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AGE AT MENARCHE AND NUTRITIONAL STATUS OF URBAN SCHOOL GIRLS

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**Thesis submitted in partial fulfilment of the requirement
for the degree of**

**Master of Science in Home Science
(Food Science and Nutrition)**

**Faculty of Agriculture
Kerala Agricultural University, Thrissur**

2007



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DECLARATION

I hereby declare that this thesis entitled "Age at Menarche and Nutritional Status of Urban School Girls" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award of any degree, diploma, associate ship, fellowship or other similar title, of any other university or society.

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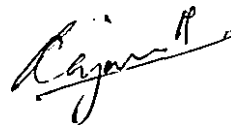
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CERTIFICATE

Certified that this thesis entitled “Age at Menarche and Nutritional Status of Urban School Girls” is a record of research work done independently by Ms. Reshmi. R (2005-16-101) under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associate ship to her.

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ACKNOWLEDGEMENT

I am grateful to 'God' who provided me the strength and zealots to fulfill the task in a satisfactory manner. I am indebted for the numberless blessings that the God showers upon my life. Let me also express my heartfelt gratitude for being a main stay in the big and small things of the entire study.

*Let me place on record my profound feelings of gratitude and indebtedness to the Chairman of the Advisory Committee, **Dr. M. Rajani**, Associate Professor, Department of Home Science for her noteworthy guidance, constant encouragement, motherly affection and sincere help during the course of investigation and in the execution of this thesis. This work would not have been possible without her valuable help and support.*

*I would profess my sincere gratitude to **Smt. N.K. Vimalakumari**, Associate Professor and Head, Department of Home Science, for her continual and timely advice, constructive criticism and expertise at all the stages of my work.*

*I am much grateful to **Dr. S. Chellammal**, Professor, Department of Home Science for extending timely and helpful advice and friendly approach during the course of this work.*

*My sincere thanks to **Dr. Vijayaraghavakumar**, Professor, Department of Agricultural Statistics for his guidance and suggestions in the preparation of schedule and in the process of statistical analysis of the data collected.*

*I greatly acknowledge the patron of College of Agriculture, the **Dean** for providing me all necessary facilities from the University during the whole course of study.*

I greatly acknowledge the co-operation rendered by Principal and Teachers of Cotton Hill School for their help in the data collection. I also wish to record my gratitude to the students for their wholehearted co-operation which enabled me for the generation of data and completion of my investigation.

*I have intense pleasure in expressing my deep sense of gratitude to **Dr. M.P. Eswari BAMS**, Registered Medical Practitioner of Devaki Health Care Centre for carrying out clinical examination for this work.*

I express my sincere thanks to Mary Teacher, Syama Teacher, Prasanna Teacher, Soffie Teacher, Nandini Teacher, Nirmala Teacher, Rari Teacher, Geetha Teacher and Suma Teacher for their noteworthy teaching and wholehearted co-operation during the whole course of study.

A special thanks to my friend Reshmi Raj for helping in the data collection.

Heartfelt thanks to my friends Lakshmi. V, Soumya, M.S. and Sadaf Aleem for their wholehearted co-operation during the whole course of study and offering me their help during a period when the demands of their own research work were quite compelling.

I am most indebted to my loving parents for their affection, constant encouragement, moral support and blessing that have enabled me to complete this work. A special thanks to my father for helping me in typing the thesis and also to my brother who has been the source of inspiration throughout my success.

*Reshmi R
(2005-16-101)*

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LIST OF ABBREVIATIONS

| | | |
|------|---|---|
| BMI | - | Body Mass Index |
| CED | - | Chronic Energy Deficiency |
| EHPA | - | Eliz Health Path for Adolescents |
| EMR | - | Early Menarche Respondents |
| LMR | - | Late Menarche Respondents |
| ICMR | - | Indian Council of Medical Research |
| NFHS | - | National Family Health Survey |
| NIN | - | National Institute of Nutrition |
| NNMB | - | National Nutrition Monitoring Bureau |
| NSI | - | Nutritional Status Index |
| RDA | - | Recommended Dietary Allowances |
| RTIs | - | Reproductive Tract Infections |
| TST | - | Triceps Skin fold Thickness |
| USDA | - | United States Department of Agriculture |
| WHR | - | Waist Hip Ratio |

*Dedicated to
My Family*

INTRODUCTION

1. INTRODUCTION

Children are valuable assets of a nation and they are the potential parents of tomorrow. The quality of life which they enjoy today would ultimately determine the quality of future population. Because of this, prime importance should be given to their health and nutrition, recreational and educational facilities (Sandhya, 1989). The quality of human resources of any country is largely determined by the quality of its child development which in turn is a reflection of health and nutritional status (Jyotilakshmi and Jamuna, 2004).

Children in the age group of 5 to 15 years are often considered as school age and constitute a significant proportion of the total population in India (Rao et al., 1984; Sachdeva et al., 2003). School age group is very important because this is the period of transition which is known as “adolescence”. The period of adolescence are arbitrarily divided into different stages based on growth characteristic. They are pre adolescence (10 to 11 years), early adolescence (11 to 14 years) and adolescence (14 to 16 years) (Jayanthi , 2000).

Adolescents, constitutes about 115 crore of the world population and they form about 22.80 per cent of Indian population (Indira, 2001) and 8.25 to 8.70 per cent of Kerala population (Chandrika, 2001).

According to Elizabeth (2005) adolescence is a period of rapid growth and perhaps the last chance to grow. Adolescent growth is linked to the onset of puberty (Elizabeth, 2000). Puberty is the stage of maturation which is accompanied by pubertal growth spurt along with the development of sexual characteristics resulting

in the attainment of reproductive capability and finally growth cessation (Sangita, 2004).

Adolescence is one of the most challenging periods in human development especially for girls (Esfarjani et al., 2003) The young girls are an important section of our society as they are the potential mothers and future home makers (Bogin, 1988). The nutritional and health status of women is an important determinant of child's nutritional status from conception onwards (Kesharee et al., 1981). Girls' health plays an important role in determining the health of future population. Adolescence in girls has been recognized as a special period in their life cycle that requires specific and special attention. Health and nutritional needs of adolescent girls are mostly neglected than boys during early days (Shivapuri, 1990).

Safe and successful child bearing depends on the health and readiness of the mother so special attention should be paid to the health, feeding and education of girls (FPAI, 1993).

Adolescence is the crucial phase of growth since it offers the second and last chance for the catch-up growth in the life cycle of girls. It is one of the fascinating periods in the human life that mark transition from being a dependent child to an independent child. It is the time during which manifold changes takes place in the physical structure, psychological and endocrine functioning, pattern of thinking, attitude towards concepts and in their moral standards and values.

The adolescent period in girls is marked by an important event in the physiological life of a female Menarche (Mokha et al., 2006). Menarche is the onset of menstruation, one of the major events within the complex changes of the puberty

in girls. There are many factors which influence the age at menarche and they are nutrition, socio-economic status, participation in strenuous physical work and medical facilities (Tiwari et al., 2005).

The present study aims to ascertain the relationship between age at menarche of urban school girls with their nutritional status, food habits and food preferences.

*REVIEW
OF
LITERATURE*

2. REVIEW OF LITERATURE

The present investigation is carried out with a view to assess the relationship between age at menarche and nutritional status of selected urban school girls. It also aims to find out the food habits and food preferences of the respondents. The review of literature pertaining to the topic has been categorized under the following three headings.

2.1 AGE AT MENARCHE

2.2 NUTRITIONAL STATUS OF GIRLS

2.3 FOOD HABITS AND PREFERENCES OF SCHOOL CHILDREN

2.1 AGE AT MENARCHE

Menarche is one of the most significant milestone in a woman's life. It represents a concrete symbol of shift from a girl to a woman. (Danii et al., 2005). It is a qualitative event of major significance and occurs between the age of 10 and 16 years in most girls, but it shows a remarkable range of variation (Tiwari et al., 2005).

Menarche or Onset of menstruation is defined as the initiation of uterine bleeding and is often marked as a potential entry into sexual relationship and reproduction (Anoop et al., 2005). First menstruation is often traumatic and very negative experience for young girls in most parts of India (George, 1994).

Unlike other gradual pubertal growth changes, such as breast development and pubic hair growth, menarche usually occurs suddenly and without precise predictability (Golub, 1992).

Menarche, which is an important transition event in the female life cycle is influenced by many factors and they are nutritional status, general health, geographic location, psychological state, socio - economic status etc.

Nutritional status is reported to be strongly and positively associated with attainment of menarche (Abioye Kuteyie et al.,1997). The age at which females attain menarche has been suggested as an indicator of their nutritional status and as a determinant of their age at first marriage and first birth (Tiwari et al., 2005). Shobha Rao (2001) opined that under nutrition during adolescence not only delayed growth spurt but affected all the linear component of growth.

Industrialized countries indicates that many girls are presenting with secondary sex characteristics at a younger age that has previously been considered normal. (Papadimitriou, 2001). John et al. (2004) found that the phenomena of earlier puberty has been attributed largely to better child care primarily as a result of improved nutrition, increased food supply and improved health services. This is similar to the findings of Meyer et al. (1990) who found that a higher dietary energy intake was associated with an earlier age at menarche.

Samsudin (1990) found girls with faster physical growth and those were relatively overweight had faster onset of menarche. Dietary composition and dietary fat in particular was related to menarche. This shows that nutrition has an important bearing on age at menarche (Acharya et al., 2006).

A study done by Amrita and Kulkarni (2000) among Maharashtrian girls found that the trend of lowering of age at menarche was well marked as they moved from lower and middle, to higher economic group. Ersoy et al. (2005) has the same

opinion that the earlier onset of menarche is because of the improvement of socio-economic condition.

The relationship between age at menarche and socio-economic status investigated in India (ICMR, 1972; Bai and Vijayalakshmi, 1973) revealed that the mean menarcheal age steadily increased with decrease in per capita income. But Sindu and Grewal (1980) found that delay in the age at menarche is seen in the girls who were involved in more strenuous physical activities. Rural girls do much hard work than the urban girls e.g. going to the fields, helping the parents in household work whereas urban girls comparatively do less of the physically strenuous work. In addition to this proper medical facilities are available for the urban girls as compared to the rural girls, so it is evident that place of living has an important role in determining the age at menarche (Mokha et al., 2006). According to ICMR (1972) the mean menarcheal age is higher in the rural girls than the urban from Punjab, Kerala, Nagpur and Poona.

A report published by Kerala Women's Commission (2003) on the status of women in Kerala showed that 80 per cent of the adolescents have their menarche between the ages 12 to 15. This report also indicated that late menarche among adolescents living in slum and coastal areas may be due to their poor intake of nutritious foods especially iron rich foods.

In a study done by Ikaraocha et al. (2005) found that in both urban and rural areas, school girls from high socio-economic class had significantly lower mean menarcheal age compared to their counterparts from low socio-economic class. They also found that in rural area, school girls involved in vigorous sport activity has a higher age of menarche. This corroborates an earlier report that active sports increases the age at menarche (Stager and Hatler, 1988).

Ikaraoha (2005) also found similarity in the mean menarcheal age of the urban school girls engaged in vigorous sporting activity and those not involved in vigorous sporting and since most of the urban girls belong to high socio-economic class, they are better nourished and therefore have a better ability to cope with the strenuous effect of vigorous sporting activity on the body physiology.

The events and experience surrounding menarche can be a significant influence on young girls in viewing themselves as well as on their understanding of reproductive health issues, and on appropriate behaviour for hygienic management of menstruation (Anoop et al., 2005). As many as 40 to 45 per cent of adolescent girls report menstrual problems. These are mainly due to psychological stress and emotional changes (Chakravarty, 1989).

Patton and co-workers (1996) in their study found that menarche emerged as the strongest predictor of depression and anxiety among adolescent girls. The physiological process of menstruation is still regarded as an unclean state, such perceptions segregate girls from the activities of normal life, such as bathing, swimming and exercise (Rierdan and Rise, 1995).

Several traditional beliefs, misconceptions and practices are linked with the issue of menstruation, which makes girls vulnerable to depression and stress as well as reproductive problems. Gupta (1990) and Bhat et al. (2004) also observed similar beliefs and superstitions.

A large proportion of adolescent girls suffer from various gynaecological problems. Particularly menstrual irregularities such as hypermenorrhoea, hypomenorrhoea, menorrhagia and dysmenorrhoea. For instance, in a study conducted in Mumbai, nearly 55 per cent of the girls were found to be suffering from

dysmenorrhoea (Vaidya et al., 1998). This is similar to the finding of Neeru et al. (2006). Similarly, a study done in Gambia found that reports of dysmenorrhoea were highest among young girls than higher age groups (Walraven et al., 2002). Gupta (1990) and Huerta – Franco and Malacare (1993) too reported that at the time of menarche girls face problem in back, head, abdomen and sometimes they feel weakness during this period.

The study done by Walraven et al. (2002) indicated that menstrual disorders were associated with infertility reproductive tract infections (RTIs), pelvic tenderness and genital prolepses. Health behaviours and practices vary from culture to culture and ignorance of culturally divergent beliefs and practices may lead to failure in health care delivery system (Spector 1991, 1995). Unsafe practices during menstruation lead to RTIs and other reproductive health problems.

The level of awareness about reproductive need and rights is very low. A study conducted in 21 districts of Gujarat state revealed that only 23 per cent of girls were aware of issues related to health, nutrition and family (Goyal and Khanna, 2003). Very few of the girls had information about menstruation at the time of their first period.

There are several misconceptions and traditional beliefs regarding menstruation and practices during menstruation which are mostly unsafe and unhygienic (Gupta and Jain, 1998). Studies also indicate that a large proportion of girls suffer from reproductive health problems and very few of them seek treatment for the same. This is similar to the findings of Narayan et al. (2001), where he found the prevalence of RTIs is three times higher among girls having unsafe menstrual practices.

2.2 NUTRITIONAL STATUS OF GIRLS

As we enter the new millennium the concept of health remained a distant dream, especially for young girls who had always been a neglected group of our society. They are the most crucial segment of our society from the point of view of *quality of future generation*, who are just on the threshold of marriage and motherhood (Varsha and Rohini, 2007).

Girls are the determinants of the health and nutrition of children of the next generation. (Asha et al., 1999), so their nutritional status is very important in determining the future population. Nutritional status can be defined as a condition of health of an individual as influenced by nutrient intake and utilization in the body (Sunita and Rita, 2005). The rapid changing physio-psychology, monitory backwardness and burden of uncontrolled population expansion especially in rural areas makes them vulnerable to malnutrition, infections and social abuse (Singh et al., 2006). Almost a quarter of India's population comprises of girls below 20 years (Krishna et al., 1991).

Despite the constitutional safe guards, even after independence the position of girl continues to be much lower than that of a boy (Valsala and Surekha, 2002). Data available shows that adolescent girls face more problems than boys. This is largely due to prevailing socio-cultural factors. Adolescent girls remain deprived of adequate access to basic health care. She is generally known as a temporary guest in her parental home or a bird of passage (Choudhary, 1990).

For young girls in India, poor nutrition, early child bearing and reproductive health complications compound the difficulties of adolescent physical development. Anaemia is one of the primary contributors to maternal mortality (20 to 25 per cent)

and is associated with compromised pubertal growth spurt and cognitive development among girls aged 10 to 19 years.

A study done by Seema and co-workers (2004) in Varanasi revealed that anaemia was the most common problem faced by many girls especially in non-menstruating girls. This is similar to the report of NFHS (1998-99) that 56 per cent of adolescent girls are anaemic. Barbin and Barbin (1994) has found that low iron stores throughout childhood may contribute to delayed menarche and impaired immune responses.

Singh et al. (2006) found that mean height and weight of adolescent girls in all groups were less than ICMR standards. Saibaba and co-workers (2002) found that maximum increase in height and weight was observed between 10 and 14 years of age and later it gets stabilized. In a study done by Singh and Mishra (2001) found that in an urban slum of Varanasi, 51.40 per cent of adolescent girls were malnourished. Poor nutrition is a sign of delayed menarche.

In a study done among adolescent girls in Rajasthan, 6.5 per cent of girls were found to have a BMI of more than 18.5 (Chaturvedi et al., 1996). In another study in government and public schools of Delhi, the prevalence of stunting was 9.9 per cent in upper socio-economic class girls and 35.30 per cent in lower middle class girls (Kapoor and Aneja, 1992).

Vasanthi et al. (1999) assessed the iron nutritional status among 312 rural school girls of Delhi, the prevalence of anaemia (Hb<12g/dl) was 28 per cent in girls who had attained menarche and 22 per cent in girls who had not attained menarche. In another study among 1,500 rural girls (10 to 19 years) from ten villages in Gujarat, the prevalence of anaemia was reported to be 60 per cent (Sheshadri, 1997).

In another study in Delhi, anaemia occurred in 46.60 per cent of high socio-economic and 56 per cent of lower middle socio-economic class girls (Kapoor and Aneja, 1992). The poor nutritional status of adolescents, especially girls, has got important implications in terms of physical work capacity and adverse reproductive outcomes (WHO, 1995).

Komlos (2000) found in his study that the late matures are most likely to be from the most economically depressed areas where chronic malnutrition was most prevalent.

2.3 FOOD HABITS AND PREFERENCES OF SCHOOL CHILDREN

The eating of a particular set of food items by a person always, depending on taste and availability of raw food materials is called food habits or dietary habits (Singh and Kaur, 1997). Food habits can also be defined as the habitual decisions an individual makes when choosing what to eat. Food habits of an individual are the characteristics and repetitive acts that he performs under the impetus of the need to provide himself with nourishment and simultaneously to meet an assortment of social and emotional goals.

