Multi Mineral		
2	Protein Supplement		
3	Iron Supplement		
4	Any other		

2.4.6. Menstrual Management

Sl. No.	Menstrual Management	Yes	No
1	**Type of material** Disposable pads cotton cloth material		
2	**Storage of Napkin** Stored in cupboards or drawers Stored in dress cabinet Stored in bathroom Stored in outside of the house		
3	**Practice of changing** Once a day Twice a day 3 times a day More than 3 times		
4	**Disposal of Napkins** Disposed (Ready made pads) Disposed (Cotton cloth) Re use the cotton cloth		
5	**Personal hygiene during mensus** Practice of bathing daily Once in 2 days Once in 3 days Hand Washing after changing napkin With water With soap and water		

Part – C MANIFEST ANXIETY SCALE

You are requested to go through the following statements carefully and respond to each of the statement in either 'Yes' or 'No'

		Yes	No.
1.	I ought not to listen people saying that you are a fool		
2.	I often dream while sleeping at night		
3.	I often fear that something might not happen to my parents		
4.	Whenever I commit a mistake, I feel nervous		
5.	I can't talk frankly to anybody		
6.	People easily take help from me but I can't do so with anybody		
7.	Sometimes I feel very nervous, when I don't know why such situations happens with me		
8.	I have difficulty in taking decisions		
9.	I am worried over that what will people say		
10.	I am worried about my future		
11.	I am very much dejected when anyone criticizes me		
12.	I fear darkness		
13.	I cannot easily mix up with people		
14.	I often fear that people may not know about me		
15.	Sometimes I escape even from my friends		
16.	I quickly feel mentally tired		
17.	I fear illness		
18.	Often I have to work unwillingly		
19.	I always speak the truth due to which I face much difficulties		
20.	I feel bore due to heavy load of work		
21.	I often find my nearest surroundings as monotonous		
22.	I fear in traveling alone		
23.	While sleeping at night I often awake with fear		

24.	The trouble with me is that I don't get good friends		
25.	I often worry that people may not understand my difficulties		
26.	I am anxious to complete my every work in time		
27.	I never say that which I should not say		
28.	On seeing people in distress I feel very much sad		
29.	I am always eager to know what others are doing rather than myself		
30.	I always worry that my friends may go ahead of me		
31.	When people rather than seeing my ability, say that I have attained success through illegal sources, I become annoyed or angry.		
32.	I take much time in crossing the road, fearing that some accident may take place		
33.	I am worried over that people may think wrong of me		
34.	I always feel that my brothers and sisters do not love me as much my friends do		
35.	My hands often get perspired		
36.	Even the smallest event frightens me		
37.	I am worried over my physical constitution		
38.	I cannot sleep peacefully		
39.	I often see fearful dreams		
40.	I worry that people may make fun of me		

Part –D – Related to Nutrition knowledge and health awareness

I Nutrition knowledge

1-A General aspects of nutrition

(Instruction: you are requested to circle the statement number which you think is correct)

1. What is the meaning of the term nutrition?
   - 1.1 Science of foods
   - 1.2 Science of health
   - 1.3 Science of nature
   - 1.4 Don't know
2. Why do we need food?
   - 2.1 For our growth and health
   - 2.2 For dreams
   - 2.3 To speak
   - 2.4 Don't know
3. What do you mean by food groups?
   - 3.1 Foods classified into different groups depending upon the nutritive value
   - 3.2 All vegetarian foods grouped together
   - 3.3 All Non vegetarian foods grouped together
   - 3.4 Don't know
4. What is the role of food groups?
   - 4.1 Important to plan balanced diet
   - 4.2 Important to know the meaning of food
   - 4.3 Important to determine the size of food
   - 4.4 Don't know
5. What is the meaning of the term balanced diet?
   - 5.1 Diet which contains more carbohydrate and fat
   - 5.2 Diet which contains carbohydrate, protein, fat, vitamins and minerals in correct proportion
   - 5.3 Diet which contains more minerals
   - 5.4 Don't know