Food preferences are important determinants of food choices (Ross, 1995 ; Baxter et al., 2000 ; Birch and Sullivan, 1991) and enjoyment has frequently been reported as the overriding reason people give for choosing a particular food (Belton, 2003).

Food preferences may have a particularly important role in the food habits of children (Birch and Sullivan, 1991) because food preferences play a critical role in influencing food choices and consumption (Cicil, 2000). It is thought that food

preferences and habits developed during childhood may persist into adulthood. (Owen et al., 1997; Mc Arthur, 1998).

Although there is no evidence that children have an innate preference for high fat or high energy foods, but there is evidence that children learn quickly to prefer energy dense foods (Birch and Fisher, 1998). Children are born with some taste preferences for e.g. it has been shown that babies are born with an innate preference for sweet tastes (POST, 2003). Research has highlighted that sensory aspects of foods are identified as important by children with respect to food choices.

Qualitative work in children aged 7 to 11 years in the UK, Spain and Italy found sensory pleasure was an important consideration in children's food choices (Kellogg's, 2002). Taste was also reported as an important factor in choices by breakfast of Swedish school boys (Gummeson et al., 1996). Hertzler (1983) reported that children preferred mild flavoured food to strong flavoured foods, and accepted raw vegetables more readily than cooked vegetables.

The school age period is nutritionally significant because this is the prime time to build up body stores of nutrients in preparation for rapid growth of adolescence (Mc Williams, 1980).

When children are young, their parents and families have greater control over what they eat. As they get older, however, what their friends eat in the school environment and what is available to them in school and else where will have an impact on what they eat. According to Neil et al. (1997) what children eat at school is dependent on many factors, including the cafeteria environment, peer pressure administrative support, teachers participation and the quality of food choices offered.

Nutrition is an important determinant of health and disease at any age, particularly during adolescence, a time of growth and development. This can also be a time of change in dietary habits. With the beginning of independence comes increased consumption of foods away from home and snacking (Ashley et al., 1992).

Many adolescent skip breakfast by choice either because they do not have the time to eat or in order to lose weight. A study by Musaiger and Gregory (1992) found that breakfast was more often skipped than lunch and dinner by boys and girls. Pranzetti et al. (1989) has shown that the percentage of students who eat nothing for breakfast is higher. She also found that consumption decreases among grown up students. In addition, many school aged children depend on "junk food" for their nourishment. Junk food comprises of anything that is quick, tasty, convenient and fashionable, children mostly prefer pizzas and burgers.

Junk foods such as chocolate bars, potato chips, soft drinks, fruit flavoured drinks, cream filled cup cakes are popular among children are described as having the opposite profile as they contained a lot of non permitted colours but are valued because of its taste and convenience (Chapman and Maclean, 1993). Krebs Smith et al. (1996) found that one-fourth of the vegetables that children consume are French fried potatoes.

Snacking is becoming the main eating style among children. All over the world snack consumption is considerably higher among school children (Sadana et al., 1997). According to Jans et al. (2001) there was a significant increase in snacking among children between the years 1977 to 1996. They found that the number of snacking occasions increased, thus increasing the total energy consumption for these children. They also reported that the proportion of energy consumption from fat increased. A study done by Yamini in Thiruvananthapuram

district (2004) found that children are eating more meals away from home and those meals are often high in fat and low in fibre rich carbohydrate such as fruits, vegetables and whole grains.

Children consume more fat than they need to. Globalization and free trade have brought fast-food establishments to most countries, especially to developing nations e.g. Mc Donald's, Pizza Huts, Burger King etc.

The shrinking world brought about by satellite TV and the internet has created a popular culture among teens around the world a culture inundated by junk snacks, soda, pizzas, and convenience foods. Children are used to "grab and run" eating styles, as many adults. Children prefer popular, tasty and easy to find junk foods.

Research has documented increased soft drink consumption among children (USDA, 2001; Bowman, 2002) and a negative relationship between the consumption of sweetened drinks by children and their intake of protein, Ca, P and Vit A (Mrdjenovic and Levitsky, 2003). Researches have also found that soft drinks displaces milk consumption (USDA, 2001; USDA, 2003) and contribute to childhood obesity and excess energy and sugar intakes. Yamini (2004) also found another trend that is the shift from drinking milk to more non-citrus juices, juice drinks and calories dense beverages.

Sarupriya and Mathew (1988) reported that intake of cereals was higher and that of green leafy vegetables, fruits, pulses, roots and tubers was lower than the recommended RDI in the diet of adolescents.

Kumari and Singh (2001) found that there is an inadequate intake of milk and milk products, green leafy vegetables, fleshy foods, sugar, jaggery among school children from Bihar whereas Rajani and Pritti (1991) said that cereal consumption as only 70 per cent of RDA in girls aged 11 to 13 years from Madhya Pradesh and 98 per cent in Bihar.

Beegum (1990) found that the diet of the most of the children (5 to 10 years) comprised mostly of cereals, roots and tubers and fleshy foods especially fish, while intake of milk and milk products and leafy vegetables were noted to be below 50 per cent of their age requirements.

In a study by Raja et al. (2001) in Bikaner found that in children about 37-40 per cent of the energy was met by fats and also the intake of salt was very high and the diet contains less fibre.

Qamra et al. (1990) reported that 64 per cent of school age girls had inadequate intake of energy. In a study done by Sandya (2001) found that majority of children's diet is not balanced in terms of food groups. Low income group take cereals, roots and tubers and fish and she also found that their diet lacks variety and adequacy. She also found that in spite of low income bakery items were taken every week which reflects the growing popularity of "Junk-foods" among new generations.

Increasing concern about competitive foods in schools are part of a broader set of concerns arising from information demonstrating shortcoming in children's diet in general. Reports on child nutrition from USDA have found that

- Among school aged children, only 2 per cent meet the dietary recommendations for all food groups (USDA, 2001).

- For each of the food groups the percentage of children meeting the recommended levels were only 14 per cent for fruits, 17 per cent for meat, 20 per cent for vegetables, 23 per cent for grains and 30 per cent for milk (USDA, 2001).
- Added sugar constitutes major part children's diets accounting for 20 per cent of total food energy. The average intake of added sugar ranges from the equivalent of 19 tea spoons a day for girls of 6 to 8 yrs old, to the equivalent of 36 tea spoons/day for boys of 14 to 18 years old.

Data from the Centre for Disease Control and Prevention (1996) mirrors that children consume too much fat, saturated fat and sodium, but not enough fruits, vegetables or calcium. Among children aged between 6 to 11 years only 16 per cent meet recommended limits for fat intake and 9 per cent for saturated fat intake. And among adolescents (ages 12 to 19) only 15 per cent meet guidelines for fat intake and only 7 per cent for saturated fat intake.

Hence it could be observed that adolescence is one of the vulnerable periods of life with various health risks especially for girls. Adolescence is a period of high nutritional risks with increased demand for nutrients which are often met with poor food choices, unhealthy eating habits and poor diet with deficient intake of calories, proteins, vitamins and minerals. Academic and psychosocial pressure which adolescent had to face and it has direct influence on their diet, food intake, health and nutritional status.

MATERIALS
&
METHODS

3. MATERIALS AND METHODS

The methodology adopted for the study entitled "Age at Menarche and Nutritional Status of Urban School Girls" is presented in this chapter under the following heads.

1.1. CONDUCT OF THE STUDY

1.1.1. Locale of the study

1.2. SELECTION OF RESPONDENTS

1.3. VARIABLES SELECTED FOR THE STUDY

1.3.1 Personal Characteristics and Socio economic status

1.3.2 Assessment of Nutritional Status of selected respondents based on

1.3.2.1. Anthropometric measurements

- Height
- Weight
- Triceps Skin fold thickness (TST)
- Waist Hip Ratio (WHR)

1.3.2.2. Biochemical assessment

1.3.2.3. Clinical examination

1.3.2.4. Computation of Nutrient intake by 24 hour recall method and food use frequency

1.1. CONDUCT OF THE STUDY

1.1.1. Locale of the study

The locale of the study was selected from Cotton Hill Girls High School, Vazuthacaud, Thiruvananthapuram. This school was purposively selected

- (i) due to the presence of highest number of girl students enrolled.
- (ii) school situated in the middle of the city with urban students.

1.2. SELECTION OF RESPONDENTS

Girls who had attained menarche during the month preceeding the survey were identified through a checklist specially designed for the purpose (Appendix I). A total of 204 students were given the checklist out of that, 103 students were identified for the study. From the identified list, two groups of girls each belonging to early (54 respondents) and late (49 respondents) onset of menarche were selected. The economic strata of the families of the families of the selected respondents were classified into low, lower middle, middle, upper middle and high income groups.

1.3. VARIABLES SELECTED FOR THE STUDY

1.3.1. Personal Characteristics and Socio economic status

In order to elicit information on socio-economic profile of the respondents details regarding date of birth of the respondents, family income, type and size of the family, religion, educational status of the respondent's parents, had to be collected. Hence, incorporating the above details a suitable pre-tested questionnaire was developed using standard procedures and was administered to the respondents which is appended in Appendix II.

1.3.2. Assessment of Nutritional status of selected respondents

Nutritional status is defined as the state of health enjoyed as a result of nutrition (Kamath, 1986). It is one of the critical indicators of health, therefore regular nutritional assessment is important to maintain the health of respondents (Mourya and Jaya, 1997).

The method followed mainly to assess the nutritional status includes anthropometric measurements, biochemical assessment, clinical examination and computation of nutrient intake by 24 hour recall method.

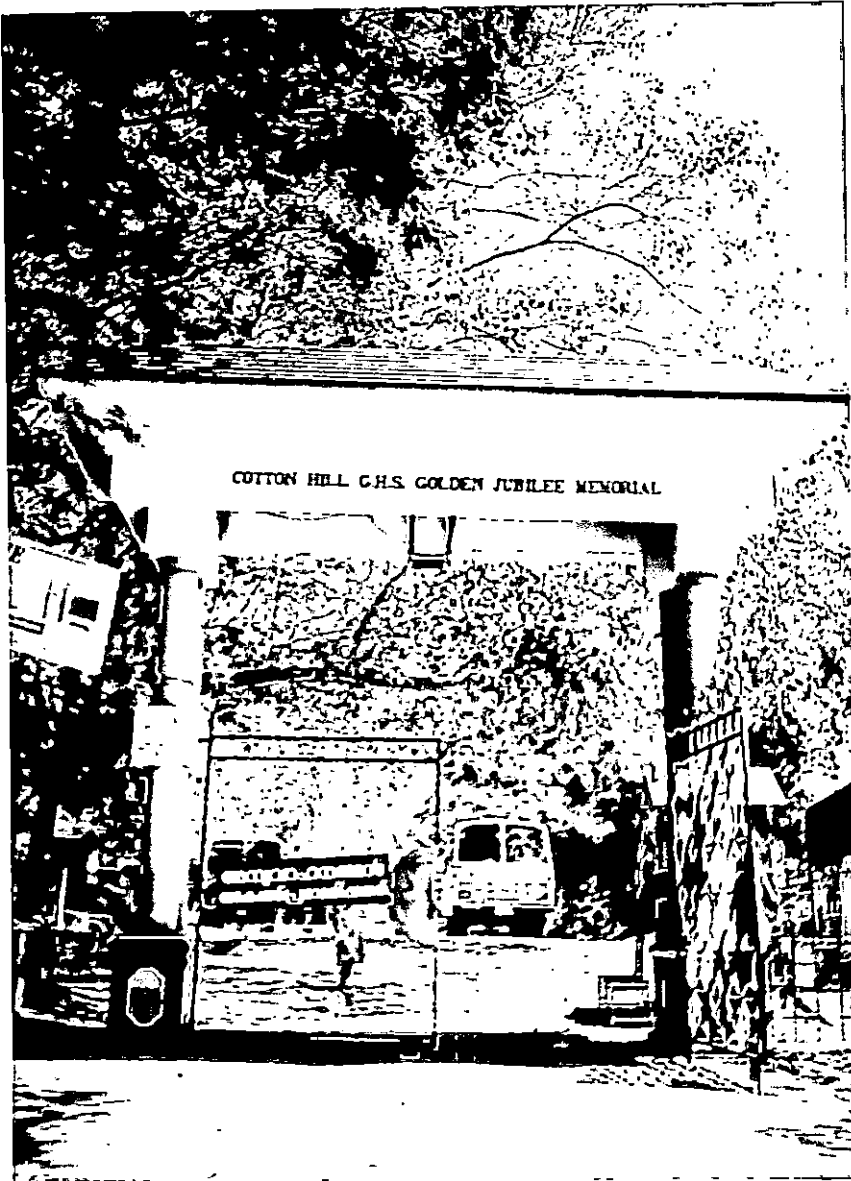


Plate 1. Locale of the study

1.3.2.1. Anthropometric measurements

For assessing the nutritional status of the respondents, anthropometric assessment is considered as an effective measure.

Anthropometry provides the single most universally applicable, inexpensive technique for assessing the size, proportions and composition of the human body. Anthropometry has been accepted as an important tool for the assessment of nutritional status (Vijayaraghavan, 1987). Anthropometry remains the conventional bench mark for epidemiological purpose (Sachdev, 2003).

Anthropometric measurements namely weight, height, Triceps Skin fold thickness (TST) and Waist Hip Ratio (WHR) measurements of the respondents were taken in the present study to assess the nutritional status.

- **Weight :** Weight is the measurement of body mass (Rao and Vijayaraghavan, 1986). Comparison of weight for age value with regional standards of corresponding age will help to determine the degree of malnutrition in a community. According to Kaul and Nyamongo (1990) a change in body weight may be the result of changes in the health of an individual, changes in food consumed or even changes in one's physical activity.

For weighing, platform weighing balance was used as it is portable and is convenient to use in the field. The weighing scale was checked periodically for accuracy. The scale was adjusted to zero before each measurement. The subjects having minimum clothing were asked to stand on the platform of the scale, without touching anything and looking straight ahead. The weight was recorded to the nearest of 0.5 Kg. Each reading was taken twice to ensure correctness of the measurement.

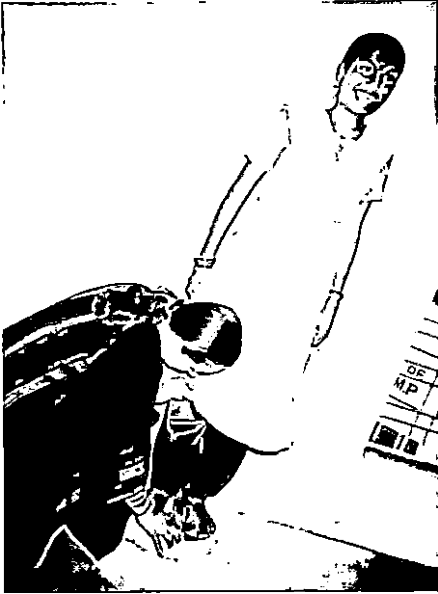
- **Height :** Height or the total length apart from nutritional and environmental factors is influenced by hereditary factors. The extend of height deficit in relation to age as compared to regional standards is regarded as a measure of the duration of malnutrition (Gopaldas and Sheshadri, 1987).

To determine height, a stadiometer was used. The subjects were asked to remove their slippers and to stand with centre of the back touching the wall with feet paralleled and heels, buttocks, shoulder and back of head touching the wall. The head was held comfortably erect, the arms hanging close by the side. The moving head piece of the stadiometer was lowered to rest flat on the top of the head and the measurement was taken. Height was read to the nearest 0.1 cms. An average of the three measurements was taken as final measurement of height of the respondents.

- **Body Mass Index (BMI) :** BMI is expressed as the ratio of weight to height square i.e. $\text{Weight (Kg)} / \text{Height}^2 \text{ (m)}$ was used as a good parameter to grade chronic energy deficiency (James et al., 1988).

$$BMI = \frac{\text{Weight (Kg)}}{\text{Height}^2 \text{ (m)}}$$

Chronic energy deficiency has been defined as a steady status in which a person is in energy balance although at a cost in terms of risk to health or an impairment of function and health. BMI is regarded as a good indicator of nutritional status. Classification of BMI of selected subjects was done based on the Eliz Health Path for Adolescent (EHPA) (Elizabeth, 2005) which is given in appendix XII.



A. Weight



B. Triceps Skin fold Thickness



C. Waist Circumference

Plate 2. Anthropometric Measurements

- **Triceps Skin fold Thickness (TST):** According to Malina et al. (1974) measurement of skin fold (fat-fold) at triceps is one of the methods for assessing the amount of subcutaneous fat, which gives an indication of the calorie reserves in the body of an individual. TST was determined using Lange's caliper. A lengthwise skin fold on the dorsal side of the left hand was firmly grasped and slightly lifted up between finger and thumb of left hand. Care was taken not to include underlying muscle. The caliper was applied about 1 cm below the operator's finger at a depth about equal to the skin folds, while the skin fold was still gently held throughout the measurement. The measurement was read to 0.1 mm accuracy. An average of three measurements was taken as final measurement of TST of the respondents.
- **Waist Hip Ratio (WHR) :** The Waist Hip Ratio (WHR) reflects the proportion of body fat located intradominally as opposed to that in the subcutaneous region (Lean et al., 1995). After documenting the waist and hip measurements of the respondents their WHR was calculated by dividing the circumference of the waist by the circumference of the hip (Chadha et al., 1995).

1.3.2.2. Biochemical Assessment

Biochemical assessment is one of the most important tool for assessing the nutritional status of the subjects. There are several biochemical indicators of malnutrition specified for different nutritional deficiencies. The haemoglobin content was estimated from the blood samples of respondents. According to Park (1997) haemoglobin level is a useful index of the overall state of nutrition irrespective of its significance in anaemia.

Haemoglobin content was estimated by cyanmethaemoglobin method as described in the Manual of Laboratory Techniques by NIN (ICMR, 1994).



Plate 3. Haemoglobin Estimation



Plate 4. Clinical Examination

1.3.2.3. Clinical Examination

Clinical examination is stated to be one of the most essential and the simplest methods used in the evaluation of nutritional status (Gupta et al., 1998). It is a part of nutritional assessment through which direct information of signs and symptoms of dietary deficiency prevalent could be obtained (Swaminathan, 1993).

The presence or absence of clinical deficiency symptoms, which is an index of nutritional status, was assessed by a qualified physician using a proforma made for the purpose. The incidence of the clinical signs and symptoms prevalent were then tabulated. The proforma is appended in VI.

1.3.2.4. Assessment of Nutrient intake by 24 hour recall method and food use frequency

Dietary habits of the respondents were assessed through diet survey, details regarding eating habits, frequency of use of different food items were also collected.

According to Swaminathan (1993) diet surveys constitute an essential part of any complete study of nutritional status of individuals or groups, providing essential information on nutrient intake levels, sources of nutrients and food habits.

Food consumption pattern is one of the important determinants of nutritional status (Despande et al., 2001). A diet survey was done to assess the food habits, dietary pattern and food use frequency of the respondents. The information regarding food preference was also collected. Besides this, their food habits like nibbling and skipping of meals, habits of taking food from outside the home and also their diet history were assessed. A detailed questionnaire was prepared, pre-tested and standardized before administering among the respondents. The questionnaire developed is given in Appendix III.

- Measurement of Nutrient intake by 24 hour recall method :** The 24 hour recall method was used to assess the actual food intake by the respondents. For this, a set of cups and spoons were standardized by the investigator following the procedure given by Thimmayamma and Rao (2003). The respondents were asked about the types of food preparations had for breakfast, lunch, teatime and dinner and the raw ingredients used for each of the preparations and the quantity consumed by them was then assessed using the standardized cups. The cups were used to aid the respondent to recall the quantities prepared and eaten. Later the raw food equivalents of the food consumed by the respondent were computed. Schedule used is given in Appendix IV.

- Food use frequency :** Frequency of use of different food items in the dietaries of the respondents clearly indicate the adequacy of the diets consumed by them. In this study, food use frequency was measured using a checklist. The locally popular foods and those frequently advertised through media were listed down and respondents use and preference for each items were rated separately.

The percentage of total score for each food group used by respondents as well as preference score of the respondents for different food items were calculated separately using the formula suggested by Reaburn et al. (1979).

$$\text{Percentage of total score for each food group} = \frac{R_1S_1 + R_2S_2 + R_3S_3 + \dots + R_nS_n}{n}$$

S_i = Scale of rating given for frequency of use of a food item (i = 1, 2, 3, --- 8)

R_i = Percentage of respondents coming under each frequency group (i = 1, 2, 3, --8)

n = Maximum scale rating (n = 8)

The mean score was calculated using the formula given below

$$\text{Mean Score for each food group} = \frac{R_1S_1 + R_2S_2 + R_3S_3 + \dots + R_nS_n}{100}$$

The percentage of respondents using each food item and also their preference for each food item was then computed (Appendix III).

Statistical Analysis

The data collected were coded and consolidated and subjected to statistical analysis. The statistical procedures used were mean, percentage, correlation and ANOVA. The results of the statistical analysis and findings have been presented in the ensuing chapter.

RESULTS

4. RESULTS

The results of the present study entitled "Age at Menarche and Nutritional Status of Urban School Girls" are presented in two groups i.e. Early Menarche Respondents (EMR) and Late Menarche Respondents (LMR) under the following heads.

- 4.1. Personal and Socio-economic characteristics of the respondents.
- 4.2. Food consumption pattern of the respondents.
- 4.3. Nutritional Status of the respondents.
- 4.4. Nutritional Status Index of the respondents.
- 4.5. Relationship between Age at Menarche and selected independent variables.

4.1 PERSONAL AND SOCIO-ECONOMIC CHARACTERISTICS OF THE RESPONDENTS

4.1.1. Personal Characteristics

Among 204 students surveyed, 54 (26.47 per cent) respondents were found in EMR (before 12 years), 101 (49.51 per cent) respondents were found in normal group (12 to 15 years) and 49 (24.02 per cent) respondents were found in LMR group (after 15 years). The EMR and LMR were further classified as in Table 1 and 2.

Age: Table 1: Age wise distribution of the EMR

| Age | EMR | |
|----------------------------------|--------|------------|
| | Number | Percentage |
| 9+ (9 years & up to 11 months) | 5 | 9.26 |
| 10+ (10 years & up to 11 months) | 38 | 70.37 |
| 11+ (11 years & up to 11 months) | 11 | 20.37 |
| Total | 54 | 100.00 |

Table 1 shows that, among EMR surveyed, 70.37 per cent belonged to the age group of 10 to 11 years, 20.37 per cent belonged to the age group of 11 to 12 years and only 9.26 per cent belonged to 9 to 10 years of age group.

Table 2: Age wise distribution of the LMR

| Age | LMR | |
|----------------------------------|--------|------------|
| | Number | Percentage |
| 15+ (15 years & up to 11 months) | 3 | 6.12 |
| 16+ (16 years & up to 11 months) | 29 | 59.18 |
| 17+ (17 years & up to 11 months) | 17 | 34.70 |
| Total | 49 | 100.00 |

Among LMR surveyed, (Table 2) 29 out of 49 (59.18 per cent) belonged to the age group of 16 to 17 years, while 34.70 per cent belong to the age group of 17 to 18 years and only 6.12 per cent belong to the age group of 15 to 16 years.

Religion: Table 3 depicts the religion wise distribution of respondents

Table 3: Religion wise distribution of respondents.

| Religion | EMR | | LMR | |
|-----------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| Hindu | 45 | 83.34 | 42 | 85.72 |
| Muslim | 5 | 9.26 | 4 | 8.16 |
| Christian | 4 | 7.40 | 3 | 6.12 |
| Total | 54 | 100.00 | 49 | 100.00 |

As summarized in the above table, 83.34 per cent of the EMR were Hindus and 85.72 per cent of LMR were Hindus. Among EMR 9.26 per cent and 7.40 per

cent were Muslims and Christians respectively. Whereas 8.16 per cent and 6.12 per cent were Muslims and Christians respectively among LMR.

Caste: Table 4: Caste wise distribution of the respondents.

| Caste | EMR | | LMR | |
|----------------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| Forward | 30 | 55.56 | 26 | 53.06 |
| Other backward | 18 | 33.33 | 15 | 30.61 |
| SC/ST | 6 | 11.11 | 8 | 16.33 |
| Total | 54 | 100.00 | 49 | 100.00 |

Table 4 reveals that majority of the respondents among both groups belonged to forward caste i.e. 55.56 per cent among EMR and 53.06 per cent among LMR whereas only 11.11 per cent of EMR belong to SC/ST while 16.33 per cent of LMR belonged to SC/ST groups.

4.1.2. Social Characteristics

Family Type: Family type was classified into nuclear, joint, extended based on composition. Joint families included parents, children, grand parents and other relatives, whereas extended families had parents their children and one or two relatives residing in the family and nuclear families had only parents and their children under the same roof.

Table 5: Type of family of respondents.

| Type of family | EMR | | LMR | |
|----------------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| Nuclear | 41 | 75.92 | 45 | 91.84 |
| Joint | 4 | 7.41 | 4 | 8.16 |
| Extended | 9 | 16.67 | - | - |
| Total | 54 | 100.00 | 49 | 100.00 |

Table 5 indicates that 75.92 per cent of EMR belonged to nuclear families but among LMR 91.84 per cent were from nuclear family.

Among EMR and LMR 7.41 per cent and 8.16 per cent were belonged to joint families. 16.67 per cent of the respondents among EMR were found to be from extended families but among LMR no one was belonging to extended families.

Family Size: It refers to the number of members in a family. Table 6 depicts the size of the family.

Table 6: Family size of the respondents.

| Size of family | EMR | | LMR | |
|----------------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| 1-4 members | 41 | 75.92 | 29 | 59.18 |
| 5-6 members | 10 | 18.52 | 18 | 36.73 |
| > 7 members | 3 | 5.56 | 2 | 4.09 |
| Total | 54 | 100.00 | 49 | 100.00 |

On of the basis of data collected, the family size were classified as small (1-4 members), medium (5-6 members) and large (> 7 members).

Out of the total respondents among EMR 75.92 per cent belonged to small family where as only 5.56 per cent belonged to large family.

Among LMR most of the respondents i.e. 59.18 percent belonged o small family but about 36.73 per cent belonged to medium family and only 4.09 per cent belonged to large family.

Educational status of Parents: The parental educational level of the sample when assessed ranged from primary to post graduation.

Table 7: Educational status of Fathers

| Educational level | EMR | | LMR | |
|---------------------------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| Primary | 1 | 1.85 | 3 | 6.12 |
| Middle | 2 | 3.70 | 7 | 14.29 |
| Secondary | 30 | 55.56 | 16 | 32.65 |
| Higher secondary | 11 | 20.37 | 3 | 6.12 |
| Degree | 7 | 12.96 | 18 | 36.74 |
| PG/Technical/Professional | 3 | 5.56 | 2 | 4.08 |
| Total | 54 | 100.00 | 49 | 100.00 |

Table 8: Educational status of Mothers

| Educational level | EMR | | LMR | |
|---------------------------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| Primary | - | - | 3 | 6.12 |
| Middle | 6 | 11.11 | 4 | 8.16 |
| Secondary | 28 | 51.85 | 19 | 38.78 |
| Higher secondary | 6 | 11.11 | 11 | 22.45 |
| Degree | 12 | 22.22 | 8 | 16.33 |
| PG/Technical/Professional | 2 | 3.71 | 4 | 8.16 |
| Total | 54 | 100.00 | 49 | 100.00 |

When father's educational status was assessed it revealed that 55.56 per cent of EMR's fathers had education up to secondary level and only 1.85 per cent had education up to primary.

Among LMR, 36.74 per cent of fathers had education up to degree level and 32.65 per cent had secondary level education where as 6.12 per cent had primary education. In both groups none of the father was found as illiterate.

In the case of mothers education, majority of them in both groups had education up to secondary level i.e. 51.85 per cent and 38.78 per cent in EMR and LMR respectively.

As indicated in table 8, 22.22 per cent among EMR's mothers and 16.33 per cent among LMR's mothers were graduates. No one was found as illiterate

Occupational Status of Parents.

Table 9: Occupational Status of Fathers

| Occupational Status | EMR | | LMR | |
|---------------------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| No job | 1 | 1.85 | 3 | 6.12 |
| Business | 7 | 12.96 | 6 | 12.34 |
| Govt. employed | 18 | 33.33 | 10 | 20.41 |
| Casual labourer | 28 | 51.85 | 34 | 69.39 |
| Total | 54 | 100.00 | 49 | 100.00 |

Table 10: Occupational Status of Mothers

| Occupational Status | EMR | | LMR | |
|---------------------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| Employed | 11 | 20.37 | 12 | 24.49 |
| House Wife | 43 | 79.63 | 37 | 75.51 |
| Total | 54 | 100.00 | 49 | 100.00 |

As illustrated in Table 9, 51.85 per cent of the respondents father among EMR were casual labourers and among LMR also most of the respondents fathers were casual labourers (69.39 per cent). Only 1.85 per cent among EMR and 6.12 per cent among LMR were unemployed.

In case of mothers employment status (Table 10) majority of the mothers were house wives i.e. 79.63 per cent among EMR and 75.51 per cent among LMR.

Monthly Income: Kunwar et al. (1998) reported that the important determinant of child's health was the economic status of the family.

Total monthly income of the respondents was assessed by adding the salary of family members as well from other sources.

Table 11: Monthly income of the family

| Total monthly income (Rs.) | EMR | | LMR | |
|-------------------------------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| ≤2250 | 20 | 37.04 | 26 | 53.06 |
| 2251 – 3500 | 6 | 11.11 | 10 | 20.41 |
| 3501 – 5000 | 5 | 9.26 | 9 | 18.37 |
| 5001 – 10,000 | 16 | 29.63 | 2 | 4.08 |
| ≥ 10,001 | 7 | 12.96 | 2 | 4.08 |
| Total | 54 | 100.00 | 49 | 100.00 |

The monthly income of the families ranged between Rs.2000 to Rs. 15,000 and the details of the families belonging to different income levels were given in the above table.

The above table reveals that about 37.04 per cent among EMR and nearly half of the respondents among LMR (53.06 per cent) were having a monthly income of less than Rs. 2250 while only 12.96 per cent of EMR and 4.08 per cent of LMR were having a monthly income of more than Rs.10, 000.

Birth order: When birth order of subjects were taken majority (30 out of 54) 55.56 per cent among EMR and 26 out of 49 (53.06 per cent) among LMR were found as

first born while 42.59 per cent among EMR and 42.86 per cent among LMR were second born. Only 1.85 per cent of EMR and 4.08 percent of LMR were found as third born as revealed in Table 12.

Table 12: Birth order of the respondents

| Birth Order | EMR | | LMR | |
|-----------------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| 1 st | 30 | 55.56 | 26 | 53.06 |
| 2 nd | 23 | 42.59 | 21 | 42.86 |
| 3 rd | 1 | 1.85 | 2 | 4.08 |
| Total | 54 | 100.00 | 49 | 100.00 |

Age at Menarche: Age at menarche of not only the respondents but of mothers, sisters, (if any), maternal cousins, paternal cousins, mother’s sister and father’s sister were also recorded. The respondents (Table 1 and 2) for the study were chosen as those who had attained menarche during the month preceding the survey

Table 13: Family history of Age at menarche

| Average Age at menarche | EMR | LMR |
|-------------------------|------------------------|------------------------|
| | (Average age in years) | (Average age in years) |
| Respondents | 10.00 (n=54) | 15.00 (n=49) |
| Mother | 13.00 (n=54) | 16.00 (n=49) |
| Sister | 12.00 (n=20) | 13.00 (n=21) |
| Maternal Cousin | 12.00 (n=46) | 13.00 (n=35) |
| Paternal Cousin | 13.00 (n=42) | 13.00 (n=30) |
| Mother’s sister | 13.00 (n=29) | 14.00 (n=31) |
| Father’s sister | 13.00 (n=35) | 14.00 (n=30) |

(n = no. of persons)

Table 13 shows the average age at menarche of the respondents, their mothers, sisters and other related persons and it was found that average age of early menarche of respondents as 10 years old while that of late menarche as 15 years old.

Among EMR, mothers average age at menarche was found to be 13 years old while that of LMR it was seen as 16 years old.

Physical activity: Physical activity in this context includes involvement of the respondents in household activity, sports, NCC, exercises like jogging, walking, yoga, dance etc.

Mean time spent on physical activities was recorded and it was revealed that the mean time spent for physical activities among EMR was 1.17 hours while 2.18 hours was spent by LMR for physical activity.

Distance from Residence to School

Table 14: Distance form residence to School

| Distance (Kms) | EMR | | LMR | |
|-----------------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| Less than 1 Km | 2 | 3.70 | 2 | 4.08 |
| 1 – 2 Km | 7 | 12.96 | 9 | 18.37 |
| 2 – 5 Km | 24 | 44.44 | 16 | 32.65 |
| More than 5 Kms | 21 | 38.89 | 22 | 44.89 |
| Total | 54 | 100.00 | 49 | 100.00 |

Table 14, indicates that 3.70 percent of EMR stayed at a distance of less than 1 Kilometer and among LMR 4.08 percent stayed at a distance of less than 1 Kilometers. Majority of the EMR (44.44 percent) stayed at a distance of 2-5 kilometer while among LMR majority (44.89 per cent) stayed at a distance of more than 5 kilometers from the school.

Mode of Conveyance

Table 15: Mode of Conveyance of the respondents

| Mode of Conveyance | EMR | | LMR | |
|--------------------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| Walking | 12 | 22.22 | 10 | 20.41 |
| Bicycle | - | - | 1 | 2.04 |
| School Bus | 21 | 38.89 | 5 | 10.20 |
| Public conveyance | 21 | 38.89 | 33 | 67.35 |
| Total | 54 | 100.00 | 49 | 100.00 |

Table 15 depicts that among EMR equal number i.e. 21 out of 54 (38.89 per cent) went to school by school bus and by public conveyance and only 22.22 per cent went to school by walking.

Among LMR most of the respondents went to school by public conveyance (67.35 per cent), while 20.41 per cent of the respondents went to school by walking and 10.20 per cent by school bus and only 1 out 49 (2.04 per cent) used bicycle as a mode of conveyance.

4.2 FOOD CONSUMPTION PATTERN OF THE RESPONDENTS.

Food consumption pattern of the respondents was assessed through diet survey. Details regarding food habits and frequency of use of the various food items were collected and the results obtained are presented below.