I. B. Related to functions of nutrients

6. What is the main function of carbohydrate?
   - 6.1 Body building
   - 6.2 Energy yielding
   - 6.3 Protection
   - 6.4 Don't know
7. What is the main function of protein?
   - 7.1 Body building
   - 7.2 Protection
   - 7.3 Energy Yielding
   - 7.4 Don't know
8. What is the main function of vitamins and minerals?
   - 8.1 Energy yielding
   - 8.2 Protective
   - 8.3 Body building
   - 8.4 Don't know
9. What is the main function of calcium?
   - 9.1 Teeth and bone formation
   - 9.2 Hair growth
   - 9.3 To increase number of brain cells
   - 9.4 Don't know
10. What is the main function of iron?
   - 10.1 Haemoglobin formation
   - 10.2 Muscle development
   - 10.3 Bone development
   - 10.4 Don't know
11. What is the main function of Vitamin A?
   - 11.1 For providing proper vision and protects from infection
   - 11.2 For providing more energy
   - 11.3 For providing knowledge
   - 11.4 Don't know

I.C. Related to Sources of Nutrients

12. What is the rich source of Carbohydrate?
    - 12.1 Cereals
    - 12.2 Oil
    - 12.3 Vegetables
    - 12.4 Don't know
13. What are the rich sources of protein?
    - 13.1 Fruits
    - 13.2 Vegetables
    - 13.3 Milk, meat and pulses
    - 13.4 Don't know
14. What are the rich sources of fat?
    - 14.1 Nuts and oil seeds
    - 14.2 Fruits
    - 14.3 Vegetables
    - 14.4 Don't know
15. What are the rich sources of calcium?
    - 15.1 Ragi, milk and leafy vegetables (Greens)
    - 15.2 Maize
    - 15.3 Orange
    - 15.4 Don't know
16. What are the rich sources of iron?
    - 16.1 Rice flakes, mint, dates and liver
    - 16.2 Raw rice, maida and sooji (Rava)
    - 16.3 Milk and milk products
    - 16.4 Don't know
17. What are rich sources of Vitamin A (β Carotene)?
    - 17.1 Yellow fruits and vegetables
    - 17.2 Rice
    - 17.3 Wheat
    - 17.4 Don't know

18. What is the rich source of Vitamin B?

    18.1 Whole cereals

    18.2 Milled cereals

    18.3 Vegetables

    18.4 Don't know

19. What is the rich source of Vitamin C?

    19.1 Citrus fruits

    19.2 Milk

    19.3 Cereals

    19.4 Don't know

I.D. Related to normal amount of food stuff

20. What is the normal amount of cereals required for your age group?

    20.1 300 gms/day

    20.2 270 gms/day

    20.3 600 gms/day

    20.4 Don't know

21. What is the normal amount of pulses required for your age group?

    21.1 30 gms /day

    21.2 60 gms/day

    21.3 75 gms/day

    21.4 Don't know

22. What is the normal amount of green leafy vegetables required for your age group?

    22.1 25 g/day

    22.2 50g/day

    22.3 100 g/day

    22.4 Don't know

23. What is the normal amount of fruits required for your age group?

    23.1 25 g/day

    23.2 50g/day

    23.3 100 g/day

    23.4 Don't know

24. What is the normal amount of other vegetables required for your age group?

24.1 25 g/day

24.2 50g/day

24.3 75 g/day

24.4 Don't know

25. What is the normal amount of water needed for your age group?

25.1 less than 500ml

25.2 500-1000 ml

25.3 Above 2500 ml

25.4 Don't know

I.F. Related to dietary habits

Note: Please read the following statements carefully you may choose answer in 5 ways as mentioned below