Among 103 respondents it was found that 6 respondents (5.83 per cent) were vegetarians and 97 respondents (94.17 per cent) were non-vegetarian. They were further classified as follows:-

Table 16: Food Habits of respondents

| Food Habits | EMR | | LMR | |
|------------------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| Vegetarian | 1 | 1.85 | 5 | 10.20 |
| Non - Vegetarian | 53 | 98.15 | 44 | 89.80 |
| Total | 54 | 100.00 | 49 | 100.00 |

Food habits of the respondents showed that majority of EMR were non-vegetarians while only 89.80 per cent among LMR were non vegetarians.

As may be seen from the Table 17 and 18 for both the group of respondents the food items like cereals, sugar, nuts and oil seeds were consumed daily. Ninety eight per cent of the EMR consumed fish daily whereas only 80 per cent of LMR consumed fish every day.

Ninety three percent among EMR and 92 per cent among LMR consumed tea/coffee daily. Daily consumption of pulses were seen as 33 per cent and 29 per cent respectively among EMR and LMR.

The daily consumption of leafy vegetables was found as very low. Only 6 per cent and 9 per cent were consuming leafy vegetables daily among LMR and EMR respectively. Majority of respondents were seen consuming leafy vegetables twice in a week i.e. about 28 per cent and 31 per cent among EMR and LMR respectively.

Consumption of roots and tubers were found as high once in a week among EMR (65 per cent) Among LMR it was seen that 47 per cent consumed roots and tubers daily and 4 percent consumed once in a week. Thirty two respondents out of 59 (59 per cent) among EMR consumed other vegetables daily and 49 per cent among LMR consumed other vegetables daily.

Only 7 per cent among EMR and 4 per cent among LMR consumed fruits daily. Majority of the respondents from both groups consumed fruits fortnightly. None of the respondents surveyed, consumed meat daily. Eighty three per cent among EMR and 63 per cent among LMR consumed meat once in a week. Two per cent among EMR and 10 percent among LMR do not consume meat at all. About 63 per cent among EMR and 41 per cent among LMR consumed milk and its products daily.

Among EMR, 20 per cent consumed milk and its products more than twice in a week., 5 per cent consumed once in a week, 7 per cent fortnightly and only 5 per cent once in a month.

But among LMR, 10 per cent of the respondents consumed milk and its products more than twice in a week. Twelve per cent consumed twice in a week. Sixteen per cent consumed once in a week. 18 percent consumed fortnightly and only 2 per cent consumed it occasionally.

Only 5 percent among EMR and 10 percent among LMR consumed egg daily while 63 percent and 39 percent from EMR and LMR respectively consumed egg once in a week.

Daily consumption of processed foods was found as 80 per cent and 61 per cent among EMR and LMR respectively.

Based on the frequency of use of the various food items by the respondents percentage of total score for each food group were calculated separately using the formula suggested by Reaburn et al. (1979).

$$\text{Percentage of total score for each food group} = \frac{R_1S_1 + R_2S_2 + R_3S_3 + \dots + R_nS_n}{n}$$

S_i = Scale of rating given for frequency of use of a food item ($i = 1,2,3, \dots 8$)

R_i = Percentage of respondents coming under each frequency group ($i = 1,2,3, \dots 8$)

n = Maximum scale rating

Table 17: Frequency of use of various food items by EMR

| Food items | Daily | | More than twice in a week | | Twice in a week | | Once in a week | | Fortnightly | | Once in a month | | Occasionally | | Never | | Total | Percentage |
|---------------------|-------|-----|---------------------------|----|-----------------|----|----------------|----|-------------|----|-----------------|---|--------------|---|-------|---|-------|------------|
| | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | | |
| Cereals | 54 | 100 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 54 | 100 |
| Pulses | 18 | 33 | 10 | 18 | 8 | 15 | 12 | 22 | 4 | 7 | 2 | 5 | - | - | - | - | 54 | 100 |
| Leafy Vegetables | 5 | 9 | 17 | 32 | 15 | 28 | 9 | 16 | 3 | 5 | 3 | 5 | 2 | 5 | - | - | 54 | 100 |
| Roots & Tubers | 10 | 18 | 5 | 9 | 2 | 5 | 35 | 65 | 2 | 5 | - | - | - | - | - | - | 54 | 100 |
| Other Vegetables | 32 | 59 | 7 | 13 | 9 | 17 | 2 | 5 | - | - | 4 | 7 | - | - | - | - | 54 | 100 |
| Fruits | 4 | 7 | 5 | 9 | 4 | 7 | 14 | 26 | 22 | 40 | 3 | 5 | 2 | 5 | - | - | 54 | 100 |
| Fish | 53 | 98 | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 2 | 54 | 100 |
| Sugar | 54 | 100 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 54 | 100 |
| Meat | - | - | - | - | 3 | 5 | 45 | 83 | 3 | 5 | 2 | 4 | - | - | 1 | 2 | 54 | 100 |
| Egg | 2 | 5 | - | - | 7 | 13 | 34 | 63 | 5 | 9 | 5 | 9 | - | - | - | - | 54 | 100 |
| Milk & Its products | 34 | 63 | 11 | 20 | - | - | 3 | 5 | 4 | 7 | 2 | 5 | - | - | - | - | 54 | 100 |
| Nuts & oil Seeds | 54 | 100 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 54 | 100 |
| Processed foods | 43 | 80 | 7 | 13 | - | - | - | - | - | - | 2 | 4 | 2 | 4 | - | - | 54 | 100 |
| Beverages | 50 | 93 | - | - | - | - | - | - | - | - | 4 | 7 | - | - | - | - | 54 | 100 |

Table 18: Frequency of use of various food items by LMR

| Food items | Daily | | More than twice in a week | | Twice in a week | | Once in a week | | Fortnightly | | Once in a month | | Occasionally | | Never | | Total | Percentage |
|---------------------|-------|-----|---------------------------|----|-----------------|----|----------------|----|-------------|----|-----------------|----|--------------|---|-------|----|-------|------------|
| | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | | |
| Cereals | 49 | 100 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 49 | 100 |
| Pulses | 14 | 29 | 12 | 24 | 29 | 5 | 10 | 2 | 4 | 2 | 4 | - | - | - | - | - | 49 | 100 |
| Leafy Vegetables | 3 | 6 | 10 | 20 | 15 | 31 | 7 | 14 | 8 | 16 | 2 | 4 | 4 | 8 | - | - | 49 | 100 |
| Roots & Tubers | 23 | 47 | 16 | 33 | 8 | 16 | 2 | 4 | - | - | - | - | - | - | - | - | 49 | 100 |
| Other Vegetables | 24 | 49 | 5 | 10 | 6 | 12 | 6 | 12 | 3 | 6 | 5 | 10 | 2 | 4 | - | - | 49 | 100 |
| Fruits | 2 | 4 | 4 | 8 | 3 | 6 | 16 | 33 | 20 | 41 | 4 | 8 | - | - | - | - | 49 | 100 |
| Fish | 39 | 80 | 3 | 6 | 2 | 4 | - | - | - | - | - | - | - | - | - | - | 49 | 100 |
| Sugar | 49 | 100 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 49 | 100 |
| Meat | - | - | - | - | - | - | 31 | 63 | 6 | 12 | 4 | 8 | 3 | 6 | 5 | 10 | 49 | 100 |
| Egg | 5 | 10 | - | - | 4 | 8 | 19 | 39 | 9 | 18 | 3 | 6 | 4 | 8 | 5 | 10 | 49 | 100 |
| Milk & Its products | 20 | 41 | 5 | 10 | 6 | 12 | 8 | 16 | 9 | 18 | - | - | 1 | 2 | - | - | 49 | 100 |
| Nuts & oil Seeds | 49 | 100 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 49 | 100 |
| Processed foods | 30 | 61 | - | - | - | - | 10 | 21 | - | - | 6 | 12 | 3 | 6 | - | - | 49 | 100 |
| Beverages | 45 | 92 | - | - | - | - | - | - | - | - | - | - | 4 | 8 | - | - | 49 | 100 |

The mean score was calculated using the formula given below

$$\text{Mean Score for each food group} = \frac{R_1S_1 + R_2S_2 + R_3S_3 + \dots + R_nS_n}{100}$$

Table 19: Food frequency score and percentage obtained from the respondents for various food items

| Food items | EMR | | LMR | |
|---------------------|------------|------------|------------|------------|
| | Mean score | Percentage | Mean score | Percentage |
| Cereals | 8.00 | 100.00 | 8.00 | 100.00 |
| Pulses | 6.33 | 79.13 | 6.52 | 81.50 |
| Leafy Vegetables | 5.89 | 73.62 | 5.36 | 67.00 |
| Roots & Tubers | 5.82 | 72.75 | 7.23 | 90.37 |
| Other Vegetables | 7.11 | 88.87 | 6.56 | 82.00 |
| Fruits | 4.76 | 59.50 | 4.77 | 59.63 |
| Milk & Its Products | 7.12 | 89.00 | 6.26 | 78.25 |
| Sugar | 8.00 | 100.00 | 8.00 | 100.00 |
| Meat | 4.79 | 59.88 | 4.09 | 51.13 |
| Egg | 4.89 | 61.13 | 4.39 | 54.87 |
| Fish | 7.38 | 92.25 | 7.16 | 89.50 |
| Nuts & Oil seeds | 8.00 | 100.00 | 8.00 | 100.00 |
| Processed foods | 7.51 | 93.87 | 6.41 | 80.12 |
| Beverages | 7.58 | 94.75 | 7.52 | 94.00 |

Table 19 reveals the average food frequency scores and percentage of total scores obtained for each food group by the respondents. Food frequency percentage of 100 was obtained for food items like cereals, sugar and nuts and oil seeds for both groups of respondents. A percentage of 94.75 and 94 were obtained for beverages

by EMR and LMR respectively. For processed foods the food frequency percentage obtained were 93.87 and 810.12 for EMR and LMR respectively.

Among EMR, 92.25, 89.00 and 88.87 respectively was obtained for fish, milk and its products and for other vegetables whereas 79.13, 73.62 and 72.75 was obtained for pulses, leafy vegetables and roots and tubers respectively. For egg the score was 61.13. The percentage obtained for meat was 59.88 and for fruits 59.5.

Among LMR, 90.37, 89.50 and 82.00 respectively were obtained for roots and tubers, fish and other vegetables. The percentage obtained for pulses was 81.50 while that of milk and its products was 78.25. The percentage for leafy vegetables was 67.00. Low food frequency scores were obtained for meat, egg, and fruits (51.13, 54.87 and 59.63 respectively).

Based on the percentage frequency, food groups included in the daily dietaries by the respondents were classified as most frequently used (percentage scores above 90), medium frequently used (Percentage scores 70-90) and less frequently used (percentage scores 50-70).

Table 20: Frequency of use of food groups by EMR based on percentage frequency

| Most Frequently used | Medium Frequently used | Less frequently used |
|----------------------|------------------------|----------------------|
| Cereals | Milk & Its Products | Fruits |
| Sugar | Other Vegetables | Egg |
| Nuts & Oil seeds | Pulses | Meat |
| Beverages | Leafy Vegetables | |
| Fish | Roots & Tubers | |
| Processed foods | | |

The above table indicated that among EMR cereals, sugar, nuts and oil seeds, beverages, fish and processed foods are the most frequently used food items. Use of

milk and its products, other vegetables, pulses, leafy vegetables and roots and tubers were found to be frequent and fruits, egg and meat to be less frequent.

Table 21: Frequency of use of food groups by LMR based on percentage frequency

| Most Frequently used | Medium Frequently used | Less frequently used |
|----------------------|------------------------|----------------------|
| Cereals | Fish | Leafy Vegetables |
| Sugar | Other Vegetables | Fruits |
| Nuts & Oil seeds | Pulses | Egg |
| Beverages | Processed foods | Meat |
| Roots & Tubers | Milk & Its Products | |

Table 21 indicates the frequency of use of food groups by LMR and it reveals that it is almost same as that of EMR but with a difference that fish and processed foods here are coming under frequently used food groups and also leafy vegetables comes under less frequently used food items.

Table 22: Frequency of taking meals daily

| Frequency | EMR | | LMR | |
|-----------------------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| Once | 2 | 3.70 | 9 | 18.87 |
| Twice | 5 | 14.81 | 14 | 28.57 |
| Thrice | 44 | 81.48 | 18 | 36.73 |
| More than three times | 3 | 5.56 | 8 | 16.33 |
| Total | 54 | 100.00 | 49 | 100.00 |

Table 22 shows that how many times meals are taken by the respondents in a day. It depicts the most of the respondents had meals thrice in a day i.e. 81.48 per cent among EMR and 36.73 per cent among LMR. Only a few among EMR had food

once and more than three times a day (3.70 per cent and 5.56 per cent respectively). But among LMR about 18.37 per cent and 16.33 of respondents had food once and more than 3 times respectively in a day.

Time schedule for taking food

Data regarding the time schedule of taking food shows that about 96.29 per cent (52 out of 54) of EMR and 59.18 (29 out of 49) of LMR had a time schedule for taking food while the rest of the respondents did not have a time schedule for taking food.

Frequency of taking food from outside

Table 23: Frequency of taking food from outside Table 23: Frequency of taking food from outside

| Frequency | EMR | | LMR | |
|------------------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| Once in a month | 9 | 16.67 | 2 | 4.08 |
| Twice in a month | 10 | 18.52 | 2 | 4.08 |
| Occasionally | 35 | 64.81 | 45 | 91.84 |
| Total | 54 | 100.00 | 49 | 100.00 |

The above table reveals that 64.81 per cent of EMR and 91.84 per cent of LMR were in the habit of taking food from outside occasionally.

Habit of taking packed home food

Data regarding the habit of taking packed home food showed that 72.22 per cent of EMR and 79.59 per cent of LMR are in a habit of taking packed lunch to school but 27.78 per cent (15 out of 54) and 20.41 per cent (10 out of 49) did not take packed lunch with them

Food preferences

Data regarding food preferences shows that all the respondents liked equally the food prepared both at home and outside home. About 66.67 percent among EMR and 14.29 per cent among LMR are in a habit of nibbling whereas 65.31 per cent among LMR and 48.15 per cent among EMR skip meals

Among the food preparations “rice” is one item which is disliked by most of them (both among EMR and LMR) and “chicken biriyani” was the most preferred food item among the respondents.

4.2.1 Diet History

Family diet history of the respondents were also assessed and it revealed that majority of the respondents were non-vegetarians (Table 16) and it was found that their family food habits was same as that of respondents.

The enquiry on avoidance of non-vegetarian foods on special occasions revealed that among EMR 77.8 percent avoided non-vegetarian foods on special occasions while 22.22 per cent did not. But among LMR 36 out of 49 (73.47 per cent) avoided non-vegetarian foods on special occasions.

Data regarding fasting revealed that about 61.11 per cent among (EMR) did not fast while 38.89 per cent of respondents did fasting every week. Among LMR, 65.31 per cent did not fast at all and only 34.69 percent of LMR do fasting.

4.3 ASSESSMENT OF NUTRITIONAL STATUS

Assessment of nutritional status of the respondents in this study was done using anthropometric measurements, 24 hour recall method, and clinical examination and biochemical parameters.

4.3.1 Anthropometric measurements

Anthropometric measurements are often used as proxies for assessing the extent and severity of malnutrition. The anthropometric measurements recorded were height, weight, triceps skin fold thickness (TST) and waist and hip circumferences.

The height and weight of the respondents were measured and these ranged from 135-163 cms and 24-60.5 kg for EMR and 135-170 cms and 30-60 Kg for LMR.

Table 24: Gomez Classification based on degree of malnutrition assessed through weight for age profile

| Cut-off level as percentage of NCHS median | Type/ Degree of malnutrition | EMR | | LMR | |
|--|------------------------------|--------|------------|--------|------------|
| | | Number | Percentage | Number | Percentage |
| <60 | Severe | - | - | 2 | 4.08 |
| 60 – 70 | Moderate | 1 | 1.85 | 14 | 28.57 |
| 75 – 90 | Mild | 8 | 14.81 | 19 | 35.19 |
| >90 | Normal | 45 | 83.33 | 14 | 25.93 |
| Total | | 54 | 100.00 | 49 | 100.00 |

According to Gomez classification (NNMB, 2002) malnutrition was classified into severe, moderate, mild and normal based on the degree of severity. As indicated in table 24, 83.33 percent of EMR were found as normal while 14.81 percent as mildly malnourished and 1.85 per cent as moderately malnourished. No one was found as severely malnourished among EMR. (Fig 1)

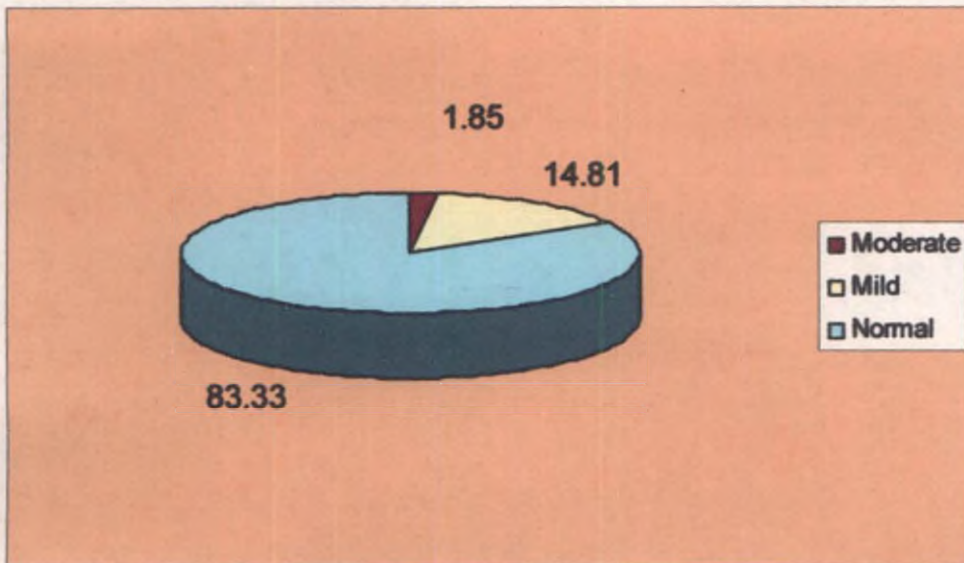


Fig.1. Type of Malnutrition observed in EMR

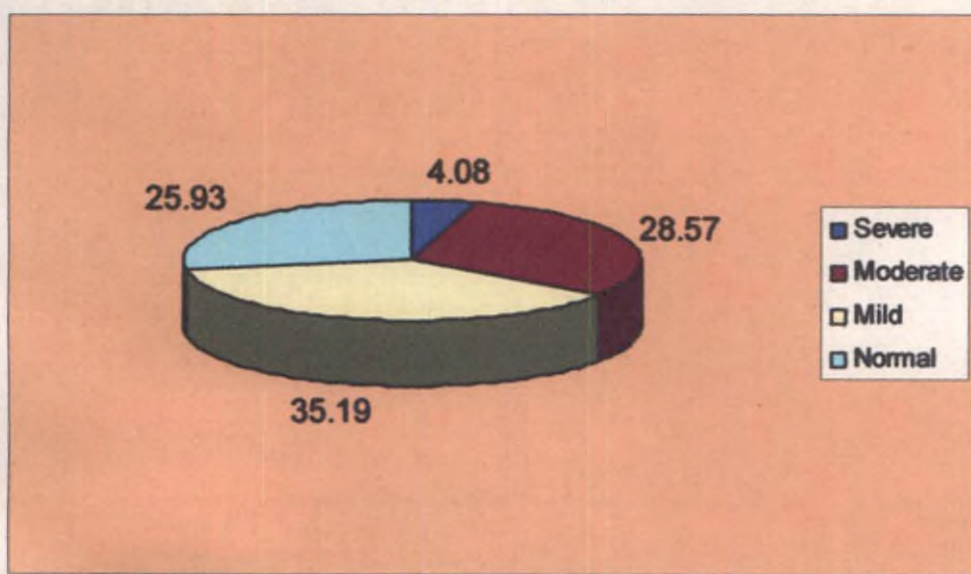


Fig.2. Type of Malnutrition observed in LMR

Among LMR, 35.19 per cent were mildly malnourished where as 28.57 percent and 25.93 percent were moderately malnourished and normal respectively. About 4.08 per cent found as severely malnourished.

4.3.1.1. Body mass Index (BMI)

Body Mass Index of the respondents was computed in order to classify them according to different categories like ‘Chronic Energy Deficit’ (CED), ‘normal’ and ‘obese’.

Table 25: Distribution of respondents based on their BMI

| BMI Classification* | EMR | | LMR | |
|---------------------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| < 15 CED | 3 | 5.56 | 2 | 4.08 |
| 15 – 22 Normal | 42 | 77.78 | 39 | 79.59 |
| > 22 Overweight | 8 | 14.81 | 7 | 14.29 |
| > 25 Obesity | 1 | 1.85 | 1 | 2.04 |
| Total | 54 | 100.00 | 49 | 100.00 |

* Source : Eliz Health Path for Adolescents (EHPA), Elizabeth, 2005

The Eliz Health Path for Adolescents (EHPA) fig(3) shows that reading within the green zone is normal i.e. from 15-22. Reading below BMI 15 indicates under weight or Chronic Energy Deficiency (CED) (blue zone), reading above 22 indicates over weight (yellow zone) and above 25 indicates obesity (red zone).

Table 25 reveals that among EMR 42 out 54 (77.78 per cent) were normal, 8 out of 54 (14.81 per cent) were overweight, 5.56 percent (3 out of 54) were under the category of CED where as only 1 respondent (1.85) was found as obese. Regarding LMR, 75.59 per cent were normal, 14.29 percent were overweight, 4.08 percent under weight and only 1 respondent (2.04 per cent) was found to be obese.

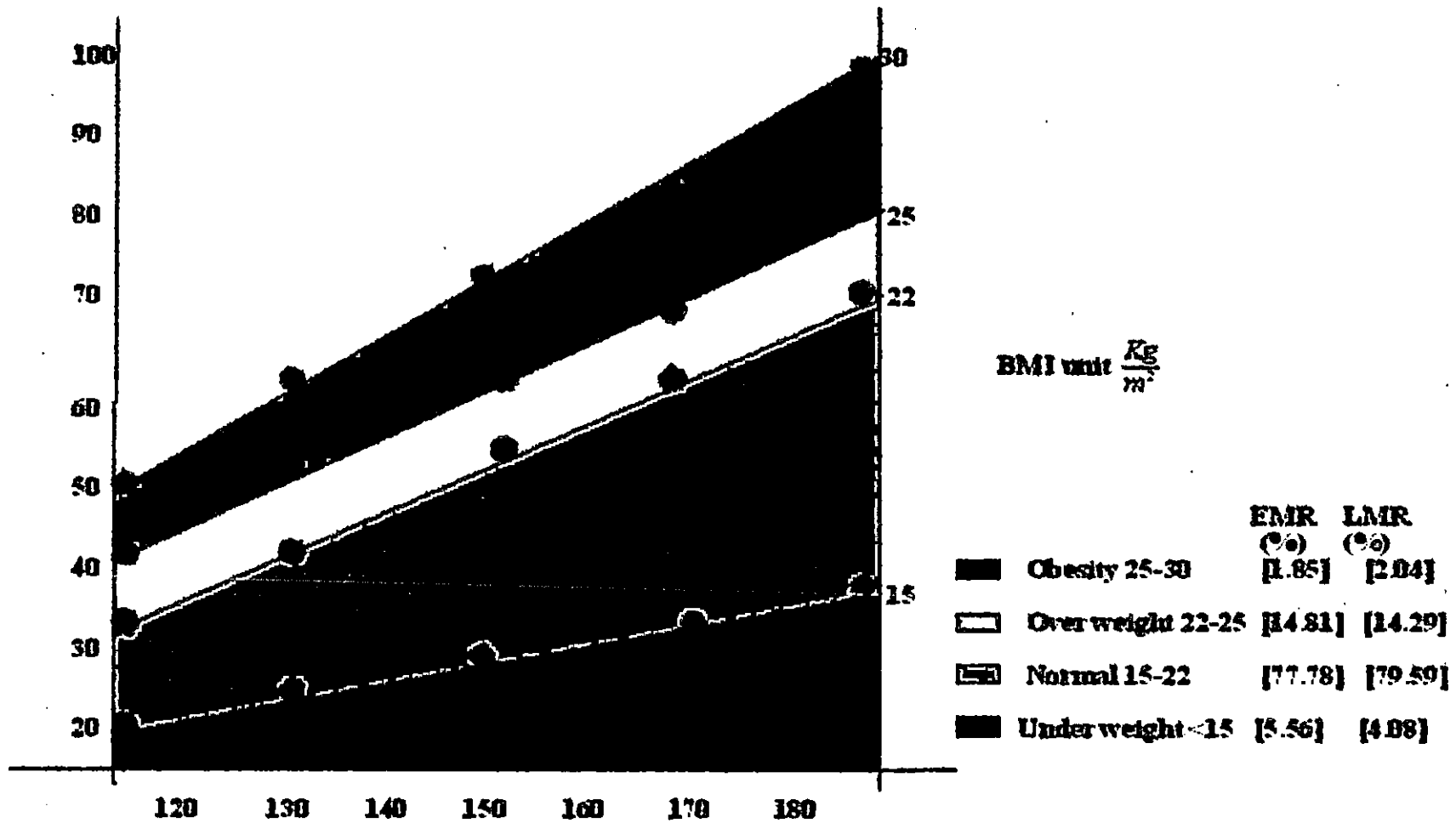


Fig 3. BMI Classification based on Eliz Health Path for Adolescents (EHPA)

4.3.1.2 Triceps Skin Fold Thickness (TST)

Table 26: Distribution of EMR based on their TST

| TST (mm)* | EMR | |
|------------------|--------|------------|
| | Number | Percentage |
| < 12 (Low) | 2 | 3.70 |
| 12 – 14 (Normal) | 11 | 20.37 |
| > 14 (High) | 41 | 75.93 |
| Total | 54 | 100.00 |

*Source: Frisancho, 1981

Table 27: Distribution of LMR based on their TST

| TST (mm)* | EMR | |
|------------------|--------|------------|
| | Number | Percentage |
| < 17 (Low) | 15 | 30.61 |
| 17 – 19 (Normal) | 21 | 42.86 |
| > 19 (High) | 13 | 26.53 |
| Total | 54 | 100.00 |

* Source: Frisancho, 1981

Table 26 reveals that 75.93 percent of EMR had high TST while 20.37 percent had normal and only 3.70 per cent had low TST.

Among LMR (Table 27) 42.86 percent had normal TST, 30.61 percent and 26.53 percent had low and high TST respectively.

4.3.1.3 Waist Hip Ratio (WHR).

Standard for WHR for adolescents is not available so the generated data is classified using the adult standard.

Table 28: Distribution of respondents based on their WHR

| WHR* | EMR | | LMR | |
|--------------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| < 0.8 (Low) | 15 | 27.78 | 30 | 61.22 |
| 0.8 (Normal) | 8 | 14.82 | 4 | 8.16 |
| > 0.8 (High) | 31 | 57.41 | 19 | 38.78 |
| Total | 54 | 100.00 | 49 | 100.00 |

* Source : Srilakshmi, 2003

Among EMR, 57.41 percent had high WHR while 27.78 per cent had low WHR, only 14.82 per cent had normal WHR. And in LMR 38.78 per cent had high WHR and 61.22 per cent had low WHR and only 4 out of 49 (8.16 percent) had normal WHR.

4.3.2 Mean Nutrient Intake

Table 29 and 30 depicts the mean nutrient intake of EMR and LMR respectively. Table 29 was compared with that of recommended allowances for girls of age group between 10-12 years and table 30 was compared with that of girls of age group between 16-18 years.

Table 29: Mean Nutrient intake of EMR

| Nutrients | Mean Intake | RDA * | % of RDA met | % of RDA deficit |
|---------------|-------------|-------|--------------|------------------|
| Energy (Kcal) | 1988.2 | 1970 | 10.92 | - |
| Protein (g) | 61.90 | 57 | 108.59 | - |
| Fat (g) | 41.90 | 22 | 190.45 | - |
| Iron (mg) | 18.60 | 19 | 97.89 | 2.11 |

*Source: ICMR, 1989

Table 29 shows the mean intake of nutrients by EMR, it revealed that the mean intake of the energy was 1988.2 Kcals, which was found to meet above the recommended allowances (100.92 per cent). The mean protein intakes were found to be 61.9 g, which was 108.59 per cent RDA.

The mean intake of fat was 41.9 g and iron was 18.6 mg. The percentage of RDA met for fat was 190.45 where as iron was found to be deficient with 2.11 per cent.

Table 30: Mean Nutrient intake of LMR

| Nutrients | Mean Intake | RDA * | % of RDA met | % of RDA deficit |
|---------------|-------------|-------|--------------|------------------|
| Energy (Kcal) | 2127.6 | 2060 | 103.28 | - 4.29 |
| Protein (g) | 60.30 | 63 | 95.71 | - |
| Fat (g) | 35.00 | 22 | 159.10 | - 32.33 |
| Iron (mg) | 20.30 | 30 | 67.67 | |

*Source: ICMR, 1989

Data regarding the mean nutrient intake of LMR showed that the energy intake was 2127.6 Kcals which was found to be above RDA. But protein (60.3 g) and iron 20.3 mg) intake was found to be deficit with 95.71 percent for protein and 67.67 percent iron were met as per RDA.

4.3.3. Clinical Examination

Table 31 depicts the clinical symptoms of deficiency diseases observed

| Clinical Symptoms | EMR | | LMR | |
|------------------------|--------|-------------|--------|-------------|
| | Number | Percentage* | Number | Percentage* |
| Anaemia | 19 | 35.19 | 21 | 42.86 |
| Skin Pigmentation | 1 | 1.85 | 1 | 2.04 |
| Gum spongy & Bleeding | 2 | 3.70 | 3 | 6.12 |
| Dental caries | 9 | 16.67 | 21 | 42.86 |
| Mottled enamel | 10 | 18.52 | 7 | 14.29 |
| Naso-labial dyssebaces | 6 | 11.11 | 9 | 18.37 |
| Eye problem | 2 | 3.70 | 4 | 8.16 |
| Skin pigmentation | 3 | 5.56 | 4 | 8.16 |
| Thyroid | - | - | 1 | 2.04 |
| Tongue red & raw | 9 | 16.67 | 7 | 14.29 |
| No clinical symptoms | 3 | 5.56 | 5 | 10.20 |

* Includes more than one item

It can be seen from Table 31 that 42.86 per cent among LMR and 35.19 per cent among EMR were found as anaemic. Among EMR 18.52 per cent had skin pigmentation, whereas only 2.04 per cent of LMR were having skin pigmentation.

Symptoms of dental caries and tongue red and raw were found to be in 16.67 per cent of EMR and 42.86 per cent of LMR were having dental caries and 14.29 percent had tongue red and raw.

Clinical symptoms like mottled enamel was present in 18.52 per cent of EMR and 14.29 per cent of LMR. Only 5.56 per cent of EMR and 10.20 per cent of LMR had no symptoms of clinical deficiencies.

4.3.4 Biochemical assessment

4.3.4.1 Hemoglobin

The biochemical assessment of nutritional status of the respondents was conducted by estimating the haemoglobin level. Table 32 shows the distribution of respondents based on haemoglobin level

Table 32: Distribution of respondents based on their haemoglobin level

| Haemoglobin level (gm/dl)* | EMR | | LMR | |
|-------------------------------|--------|------------|--------|------------|
| | Number | Percentage | Number | Percentage |
| < 7.9 (Severe) | - | - | - | - |
| 8.0 – 9.9 (Moderate) | 4 | 7.41 | 3 | 6.12 |
| 10.0 – 10.9 (Mild) | 15 | 27.78 | 17 | 34.69 |
| 11 – 11.9 (Marginal) | 7 | 12.96 | 9 | 18.37 |
| >12 (Non marginal) | 28 | 51.85 | 20 | 40.82 |
| Total | 54 | 100.00 | 49 | 100.00 |

*Source : NIN, 1984

From Table 32, it can be seen that among EMR, 51.85 percent were non-anemic where as 27.78 per cent were mildly anaemic, 12.96 per cent were marginally anaemic and 7.41 per cent were moderately anaemic.

Among LMR, 20 out of 49 (40.82 per cent) were non-anaemic, 34.69 per cent mildly anaemic, 18.37 marginally anaemic and only 6.12 percent were moderately anaemic.

None of the respondents were found to be severely anaemic in both the groups.

4.4 NUTRITIONAL STATUS INDEX

Nutritional Status Index (NSI) of the respondents were assessed using the parameters such as height, Weight, WHR, haemoglobin level, energy and protein intake of the respondents. The formula of NSI developed for i^{th} sample (respondents) was

$$NSI = \sum \left[\frac{X_{ij} - N_{ij}}{S_{ij}} \right]$$

Where, X_{ij} = Observation corresponding to j^{th} variable for the i^{th} sample

N_{ij} = Normal value corresponding to j^{th} variable for the i^{th} sample

S_{ij} = Standard deviation corresponding to j^{th} variable for the i^{th} sample

\sum = Indicate sum over all the variables for the i^{th} sample (respondents)

The respondents were classified based on their NSI as those above mean + standard deviation (S.D) as high, those between mean \pm S.D as medium, and the respondents below mean - S.D as low NSI.

It was found that the NSI values obtained for the EMR ranged from 0.18 to 9.13 whereas for LMR it ranges between 0.01 and 5.41. The NSI values of the respondents are given in Appendix X and XI. The distribution of the respondents based on their NSI is given in Table 33 and 34.

The mean value of NSI of the EMR were 2.91 and the S.D was 2.13 and the mean value of NSI of LMR were 2.02 and the S.D was 1.61



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Table 33: Distribution of EMR based on their NSI

| NSI | Number | Percentage | Mean \pm S.D |
|--------|--------|------------|---------------------------|
| High | 6 | 11.11 | $> (2.91 + 2.13)$ |
| Medium | 39 | 72.22 | Between (2.91 ± 2.13) |
| Low | 9 | 16.67 | $< (2.91 - 2.13)$ |
| Total | 54 | 100.00 | |

Table 33 depicts that 72.22 per cent of the respondents had a medium NSI while 11.11 per cent of the respondents had high NSI and 16.67 per cent of the respondents had low NSI.