SA - Strongly agree

A - Agree

UC - Undecided

DA - Disagree

SDA - Strongly disagree

Sl.No.	Statement	SA	A	UC	DA	SDA
1.	Habit of taking seasonal fruits is a good practice					
2.	Excessive hot foods (pungent task) are good to health					
3.	Bottled cool drinks are good for health					
4.	Cut the vegetables into bigger pieces to prevent the loss of nutrients					
5.	It is necessary to take green leafy vegetables daily					
6.	It is good to take raw vegetables daily					
7.	It is good to take adequate water					
8.	Dieting is not good to health					

9.	Avoiding all the non vegetarian foods and milk is not a problem to get adequate amount of Vitamin B_{12}					
10.	Skipping a meal daily is a good practice					

II. Health problems related to pre pubertal and post pubertal age group

(Instruction: you are requested to circle the statement number which you think is correct)

1. What are the common nutritional problems in your age group?
   - 1.1. Under weight, Obesity, Anaemia and Anorexia nervosa
   - 1.2. Renal diseases, Diabetes and Gall bladder disease
   - 1.3. Hypertension, cancer and Tuberculosis
   - 1.4. Don't know
2. What do you mean by underweight?
   - 2.1 Body weight below normal weight according to the age
   - 2.2 Body weight below normal weight
   - 2.3 Body weight below 20 kg
   - 2.4 Don't know
3. What is the main reason for under weight?
   - 3.1 Adequate intake of food
   - 3.2 Inadequate intake of food according to the age
   - 3.3 Intake of food less than 100gms
   - 3.4 Don't know
4. How do you control underweight?
   - 4.1 By intake of minimum food
   - 4.2 By intake of balanced, adequate food according to the age
   - 4.3 By food intake, once a day
   - 4.4 Don't know

5. What are the complications of under weight?
    5.1 Anaemia, mal nutrition and infectious diseases
    5.2 Liver diseases
    5.3 Heart diseases
    5.4 Don't know
6. What do you mean by obesity?
    6.1 Excessive body weight according to their age
    6.2 Body weight above 40 kg
    6.3 Body weight above 50 kg
    6.4 Don't know
7. What is the main reason for obesity?
    7.1 Excessive intake of food and inadequate physical activities
    7.2 Consumption of more greens
    7.3 Excessive exercise
    7.4 Don't know
8. How do you control obesity?
    8.1 By taking adequate food according to age and regular exercises
    8.2 By taking minimum amount of green leafy vegetables
    8.3 By taking sweets
    8.4 Don't know
9. What are the complications of obesity?
    9.1 Cardiac diseases, Diabetes mellitus and hypertension
    9.2 Liver diseases
    9.3 Anaemia
    9.4 Don't know
10. What do you mean by anemia?
    10.1 Low level of Haemoglobin in blood
    10.2 Low level of Oxygen in blood
    10.3 Low level of fat in blood
    10.4 Don't know

11. What are the main causes for anemia?
    11.1 Low iron intake, worm infestation and excessive blood loss
    11.2 Over eating and consumption of more fruits
    11.3 Diabetes mellitus and hypertension
    11.4 Don't know
12. How do you control anemia?
    12.1 By taking carbohydrate rich foods
    12.2 By taking iron and protein rich foods
    12.3 By taking fat rich foods
    12.4 Don't know
13. What is the complication of anemia?
    13.1 Easy fatigability
    13.2 Blood cancer
    13.3 Convulsions
    13.4 Don't know
14. What do you mean by anorexia nervosa?
    14.1 Voluntarily refusal of food leading to severe weight loss and wasting
    14.2 Depression
    14.3 Low body weight
    14.4 Don't know
15. What is the main cause for Anorexia nervosa?
    15.1 Fasting or dieting
    15.2 Taking only liquids
    15.3 Taking oily foods
    15.4 Don't know
16. How do you control anorexia nervosa?
    16.1 Behavior modification counseling and taking balanced diet
    16.2 Eating more sweets
    16.3 Eating more snacks
    16.4 Don't know