Table 34: Distribution of LMR based on their NSI

| NSI | Number | Percentage | Mean \pm S.D |
|--------|--------|------------|---------------------------|
| High | 7 | 14.30 | $> (2.02 + 1.61)$ |
| Medium | 34 | 69.39 | Between (2.02 ± 1.61) |
| Low | 8 | 16.33 | $< (2.02 - 1.61)$ |
| Total | 49 | 100.00 | |

Table 34 depicts that 69.39 per cent of the respondents had a medium NSI while 16.33 percent of the respondents had low NSI whereas only 14.30 percent of the respondents had high NSI.

4.5. RELATIONSHIP BETWEEN AGE AT MENARCHE AND SELECTED INDEPENDENT VARIABLES.

Relationship between age at menarche of the respondents and selected independent variables was ascertained using correlation technique.

The independent variables selected were family size, total family income, mother's menarcheal age, respondents' weight, height, TST, BMI, WHR, haemoglobin level, NSI, dietary variables like energy, protein, fat and iron intake.

Table 35: Relationship between age at menarche and selected independent variables

| Independent variables | Age at Menarche | |
|-------------------------|-----------------|----------|
| | EMR | LMR |
| Family size | 0.2331 | 0.4361** |
| Total Family Income | 0.2699* | 0.0161 |
| Mother's menarcheal age | 0.0970 | 0.1743 |
| Weight | 0.4229** | 0.1086 |
| Height | 0.1678 | 0.0869 |
| TST | 0.3451** | 0.0086 |
| BMI | 0.3877** | 0.0708 |
| WHR | 0.0392 | 0.2072 |
| Haemoglobin level | 0.0494 | 0.1796 |
| NSI | 0.2731* | 0.0555 |
| Energy Intake | 0.3366** | 0.1612 |
| Protein Intake | 0.1900 | 0.2391 |
| Fat Intake | 0.2830* | 0.2046 |
| Iron Intake | 0.1364 | 0.0147 |

* Significant at 5% level

** Significant at 1% level

Table 35 indicates that there is a significant relationship between age at menarche of EMR with total family income (0.2699*), NSI (0.2731*) and fat intake (0.2830*) at 5 per cent level whereas at 1 per cent level the significance was found to be with weight (0.4299**), TST (0.3451**), BMI (0.3877**) and energy intake (0.3366**).

Among LMR, family size, (0.4631**) were having a significant correlation with age at menarche and no other variables had a significant relationship with age at menarche of LMR.

4.5.1 Association of Consumption of proteineous foods and Age at Menarche.

The degree of association between proteineous foods and age at menarche obtained through χ^2 values is presented in the following table.

Table 36: Association of consumption of proteineous food with age at menarche

| Protein foods | χ^2 | |
|---------------|------------|-----------|
| | EMR (n=54) | LMR(n=49) |
| Egg | 12.63* | NS |
| Meat | NS | NS |
| Fish | NS | NS |
| Milk | NS | NS |

* Significant at 5% level

NS = Not Significant

χ^2 test showed that there is a significant association between consumption of egg with early menarche but no significant association was found with rest of the proteineous foods. It was found that consumption of proteineous foods had no association with late menarche.

4.5.2 Group wise comparison of selected independent variables

Table 37: Group wise comparison of selected independent variables

| Variables | Average value of EMR | Average value of LMR | F - Value |
|---------------------------|----------------------|----------------------|-----------|
| Family size | 2.26 | 2.63 | 4.31* |
| Mother's menarcheal age | 13.00 | 16.00 | 15.05** |
| Weight (Kg) | 42.74 | 47.66 | 9.53** |
| Height (cms) | 150.05 | 157.67 | 27.59** |
| Haemoglobin level (gm/dl) | 11.88 | 11.71 | 0.34 |
| Age at menarche (months) | 120 | 180 | 955.10** |
| NSI | 1.97 | 0.29 | 9.04** |
| TST (mm) | 16.72 | 18.02 | 4.50* |
| WHR | 0.80 | 0.81 | 0.31 |
| Income | 4486.74 | 3052.78 | 5.17* |
| BMI | 18.95 | 19.20 | 0.21 |

* Significant at 5% level

** Significant at 1% level

The ANOVA results revealed that there is significant differences between mothers menarcheal age (15.05**), weight (9.53**), height (27.59**), age at menarche (955.10**), NSI (9.04**) at 1 per cent level and family size (4.31*), TST (4.50*) and income (5.17*) at 5 per cent level between EMR and LMR.

But it was also found that there is no significant differences between EMR's and LMR's haemoglobin level, WHR and BMI.

DISCUSSION

5. DISCUSSION

The results presented in the previous chapter are discussed in this session with relevant empirical evidences, under the following headings.

- 5.1 Personal and Socio-economic characteristics of the respondents.
- 5.2 Food consumption pattern of the respondents.
- 5.3 Nutritional Status of the respondents.
- 5.4 Nutritional Status Index of the respondents.
- 5.5 Relationship between Age at Menarche and selected independent variables.

5.1 PERSONAL AND SOCIO-ECONOMIC CHARACTERISTICS OF THE RESPONDENTS

Children are one of the most important groups of any society as they have an influential effect on the future socio-economic and cultural status of the society (Pourmaghim and Aminpour, 2003). A recent research reveals that socio-economic and demographics factors play an important role in the food consumption pattern (Rahman and Rao, 2002). Other research studies done earlier also indicate that the effect of nutrition can be understood only in terms of family and social environment and also the kinds of economic and educational resources of the children (Ricciuti, 1993). Hence the personal and socio-economic characteristics of the respondents were ascertained. Data on age of respondents revealed that majority of the (Early Menarche Respondents) EMR belonged to the age group of 10-10.9 years (70.37 per cent) and among (Late Menarche Respondents) LMR majority were belonged to the age group of 16-16.9 years (59.18 per cent).

Assessment of the religion of the respondents (Table 3) revealed that 83.34 per cent among EMR and 85.72 per cent among LMR were belonged to Hindu community. This agrees with the findings of Kerala Statistical Institute (2000) that vast majority of the population of the Thiruvananthapuram District is predominated by Hindu religion, followed by Christians and Muslims.

The caste wise distribution of the respondents revealed that among EMR and LMR majority belonged to forward caste with 55.56 and 53.06 per cent respectively and 33.33 per cent and 30.61 per cent of EMR and LMR respectively belonged to backward caste while 6 out of 54 (among EMR) and 8 out of 49 (among LMR) belonged to SC/ST.

The familial backgrounds of the respondents were also studied in detail to understand the socio-economic conditions. Arora (1991) opined that socio-economic level such as social, economic, religious and the family background in general, have a very distinct part to play in determining the attitudes and food behavioural pattern of an individual. Concerning the family type, it is observed that about 75.92 per cent of EMR and 91.84 per cent of LMR belonged to nuclear families. Only 7.41 per cent and 16.67 per cent of EMR belonged to joint and extended families respectively. Among LMR, rests of 8.16 per cent were found to be in joint families and one was found to belong to extended families. This data shows that the concept of nuclear family is becoming more and more common in our society and joint family system is fast disappearing. Saxena (1986) was of the opinion that the nuclear families are generally better than joint families for the healthy development of a child.

Regarding the family size, Park (1997) had reported that average family size in India is four. In the present study also majority (75.92 per cent EMR and 59.18 per

cent LMR) belonged to small sized families with 1 to 4 members, comprising of father, mother and one or two children. While 18.52 per cent of EMR and 36.73 per cent of LMR belonged to medium sized families and only 5.56 per cent of EMR and 4.09 per cent of LMR were from large size families with above 7 members among EMR and LMR respectively.

In this study, it was found that majority of the respondents parents in both group (EMR and LMR) has education up to secondary level (Table 7 and 8). None of the parents were found to be illiterate. The level of education of parents influence the activities of children and their purchase requirements (Sonia et al., 2001). She also found that higher the level of education of parents, the more, children were able to realize the intention of TV commercials made on them. Occupation status of parents showed the most of the fathers were casual labourers i.e. 51.85 per cent of EMR and 69.39 per cent of LMR. Mothers' occupational status showed that only 20.37 per cent and 24.49 per cent of EMR and LMR respectively were employed while rest of the mothers of both group were house wives. Singh (1997) found that parent's occupation will affect parent child relationship and thus home climate.

On analysis of economic status of the selected respondents, it could be observed that 37.04 per cent of EMR and 53.06 per cent of LMR were having a monthly income below \leq Rs. 2250. Among EMR 29.63, 12.96 and 11.11 per cent were having a income level between Rs. 5001 to 10000, above Rs. 10001 and Rs. 2251 to 3500 respectively. Only 9.26 per cent of EMR were having a income level of Rs. 3501 to 5000. But among LMR 20.41 were having an income level Rs. 2251 to 3500 and 18.37 per cent were having an income level between Rs. 3501 to 5000 while equal number of respondents i.e. 4.08 per cent were having an income level of Rs. 5001 to 10000 and above Rs. 10001. On comparing the economic status of the EMR's families were found in a better position than LMR. The high level of income provides enough opportunities for better nourishment and care.

Data on birth order reveals that most of the respondents were first born i.e. 55.56 per cent of EMR and 53.06 per cent of LMR while rest of the respondents were second and third born.

The age at which first menstrual period occurs is an excellent physiological marker of adolescent maturation (Neeru et al., 2006). The age at menarche is widely considered as an important landmark in the sexual maturity. In this study, it was found that average early age at menarche as 10 years while for late menarche it was found as 15 years. This was in line with the study done by Neeru and co-workers in 2006.

Mother's menarcheal age as said by Ersoy et al. (2005) is a good predictor of the daughter's menarcheal age in non-obese girls and the BMI is an important factor. Here in this study it was found that the average age at menarche of mothers of early menarcheal girls as 13 years and while that of LMR as 16 years. The present study results also substantiate the above findings as in the case of LMR.

It was revealed from the study that 1.17 hours is the average time spent/day by EMR on physical activities which includes household activity, sports, NCC, jogging, walking, dancing etc. While the average time spent by LMR was 2.18 hours/day. Chidierbere (2005) had shown that the mean age of menarche was significantly higher in girls involved in vigorous sporting activity this may be the reason for late menarche in this study subjects.

Data on the distance of school from residence of respondents revealed that about 44.44 per cent of EMR and 32.65 per cent of LMR stayed at a distance between 2-5 Kms, whereas 44.89 per cent of LMR and 38.89 per cent of EMR were

stayed at a distance of more than 5 Kms. Staying at less than 1 km distance was reported by only 3.70 per cent (EMR) and 4.08 per cent (LMR).

Assessment of mode of transport revealed that about 67.35 per cent of LMR and 38.89 per cent of EMR were using public conveyance to reach the school. This may be due to the reason that majority of them stayed at a distance more than 5 Kms.

5.2 FOOD CONSUMPTION PATTERN OF THE RESPONDENTS.

According to Gift et al. (1972) food habits of an individual are the characteristics repetitive act that he performs under the impetus of need to provide himself with nourishment and simultaneously to meet an assortment of social and emotional goals. Mony (1993) opined that biological and psychological development changes during the adolescent period has a dynamic effect on the food preference, food habits and eating behavior of adolescents. In the present study it was found from the food habits that 98.15 per cent among EMR and 89.80 per cent among LMR were non-vegetarians while 1.85 per cent and 10.20 per cent among EMR and LMR were Hindu-Brahmin and were vegetarians. Similar results were observed by Krishna Roopa (2003) and Beatrice (1999) in their studies undertaken in Thiruvananthapuram District where majority of adolescents were noted as non-vegetarians. Consumption pattern of Keralites as reported by Kerala Statistical Institute (2000) also revealed that 98 per cent of the Keralities are habituated to non-vegetarian foods.

On assessing the frequency of use of food items by the respondents it was found that cereals were consumed daily, as cereal is the staple food of India and among this, rice is consumed daily by Keralites. In addition to this nuts and oil seeds and sugar was found to be used daily by the respondents. Coconut was used daily

since it is an integral part of the gravy of dishes based on vegetables or fish. A study done by Vibha and Sibal (2003) among Senior Secondary Students in Delhi Schools also revealed the same that cereals, fats and oils and sugar were consumed daily by adolescents. These findings were found as same for both the group i.e. EMR and LMR.

Next to cereals, fish, processed foods and beverages were found as consumed almost daily by EMR and along with these food groups, roots and tubers were consumed almost daily by LMR. Consumption of fish was high as reported by Nirmala (2002). Supreet (2005) reported that the consumption of processed foods and fast food is increasing among children. Consumption of tea/coffee was found higher than carbonated beverages. The consumption of roots and tubers were found as higher among LMR (90.37 per cent) and among EMR it was found to be only 72.75 per cent. But both small and big onions are taken daily as these are included as seasoning in most of the preparations.

Among EMR, pulses, leafy vegetables, roots and tubers, other vegetables, milk and its products are included at alternate dietaries whereas among LMR the foods which are used as alternate dietaries are pulses, other vegetables, milk and its products, fish and processed foods. In this study it was found that all the respondents consumed milk daily. This study is not in line with that of Khalil (2003) and Yamini (2004) as only a very negligible percentage of adolescent girls had either, egg or fruits in their daily food choices. In a study done by Raja et al. (2003) on school girls revealed that green leafy vegetables are consumed daily or on alternate days by 36 per cent of the respondents. A study done by Kumari and Singh (2001) on secondary school children in Samastipur District of Bihar, reported that green leafy vegetables, other vegetables and fruits are inadequate in adolescents diet.

Egg consumption was found to be mostly once in a week. Among fruits, banana was consumed almost daily. The study done by Krishna Roopa (2003) also revealed that when adolescent skip breakfast their mother compel them to take milk, egg and fruits mainly banana. This may be due to the frequent availability and comparatively cheaper price of banana.

Food preference is formed as a result of complex interaction of many factors in an individual's environment (Eggert, 1984). All the respondents reported that they like equally the food prepared both at home and outside home. 91.84 per cent among LMR and 64.81 per cent among EMR take food from outside occasionally.

About 66.67 per cent among EMR and 14.29 percent among LMR are in a habit of nibbling whereas 65.31 per cent among LMR and 48.15 per cent among EMR skip meals. Skipping of meals is seen generally among older girls and this was found to be true by Nickles et al. (2002) where he found that skipping lunches is generally taken to be away of controlling weight. In this study it was found that mostly breakfast was skipped. This is in line with the findings of Pranzetti et al. (1989). Lack of time due to tuition classes were the reasons reported by the respondents. About 72.22 per cent of EMR and 79.59 per cent of LMR were in a habit of taking packed lunch with them. 96.29 per cent of EMR and 59.18 per cent of the LMR had a time schedule for taking food while 81.48 per cent of EMR and 36.73 per cent of LMR had meals 3 times a day as we can see that only small percent of the LMR had meals 3 times a day while 28.57 per cent had meals only two times a day and 18.37 per cent had meals only once in a day and 16.33 per cent (8 out of 49) had meals more than 3 times a day.

Among EMR and LMR, 'rice' is the most disliked food item whereas "chicken biriyani" was the most preferred food item among both the groups. Chacko

and Begum (2007) opined that consumption of foods high in both fat and sugars are very common among adolescents children.

Diet history is equally important in assessing nutritional status (Poleman and Capra, 1984). Diet history of the respondents revealed that majorities were non-vegetarian and only a small portion of the respondents were vegetarians because they were Hindu-Brahmins.

Majority (77.78 per cent) of the respondents were found to avoid non-vegetarian foods on special occasions like Vishu, Onam, Diwali, Siva Ratri etc and also on birthdays, marriages, etc. But some of the respondents include non-vegetarian foods on birthdays.

Data regarding fasting revealed that all Fridays and Saturdays are the days when 61.11 per cent of EMR and 38.89 per cent of LMR among the respondents keep fasting. Some of the respondents' family had a particular belief regarding the use of vessels for preparation of foods e.g. Mud vessel used to cooking enhances taste and also banana leaves for serving food.

5.3 ASSESSMENT OF NUTRITIONAL STATUS

Children form a significant part of our population and the assessment of their nutritional status is relevant as healthy children are a pre-requisite to healthy adult life and healthy future generation. Optimum care and guidance provided during this period could help them to develop to their optimum potential, because life risks during this period is rather high. Poor food habits, hectic life style and neglected diet are known to be the main causes of their health risks.

Nutritional anthropometry is the measurement of human body at various ages and it is based on the concepts that an appropriate amount should reflect any morphological variation due to significant functional and physiological change (Rao, 1996).

Anthropometric measurements viz, height, weight, Triceps Skin fold Thickness (TST) and Waist Hip Ratio (WHR) were taken into account for assessing the nutritional status of the respondents.

Body Mass Index (BMI) is an indicator of body's energy stores as reported by Choudhary and Solanki (1999). It is found from this study that among EMR 77.78 per cent are normal and among LMR 79.59 per cent were normal.

The prevalence of overweight was found to be 14.81 per cent and 14.29 per cent among EMR and LMR respectively. In a study done of Ramachandran (2002) on 13 to 18 years old children in India showed that the prevalence of overweight was 17.8 per cent among boys and 15.8 per cent among girls. In this study the prevalence of under nutrition were found as 5.56 per cent and 4.08 per cent among EMR and LMR respectively whereas from the total subjects only 2 respondents were found obese.

TST measurement helped to assess the subcutaneous fat reserve which in turn gives an indication of calorie reserves in the body of an individual (Malina et al., 1974). It can be seen from table 26 and 27 that among EMR majority of them were having high TST (75.93 per cent) where as among LMR majority had normal (42.86 per cent) TST values.

An increase in the WHR indicates increased accumulation of abdominal fat. In this study 57.41 per cent of EMR and 38.78 percent of LMR had high WHR. This shows that EMR had high abdominal fat and this may be a reason for their early menarche.

Food consumption is another important determinant of nutritional status. An adequate or balanced diet provides all the essential nutrients in sufficient quantities and proper proportion to meet the needs of the body (ICMR, 1989). In this study, it was revealed that among EMR except for iron all other nutrients adequately met the RDA. Among the nutrients, energy intake was 100.92 per cent of Recommended Dietary Allowances (RDA), protein intake was 108.59 percentage of RDA whereas fat intake was found as 190.45 percentage of RDA. The high protein intake is may be due to the intake of fish every day. Meyer et al. (1990) showed that a higher dietary energy intake was associated with an earlier age at menarche. Dietary composition and dietary fat in particular was related to menarche. Intake of iron was below RDA only 2.11 percentage deficit.

Among LMR, energy intake and fat intake was found to be more than the RDA i.e. 103.28 percentage of RDA for energy and 159.10 percentage of RDA for fat. At the same time protein intake and iron intake was found as below RDA. About 4.29 percentage and 32.33 percentage deficit for protein and iron intake respectively. Barbin and Barbin (1992) opined that low iron stores throughout childhood may contribute to a delayed menarche and impaired immune response.

From the clinical examination it was seen that anaemia is the most common nutritional deficiency symptom noted. In school children anaemia impairs scholastic performance and in young woman, the reproductive performance (Thirumani and Uma, 2005). Among EMR the percentage of respondents found anaemic were 35.19

and among LMR it was 42.86 per cent. Agarwal (1998) reported that in the urban slums of Delhi the prevalence of anaemia in pre-menarcheal and post-menarcheal girls was 6.6 and 48.4 per cent respectively. The prevalence of anaemia in post-menarcheal girls may be due to loss of iron through menstruation.

Other clinical symptom found among the respondents was dental caries. Dental caries was found high among LMR (42.86 per cent). Mottled enamel was found among 18.52 per cent of EMR and 14.29 per cent of LMR. Mild symptoms of skin pigmentation, bleeding gum, eye and skin problem, thyroid enlargement, naso-labial dyssebaces were found in some of respondents studied.

A study done by Shahbuddin (2000) in Bangladesh has proved that 46.00 per cent suffer from angular stomatitis, 32.00 per cent had thyroid enlargement. The deficiency symptoms shown by the respondents may be due to the inadequate and unbalanced diet with low intake of fruits and vegetables which led to micronutrient deficiencies that may result in deficiency symptoms and poor work efficiency.

Haemoglobin level is another indicator of an individual's health and nutritional status. The present study revealed that majority were non-anaemic and also found that none of the respondents were severely anaemic. Among EMR 7.41 per cent, 27.78 per cent and 12.96 per cent were found to be moderately, mildly and marginally anaemic whereas among LMR 6.12, 34.69 and 18.37 per cent of the respondents were moderately, mildly and marginally anaemic.

Gawarikar et al. (2002) opined that due to growth spurt in adolescent period the risk of iron deficiency anaemia appears to be more for boys and in girls this remain as such during their reproductive life.

5.4 NUTRITIONAL STATUS INDEX

The Nutritional Status Index (NSI) of the respondents was compared based on the various parameters assessed for determining the nutritional status like height, weight, WHR, Haemoglobin level, Energy and Protein intake. Nutritional status indexes computed indicated that the mean value for the EMR was 2.91 and the nutritional status index of the EMR ranged between 0.18 and 9.13 and of LMR it ranged between 0.01 and 5.41. Majority (72.22 per cent) of the EMR had medium nutritional status index and 16.67 per cent has low NSI and 11.11 per cent has high NSI. Among LMR, 69.39 per cent had medium NSI whereas 16.33 and 14.30 per cent had low and high NSI respectively.

5.5 RELATIONSHIP BETWEEN AGE AT MENARCHE AND SELECTED INDEPENDENT VARIABLES.

In the present study it was found that among the socio-economic variables studied, total family income had a co-relation with age at menarche of EMR. As family income increases the phenomena of earlier puberty increases (John et al., 2004). With regard to LMR, family size had a co-relation with age at menarche but no other variables had a co-relation with LMR's age at menarche.

Among EMR dietary variables like energy and fat intake had a co-relation with age at menarche. This is in a line with the findings of Meyer et al. (1990). Variable like weight, TST, BMI, NSI, has a relation too. David et al. (2002) is of the opinion that height and weight has a relation in early age at menarche.

It was found that the only protein food which has association with age at menarche was egg and the association was with EMR. All other (Table 36) has no significant association.

Valsik et al. (1973) also found the same result that protein rich diet includes an earlier onset of menarche. Amrita and Kulkarni (2000) found that egg consumption had a positive relation with earlier menarche.

A group wise comparison of selected independent variables of EMR and LMR was carried out using ANOVA and it was found that except haemoglobin level, WHR and BMI all other variables had a significant differences (Table 37) between themselves.

From this study, it was found that the average age of early menarche among the respondents was 10 years while that of late menarche was 15 years.

Food habits of the respondents showed that about 98.15 per cent of EMR were non-vegetarians whereas 89.80 per cent of LMR were non-vegetarians. Among LMR, fat intake was high but protein and iron intake were found to be deficit in comparison with RDA.

SUMMARY

6. SUMMARY

The present study entitled "Age at Menarche and Nutritional Status of Urban School Girls" was conducted with an objective to find out the age at menarche among urban school girls in relation to their nutritional status, food habits and food preference.

Locale of the study selected was Govt. Girls High School, Cotton Hill, Thiruvananthapuram District. Girls who had menarche one month prior to the survey was the criteria followed for selection of the respondents. A checklist specially designed for the purpose was used to identify the respondents. The selected sample comprised of 103 students with 54 respondents who had early menarche and 49 respondents who had late menarche.

An explorative survey technique with co relational approach was used for the study.

Assessment of social status of the respondents revealed that among Early Menarche Respondents (EMR) majority belonged to the age group of 10-11 years and among Late Menarche Respondents (LMR) it was found as 16-17 years. Majority of the respondents belonged to Hindu religion and about 55.56 per cent of EMR and 53.06 per cent of LMR belonged to forward caste. Analysis of family structure revealed that majority of the respondents belonged to nuclear type of families and had a family size of 1-4 members.

Regarding parents educational status it was found that for both the groups (EMR and LMR) the majority of fathers and mothers had education up to secondary

level. The occupational status of the fathers showed that majority of them were casual labourers and among mothers most of them were house wives. About 53.06 per cent of EMR and 37.04 per cent of LMR had a family of \leq Rs.2250. Data regarding birth order shows that majority were first born.

Age at menarche shows that average early menarcheal age was found to be 10 years and average late menarcheal age was found to be 15 years.

Dietary habits of the respondents indicated that all of them were habitual non-vegetarians. Among EMR, cereals, sugars, nuts and oil seeds, beverages, processed foods and fish were the food items frequently used, whereas among LMR cereals, beverages, roots and tubers, sugar and nuts and oil seeds were frequently used among both the groups. Fruits, meat and egg were the food items used less frequently.

Classification of the respondents based on the Body Mass Index (BMI) revealed that majority were normal, only 5.56 per cent among EMR and 4.08 per cent among LMR were found to be Chronic Energy Deficiency (CED). And only 1 each from the two groups was found to be obese. Assessment of Triceps Skin fold Thickness (TST) revealed that 75.93 per cent of EMR had high TST and 42.86 per cent of LMR had normal TST. Majority of the EMR had high Waist Hip Ratio (WHR) while among LMR most of them had low WHR.

Mean nutrient intake of the respondents showed that among EMR energy, protein and fat intake were found as per with Recommended Dietary Allowances (RDA) whereas iron intake was found deficit. But among LMR energy and fat intake met RDA and iron and protein intake were deficit.

Assessment of clinical status of the respondents revealed that majority had anaemia. Other symptoms like dental caries, mottled enamel were also found among the respondents.

Haemoglobin level of the respondents revealed that about 51.85 per cent of EMR and 40.82 per cent of LMR were non-anaemic. None of the respondents were found to be severely anaemic.

Nutritional Status Index (NSI) of the respondents was computed incorporating relevant parameters like height, weight, TST, WHR, haemoglobin level, calorie intake and protein intake. Among both groups, majority of the respondents were found to be normal.

A significant correlation was found between age at menarche and total family income, BMI, TST, NSI, weight, energy and protein intake of EMR and for LMR only family size was found to be having correlation with age at menarche and no other variables was having correlation with LMR's age at menarche.

It has been investigated that the intake of protein and fat foods of the EMR was more than the RDA where as among the LMR the protein and iron intake was below the RDA. The fat intake of the LMR were also found above the RDA.

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7. REFERENCES

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AGE AT MENARCHE AND NUTRITIONAL STATUS OF URBAN SCHOOL GIRLS

RESHMI. R

**Abstract of the
thesis submitted in partial fulfilment of the requirement
for the degree of**

**Master of Science in Home Science
(Food Science and Nutrition)**

**Faculty of Agriculture
Kerala Agricultural University, Thrissur**

2007

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8. ABSTRACT

A study on "Age at Menarche and Nutritional Status of Urban School Girls" was carried out to find out the relationship between age at menarche and nutritional status of urban school girls. Data regarding socio-economic characteristics, food consumption pattern and nutritional status of the respondents were generated.

The present study was done among the two groups viz. Early Menarche Respondents (EMR) and Late Menarche Respondents (LMR). Majority of the EMR were in a age group of 10-11 years whereas LMR were in a age group of 16-17 years. Social status of the respondents indicated that majority of them were Hindus and belonged to forwarded castes.

Nuclear families consisting of four members were found to be common among the respondents. Economic status of the respondents revealed that majority of them had a family income less than Rs.2250 per month.

Majority of the respondents of the current study were habitual non-vegetarians. Cereals, nuts and oil seeds, sugar were used daily in the dietaries among both the groups while egg, meat and fruits were less frequently used by them.

Analysis of the anthropometric data, showed that more than fifty per cent of respondents had normal Body Mass Index (BMI) and Triceps Skin fold Thickness (TST) where as Waist Hip Ratio (WHR) was found high in majority of EMR and low among LMR.

Nutrient intake of the respondents showed that among EMR, except iron, protein and fat intake were found to be at par with Recommended Dietary

Allowances (RDA) whereas among LMR except protein and iron, fat intake was found above the RDA.

Clinical examination revealed mild symptoms of anaemia, teeth caries and mottled enamel among the respondents.

The results of the biochemical assessment indicated that majority of the respondents were non anaemic. A reasonable percentage of the respondents were mildly anaemic. No one was found severely anaemic.

Nutritional Status Index (NSI) of EMR varies from 0.18 to 9.13 whereas for LMR it ranged between 0.01 and 5.41. Majority of the EMR and LMR were found to be having medium NSI.

A significant co-relation was observed between EMR's age at menarche with independent variables such as total family income, body weight, TST, BMI, NSI, energy and fat intake where as with LMR only family size showed a co relation with their age at menarche.

APPENDICES

APPENDIX – I

**KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI
DEPARTMENT OF HOME SCIENCE**

CHECKLIST USED FOR IDENTIFYING RESPONDENTS

- Name :
- Class & Class No. :
- Date of Birth :
- Date of Menarche :
- Father's Occupation :
- Mother's Occupation :
- Monthly Income :
- Place of Living : Rural / Urban

APPENDIX – II

KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI
DEPARTMENT OF HOME SCIENCE

INTERVIEW SCHEDULE USED TO ELICIT INFORMATION OF
PERSONAL DATA FROM THE RESPONDENTS

- 1. Name :
- 2. Class and Division :
- 3. Roll No. :
- 4. Date of birth and age :
- 5. Residential address :

SOCIO-ECONOMIC DATA

- 6. Type of family : Nuclear/Joint/Extended
- 7. Religion : Hindu/Muslim/Christian
- 8. Caste : Forward/Backward SC/ST
- 9. Family Size : Adults.....Children.....
- 10. Educational status of parents
 - Father (1) Primary (2) Middle (3) Secondary (4) Higher Secondary
(5) Degree (6) PG-Technical Professional/Others
 - Mother (1) Primary (2) Middle (3) Secondary (4) Higher Secondary
(5) Degree (6) PG Technical Professional/Others
- 11. Occupational status of parents and income
 - Father :
 - Mother :
 - Income from other sources
 - Monthly income (Total) :
- 12. Birth order :

13. No of siblings :
14. Age at menarche :
- Mother :
- Sister(s) :
- Maternal Cousin(s) :
- Paternal cousin(s) :
- Mother's Sister(s) :
- Father's Sister (s) :
15. Particulars about physical activity

Physical activity

Hours spent

Household activities (specify)

Sports activities (specify)

N.C.C

Exercise -Jogging

Walking

Yoga

Dance

Physical exercise at home

16. Distance from Residence to School Km
17. Mode of conveyance
- By Walk
 - Bicycle
 - School Bus
 - Public conveyance

APPENDIX – III Continues

| Food item | Daily | More than Twice in a week | Twice in a week | Once in a week | Fort nightly | Once in a month | Occa- sionally | Never |
|-------------------------------|-------|---------------------------|-----------------|----------------|--------------|-----------------|----------------|-------|
| <u>Processed foods</u> | | | | | | | | |
| - Pickles | | | | | | | | |
| - Jam | | | | | | | | |
| - Noodles | | | | | | | | |
| - Pizzas | | | | | | | | |
| - Burger | | | | | | | | |
| - Cake | | | | | | | | |
| - Ice creams | | | | | | | | |
| - Sweets | | | | | | | | |
| <u>Beverages</u> | | | | | | | | |
| - Tea | | | | | | | | |
| - Coffee | | | | | | | | |
| - Fruit Juices | | | | | | | | |
| - Cola | | | | | | | | |
| - Pepsi | | | | | | | | |
| - Bourn vita | | | | | | | | |
| - Complian | | | | | | | | |
| - Horlicks | | | | | | | | |
| - Cocoa | | | | | | | | |

4. How many times, meals are taken in a day?

- Once
- Twice
- Three
- More than Thrice

5. Do you have specific time schedule for taking food : Yes/No

If yes give details:

| Meal | Timing |
|-----------|--------|
| Breakfast | |
| Lunch | |
| Tea | |
| Dinner | |

6. Do you consume left over food? Yes/No
If yes, give details

7. How often do you take food from outside? (Please tick)
Daily
Once in a week
Twice in a week
Occasionally

8. Do you have the habit of taking packed lunch with you : Yes/No
If No from where do you take lunch : Canteen/others?

9. Name the most liked food
How often do you consume these foods (Please Tick?)
Daily
Weekly
Twice in a week
Thrice in a week
Occasionally

10. Name the least liked food

11. Do you have the habit of Nibbling/Skipping Meal?

APPENDIX – IV
KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI
DEPARTMENT OF HOME SCIENCE

**SCHEDULE TO ASSESS INDIVIDUAL DIETARY CONSUMPTION OF THE
 RESPONDENTS**

Name of the Respondent . . . :

| Items | 1st day | Qty | 2 nd day | Qty | 3 rd day | Qty |
|---------------|---------|-----|---------------------|-----|---------------------|-----|
| Early morning | | | | | | |
| Breakfast | | | | | | |
| Mid-morning | | | | | | |
| Lunch | | | | | | |
| Mid-noon | | | | | | |
| Dinner | | | | | | |
| Bed Time | | | | | | |

APPENDIX – V
KERALA AGRICULTURAL UNIVERSITY
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DEPARTMENT OF HOME SCIENCE

**SCHEDULE TO ELICIT INFORMATION ON THE ANTHROPOMETRIC
STATUS OF THE RESPONDENTS**

- 1. Name of the respondent :
- 2. Body weight (Kg) :
- 3. Height (cms) :
- 4. Triceps skin fold thickness (TST) (mm) :
- 5. Waist measurement (cms) :
- 6. Hip measurement (cms) :
- 7. Body Mass Index (BMI) :
- 8. Waist/Hip ratio (WHR) :
- 9. Haemoglobin level (gm/dl) :

APPENDIX – VI

KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI
DEPARTMENT OF HOME SCIENCE

SCHEDULE TO COLLECT THE INFORMATION REGARDING THE
NUTRITIONAL ASSESSMENT OF THE RESPONDENTS

- 1. Name of the Student :
- 2. Age :
- 3. Class and Class No. :

Clinical Examination

- 1. Parotid enlargement :
- 2. Oedema :
- 3. Emaciation :
- 4. Marasmus :
- 5. Conjunctival xerosis :
- 6. Bitot's spot :
- 7. Corneal xerosis/Keratomalacia :
- 8. Night Blindness :
- 9. Photophobia :
- 10. Aneamia :
- 11. Tongue red and raw :
- 12. Atrophic lingual papilla :
- 13. Pellagra :
- 14. Cracked pavement dermatitis :
- 15. Pigmentation :
- 16. Phrynoderma :
- 17. Koilonychia :
- 18. Gums-spongy, bleeding :
- 19. Teeth caries :
- 20. Mottled enamel :
- 21. Thyroid enlargement :
- 22. Knock-knees or bow legs :
- 23. Frontal and parietal bossing :
- 24. Naso-labial dyssebacea :

APPENDIX – VII
KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI
DEPARTMENT OF HOME SCIENCE

SCHEDULE TO ELICIT THE FAMILY DIET HISTORY OF THE
RESPONDENT

1. Name of the Respondent :
2. Food habit
 - (a) Vegetarian Non Vegetarian
Lacto – Vegetarian Lacto Non vegetarian
 - (b) Are you afrom childhood? : Yes/No
If Yes, reasons for remaining.....
 - (c) Do all the members of your family belong to the same category? Yes/No
If No,
Diversified members Reasons for Diversity
1.....
2.....
3.....
 - (c) Do you avoid any non-vegetarian foods on special occasions : Yes/No
If yes,
No Occasions Foods avoided Reasons
1.
2.
3.