17. What are the complications of anorexia nervosa?

17.1 Anaemia and frequent infections

17.2 Constipation and renal failure

17.3 Paralysis

17.4 Don't know

18. What do you mean by menstrual hygiene?

18.1 Changing the napkins whenever necessary and washing the area with soap and water

18.2 Living in a clean house during menstruation

18.3 Wearing clean dresses

18.4 Don't know

19. What are the effects of poor menstrual hygiene?

19.1 Burning sensation while passing urine, urinary tract infection (UTI)

19.2 Renal stones

19.3 Liver diseases

19.4 Don't know

20. How do you control urinary tract infection?

20.1 By proper menstrual hygiene

20.2 By diet rich in calcium

20.3 Don't know

III General Health Problems

(Instruction: you are requested to circle the statement number which you think is correct)

1. Communicable disease means

1.1 Which can be transmitted directly from one person to another

1.2 Which can't be transmitted directly from one person to another

1.3 Blood related diseases

1.4 Don't know

2. Various communicable diseases are
    2.1 Tuberculosis, Acquired Immuno deficiency syndrome (AIDS), Hepatitis
    2.2 Hypertension, Cancer, Psychiatric problems
    2.3 Diabetes mellitus
    2.4 Don't know
3. Various causes of communicable diseases are
    3.1 Micro organisms, Water, Air, Physical contact, Body fluids
    3.2 Medicines, over eating
    3.3 Excessive sleeping
    3.4 Don't know
4. Various health tips to prevent or overcome communicable disease are
    4.1 Clean habits, away from various sources of infection
    4.2 Regular exercise and physical activity
    4.3 Regular work
    4.4 Don't know
5. Non communicable disease means
    5.1 Which can be transmitted directly from one person to another
    5.2 Which can't be transmitted directly from one person to another
    5.3 Blood related diseases
    5.4 Don't know
6. Various non communicable diseases are
    6.1 Tuberculosis, AIDS
    6.2 Hypertension, Diabetes, Cancer, psychiatric problems
    6.3 Hepatitis, fever
    6.4 Don't know
7. Various causes of non communicable diseases are
    7.1 Micro organisms, Air, Water
    7.2 Genetic factor, Habits, Stress
    7.3 Physical contact and body fluids
    7.4 Don't know

8. Various health tips to prevent or overcome non communicable disease are
   8.1 Balanced diet, Healthy habits and regular exercise
   8.2 Eating more amount of fatty food items
   8.3 Fasting
   8.4 Don't know
9. Degenerative disease is
   9.1 Disease which become worse with aging
   9.2 Disease which affect only females
   9.3 Disease which affect only children
   9.4 Don't know
10. Example for degenerative disease
   10.1 Osteo Arthritis
   10.2 Fever, Jaundice
   10.3 Hypertension
   10.4 Don't know
11. Various causes of degenerative disease are
   11.1 Aging, Faulty dietary habits
   11.2 Micro organisms ,Inadequate exercise
   11.3 Body fluids
   11.4 Don't know
12. Various health tips to prevent or overcome degenerative disease are
   12.1 Adequate physical activities, balanced diet and free from stress
   12.2 Excessive physical activities, Excessive food intake
   12.3 Low physical activity and minimum food consumption
   12.4 Don't know

Part E

Informal Questionnaire to be filled by parents

(For the amount of time spent consider 3 days activity of your daughter)

1. Physical activity (Exercise/Sports/Yoga)

   Does your Daughter involve in any of the above activity daily?

   Yes/No

2. If yes means, what type of Exercise/Games?

   Indoor/Out door (outdoor (example) – Energy Consuming activities like cycling and playing cricket)

3. How long your daughter play?

   1) Less than half an hour
   2) Half an hour to one hour
   3) More than one hour

4. What is your daughter's mode of transport to school?

   - Active means (Walking/cycling)
   - In active means (bus/Two wheeler)

5. Tick and mention the amount of time spent by your daughter for (Sedentary activities) Watching television/playing video games.

   1) Less than half an hour
   2) Half an hour to one hour
   3) More than one hour