3. Does your family omit any meal of the day/fasting because of any particular belief?

Days Meals omitted Reasons

4. Special occasions and festivals

| | Foods included | Reasons | Foods avoided | Reasons |
|-------------------|----------------|---------|---------------|---------|
| Special occasions | | | | |
| Festivals | | | | |

5. Does you family had particular belief regarding

(a) Preparation of foods Reasons

APPENDIX – VIII

KERALA AGRICULTURAL UNIVERSITY
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DEPARTMENT OF HOME SCIENCE

AGE AND ANTHROPOMETRIC VALUES OF EMR

| Sl. No. | Age (months) | Wt. (Kg) | Ht.(cms) | TST (mm) | WHR |
|---------|--------------|----------|----------|----------|------|
| 1. | 134 | 24 | 135.8 | 15 | 0.78 |
| 2. | 140 | 37 | 145.3 | 15 | 0.80 |
| 3. | 137 | 40 | 155.0 | 15 | 0.83 |
| 4. | 130 | 39 | 148.0 | 20 | 0.84 |
| 5. | 130 | 43 | 140.2 | 21 | 0.79 |
| 6. | 134 | 49 | 142.6 | 21 | 0.85 |
| 7. | 132 | 37 | 147.5 | 12 | 0.79 |
| 8. | 132 | 32 | 140.5 | 11 | 0.83 |
| 9. | 137 | 43 | 153.3 | 16 | 0.85 |
| 10. | 133 | 47.6 | 143.7 | 18 | 0.80 |
| 11. | 138 | 43 | 145.9 | 22 | 0.77 |
| 12. | 140 | 33 | 145.8 | 17 | 0.84 |
| 13. | 132 | 60.5 | 154.0 | 26 | 0.82 |
| 14. | 135 | 30 | 137.7 | 16 | 0.85 |
| 15. | 137 | 43 | 146.9 | 16 | 0.83 |
| 16. | 144 | 52.5 | 153.0 | 17 | 0.79 |
| 17. | 132 | 50 | 154.4 | 16 | 0.77 |
| 18. | 134 | 50 | 149.0 | 17 | 0.72 |
| 19. | 144 | 37 | 149.5 | 16 | 0.74 |
| 20. | 144 | 45 | 144.6 | 21 | 0.84 |
| 21. | 144 | 35 | 150.0 | 20 | 0.79 |
| 22. | 138 | 35 | 150.0 | 15 | 0.89 |
| 23. | 144 | 47 | 160.0 | 20 | 0.89 |
| 24. | 144 | 47 | 153.8 | 20 | 0.82 |
| 25. | 134 | 43 | 153.5 | 19 | 0.83 |
| 26. | 146 | 35 | 156.5 | 20 | 0.78 |
| 27. | 144 | 47 | 160.0 | 15 | 0.79 |
| 28. | 144 | 47.5 | 161.0 | 12 | 0.77 |
| 29. | 140 | 47 | 154.5 | 17 | 0.80 |
| 30. | 138 | 35 | 142.0 | 14 | 0.75 |
| 31. | 140 | 54 | 156.0 | 16 | 0.77 |
| 32. | 144 | 41 | 149.5 | 11 | 0.75 |
| 33. | 126 | 44 | 156.0 | 15 | 0.75 |

APPENDIX – VIII continues

| Sl. No. | Age (months) | Wt. (Kg) | Ht.(cms) | TST (mm) | WHR |
|---------|-----------------|----------|----------|----------|------|
| 34. | 140 | 38 | 147.8 | 14 | 0.80 |
| 35. | 130 | 57 | 157.0 | 18 | 0.78 |
| 36. | 136 | 52 | 150.0 | 21 | 0.77 |
| 37. | 120 | 45 | 152.2 | 14 | 0.80 |
| 38. | 138 | 51 | 148.5 | 21 | 0.80 |
| 39. | 140 | 38 | 163.3 | 19 | 0.77 |
| 40. | 132 | 33 | 140.9 | 15 | 0.82 |
| 41. | 142 | 50 | 163.0 | 23 | 0.82 |
| 42. | 134 | 42 | 152.3 | 28 | 0.78 |
| 43. | 137 | 47 | 154.0 | 19 | 0.88 |
| 44. | 136 | 55 | 161.0 | 15 | 0.82 |
| 45. | 137 | 49 | 150.0 | 14 | 0.82 |
| 46. | 139 | 42 | 146.0 | 16 | 0.84 |
| 47. | 135 | 44.5 | 146.7 | 16 | 0.74 |
| 48. | 137 | 34.5 | 147.5 | 13 | 0.77 |
| 49. | 133 | 30 | 135.0 | 16 | 0.75 |
| 50. | 141 | 40 | 144.8 | 17 | 0.74 |
| 51. | 136 | 36 | 155.0 | 12 | 0.80 |
| 52. | 133 | 43 | 146.8 | 14 | 0.83 |
| 53. | 138 | 45 | 149.5 | 14 | 0.81 |
| 54. | 138 | 43 | 156.0 | 12 | 0.80 |

APPENDIX – IX
KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI
DEPARTMENT OF HOME SCIENCE

AGE AND ANTHROPOMETRIC VALUES OF LMR

| Sl. No. | Age (months) | Wt. (Kg) | Ht.(cms) | TST (mm) | WHR |
|---------|--------------|----------|----------|----------|------|
| 1. | 204 | 63 | 163 | 17 | 0.80 |
| 2. | 199 | 59 | 158 | 15 | 0.79 |
| 3. | 201 | 59 | 164 | 16 | 0.75 |
| 4. | 192 | 60 | 162 | 17 | 0.89 |
| 5. | 202 | 55 | 165.4 | 18 | 0.82 |
| 6. | 191 | 58 | 162.5 | 15 | 0.89 |
| 7. | 196 | 65 | 164.5 | 21 | 0.83 |
| 8. | 192 | 59 | 162.5 | 18 | 0.88 |
| 9. | 192 | 64 | 163.8 | 18 | 0.89 |
| 10. | 200 | 50 | 164 | 18 | 0.94 |
| 11. | 205 | 64 | 162.6 | 18 | 0.90 |
| 12. | 207 | 58 | 165 | 17 | 0.79 |
| 13. | 201 | 55 | 167 | 14 | 0.89 |
| 14. | 192 | 61 | 166 | 13 | 0.71 |
| 15. | 210 | 48 | 158 | 16 | 0.84 |
| 16. | 215 | 59 | 163.4 | 18 | 0.94 |
| 17. | 199 | 57 | 158 | 17 | 0.79 |
| 18. | 203 | 50 | 158 | 16 | 0.83 |
| 19. | 199 | 57 | 165 | 15 | 0.78 |
| 20. | 200 | 67 | 163 | 16 | 0.78 |
| 21. | 186 | 57 | 163 | 18 | 0.82 |
| 22. | 200 | 53 | 163 | 14 | 0.80 |
| 23. | 192 | 57 | 163.02 | 16 | 0.80 |
| 24. | 192 | 65 | 164.5 | 24 | 0.79 |
| 25. | 196 | 54 | 154 | 17 | 0.83 |
| 26. | 204 | 51 | 162.4 | 20 | 0.77 |
| 27. | 194 | 58 | 154 | 17 | 0.80 |
| 28. | 192 | 59 | 162.4 | 17 | 0.71 |
| 29. | 204 | 54 | 156 | 19 | 0.71 |
| 30. | 192 | 40 | 160.5 | 15 | 0.80 |
| 31. | 199 | 40 | 157 | 15 | 0.76 |
| 32. | 194 | 44.7 | 160 | 21 | 0.87 |
| 33. | 188 | 63 | 163 | 23 | 0.84 |

APPENDIX – IX continues

| Sl. No. | Age (months) | Wt. (Kg) | Ht.(cms) | TST (mm) | WHR |
|---------|-----------------|----------|----------|----------|------|
| 34. | 204 | 62 | 164 | 23 | 0.89 |
| 35. | 209 | 44 | 159 | 14 | 0.87 |
| 36. | 204 | 50 | 162 | 22 | 0.77 |
| 37. | 201 | 49 | 165.5 | 23 | 0.83 |
| 38. | 214 | 65 | 170 | 17 | 0.83 |
| 39. | 220 | 42 | 150 | 23 | 0.83 |
| 40. | 207 | 59 | 156 | 18 | 0.75 |
| 41. | 200 | 55 | 140 | 14 | 0.78 |
| 42. | 204 | 68 | 168.3 | 23 | 0.84 |
| 43. | 199 | 50 | 167 | 18 | 0.84 |
| 44. | 221 | 59 | 163.7 | 23 | 0.80 |
| 45. | 213 | 59 | 159.5 | 20 | 0.85 |
| 46. | 201 | 50 | 162 | 22 | 0.89 |
| 47. | 207 | 55 | 156 | 17 | 0.92 |
| 48. | 205 | 65 | 162.5 | 19 | 0.85 |
| 49. | 204 | 51 | 162 | 18 | 0.78 |

APPENDIX - X
KERALA AGRICULTURAL UNIVERSITY
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DEPARTMENT OF HOME SCIENCE

NSI VALUES OF EMR

| Sl.No. | NSI Values |
|--------|------------|
| 1. | 5.13851 |
| 2. | 0.768859 |
| 3. | 0.850225 |
| 4. | 3.251764 |
| 5. | 2.172159 |
| 6. | 3.729963 |
| 7. | 0.72829 |
| 8. | 2.53399 |
| 9. | 2.96717 |
| 10. | 0.365706 |
| 11. | 2.003397 |
| 12. | 0.179078 |
| 13. | 6.716888 |
| 14. | 0.936553 |
| 15. | 3.094079 |
| 16. | 0.2639097 |
| 17. | 3.670264 |
| 18. | 1.97992 |
| 19. | 4.51372 |
| 20. | 2.138766 |
| 21. | 0.106885 |
| 22. | 0.70822 |
| 23. | 0.5858685 |
| 24. | 0.3466364 |
| 25. | 2.653142 |
| 26. | 3.220726 |
| 27. | 5.64887 |
| 28. | 2.199381 |
| 29. | 4.729634 |
| 30. | 0.126328 |
| 31. | 5.68222 |
| 32. | 3.744812 |
| 33. | 4.189253 |

APPENDIX – X Continues

| Sl.No. | NSI Values |
|--------|------------|
| 34. | 0.358215 |
| 35. | 3.347643 |
| 36. | 3.690583 |
| 37. | 2.557609 |
| 38. | 1.007913 |
| 39. | 0.819311 |
| 40. | 0.009137 |
| 41. | 8.55044 |
| 42. | 1.27511 |
| 43. | 9.125016 |
| 44. | 4.944075 |
| 45. | 3.630449 |
| 46. | 4.966107 |
| 47. | 0.586043 |
| 48. | 0.586043 |
| 49. | 0.36546 |
| 50. | 4.69969 |
| 51. | 1.32283 |
| 52. | 2.113477 |
| 53. | 0.93501 |
| 54. | 5.888027 |

APPENDIX – XI
KERALA AGRICULTURAL UNIVERSITY
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DEPARTMENT OF HOME SCIENCE

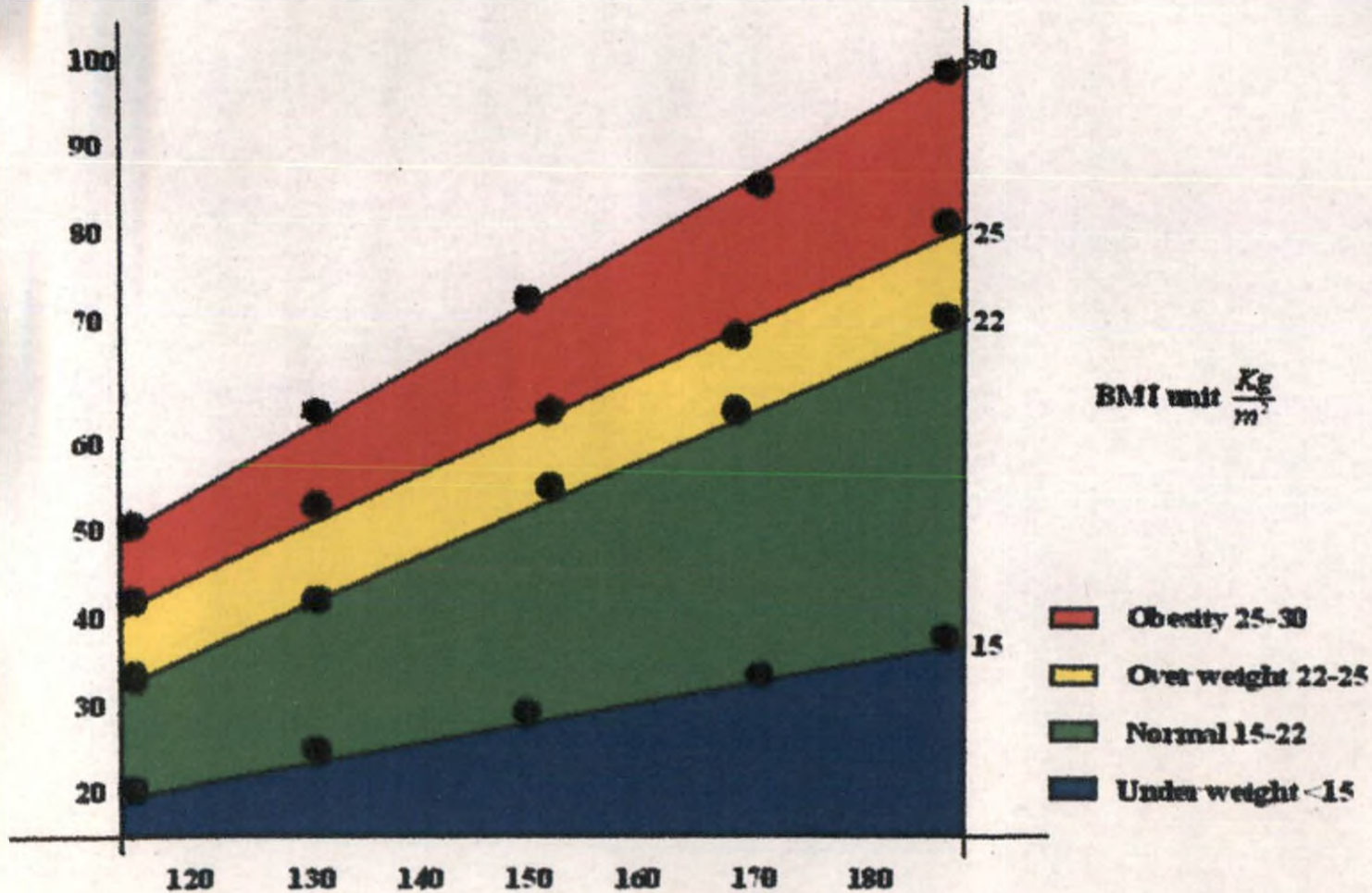
NSI VALUES OF LMR

| Sl.No. | NSI Values |
|--------|------------|
| 1. | 0.77384 |
| 2. | 3.24793 |
| 3. | 1.93709 |
| 4. | 0.19457 |
| 5. | 0.32553 |
| 6. | 0.098663 |
| 7. | 4.424645 |
| 8. | 1.005526 |
| 9. | 1.448584 |
| 10. | 0.85681 |
| 11. | 1.239958 |
| 12. | 0.0788 |
| 13. | 0.732172 |
| 14. | 1.82036 |
| 15. | 0.89218 |
| 16. | 5.24831 |
| 17. | 0.648224 |
| 18. | 0.45653 |
| 19. | 1.689815 |
| 20. | 4.542761 |
| 21. | 1.216482 |
| 22. | 2.8931 |
| 23. | 0.014488 |
| 24. | 2.357288 |
| 25. | 4.22301 |
| 26. | 0.225153 |
| 27. | 1.757513 |
| 28. | 3.88687 |
| 29. | 1.002697 |
| 30. | 3.84605 |
| 31. | 0.071034 |
| 32. | 1.005245 |
| 33. | 5.336509 |

APPENDIX – XI Continues

| Sl.No. | NSI Values |
|--------|------------|
| 34. | 0.773937 |
| 35. | 0.548395 |
| 36. | 2.482614 |
| 37. | 3.62051 |
| 38. | 4.194393 |
| 39. | 5.40661 |
| 40. | 2.41565 |
| 41. | 3.529203 |
| 42. | 1.369116 |
| 43. | 2.991737 |
| 44. | 1.80013 |
| 45. | 1.12737 |
| 46. | 1.65999 |
| 47. | 4.075908 |
| 48. | 0.173377 |
| 49. | 1.002583 |

APPENDIX - XII
 KERALA AGRICULTURAL UNIVERSITY
 COLLEGE OF AGRICULTURE, VELLAYANI
 DEPARTMENT OF HOME SCIENCE



Eliz Health Path for Adolescents (EHPA)

