PROMOTING FRUIT AND VEGETABLE CONSUMPTION AMONG SCHOOL CHILDREN THROUGH NUTRITION INTERVENTION PROGRAMME

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DECLARATION

I hereby declare that this thesis entitled **"Promoting fruit and vegetable consumption among school children through nutrition intervention programme"** 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 of society.

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CERTIFICATE

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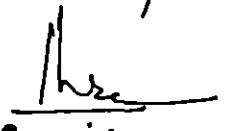**3. Dr. B. R. REGHUNATH**
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Dedicated to

My Parents

&

My Brothers

AKNOWLEDGEMENT

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LIST OF ABRAVATION USED

BMI   –   Body Mass Index

EHPA   –   Eliz Health Path for Adolescent

FAO   –   Food and Agricultural Organization

IARC   –   International Agency for Research on Cancer

ICMR   –   Indian Council of Medical Research

IDD   –   Iodine Deficiency Disorder

LDL   –   Low Density Lipoprotein

NFHS   --   National Family Health Service

NIC   –   National Cancer Institute

NNMB   –   National Nutrition Monitoring Bureau

WHO   –   World Health Organization

USDA   --   United State Department of Agriculture

YFMP   –   Youth Farm Market Project

Introduction

1. INTRODUCTION

"Upon our children, how they are taught, rests the fate or fortune of tomorrow's world" (B.C. Forbes)

"The child is father of the man." (William Wordsworth)

Children are valuable assets of a nation and they are the potential citizens of tomorrow. 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. High school age group is very important because this is the period of transition which is known as adolescence.

Nutrition has an important role in the life of a child because of the impact it can have on the growth, development and ability to learn. A child who does not receive proper nutrition will not achieve required physical and mental potential.

Most individuals establish their personal food and exercise habits in their first 10 to 15 years of life, so it is important to introduce positive nutritional message early. The ability to choose a nutritious diet is not instinctive, but a skill that is learned from experience and their surrounding environment. It is highly essential that children have a balanced diet for their age. And this is a period of high nutritional risks when increased demand for nutrients is often met with poor choices of food, unhealthy eating habits and deficient intake of calories, protein, vitamins and minerals.

Fruits and vegetables play a vital role in child nutrition. Today the consumption of fruits and vegetables are getting lower as the processed foods have taken its place. Fruits and vegetables are important sources of a wide range of vital

micronutrients, and there is now strong evidence that fruits and vegetables consumption can prevent a number of chronic diseases including cancer (IARC, 2003, WHO, 2003).

Fruits and vegetables provide many essential vitamins and minerals. A proper diet including fruits and vegetables is very important to the growth and development of children. They are important components of a healthy diet, and their sufficient daily consumption could help to prevent major diseases. Including fruits and vegetables consistently in a diet can also assist with weight control. This may be because of fruits and vegetables being a food that is nutrient dense and generally low in calorie. It is recommended that children should eat five servings of fruits and vegetables a day.

Childhood fruit consumption appeared to be protective against cancer in adulthood (Maynard et al., 2003). There is also growing evidence that fruit and vegetable consumption in children gives protect against a range of childhood illnesses.

Currently, children of the age group of 6-12 years eat an average of 200 g fruits and vegetables a day, only half of the recommended servings. This habit makes children a prime target for nutrition education and is necessary to teach children the importance of including fruits and vegetables in their diet.

Over the years children in India have consistently consumed fewer than the recommended servings of fruits and vegetables. Instead they are consuming high fat calorically dense, nutrient poor foods and as a result there is increase in number of over weight and obese children. Low income population tends to consume even less fruits and vegetables. Fruits and vegetables are not available in the homes of low income children because their parents consider that they are expensive, hard to select, and difficult to store.

Food preference and dietary habits are established during childhood. This means that interventions need to be targeted at young children while they are forming their life long habits. Since most children are enrolled in school, the class room is a suitable place to teach nutrition education. It is well recognized that the school setting provides many opportunities to improve dietary behaviour. There are many ways one can teach nutrition, however this study is focused on a hands-on nutrition education combined with gardening and multimedia tools.

Gardening has proven to be a successful tool in teaching nutrition to children. Gardening and related activities could lead to better attitude about fruits and vegetables. Hence the present study is attempted with the major objective to promote the fruit and vegetable consumption in children through nutrition intervention like nutrition education, games, nutrition gardening and eventually to evaluate the impact of the nutrition intervention on knowledge on nutrition, consumption and preference towards fruits and vegetables.

Review of literature

2. REVIEW OF LITERATURE

Nutrition intervention to promote fruit and vegetable consumption is an important component of nutrition education in schools as it is the need of the hour, because of the prevailing wrong food habits of the present children. The literature reviewed in this chapter looks at the importance of good diet including fruits and vegetables , the general influences on fruit an vegetable consumption, the attitudes and behaviours that children have towards fruits and vegetables, how nutrition affects different populations, research that has been conducted on nutrition education in schools and nutrition education using gardens.

This chapter is grouped into the following categories:

2.1   The importance of good nutrition in school going children

2.2   Nutritional attitudes and the present scenario of fruits and vegetables consumption among school children

2.3   Factors influencing fruits and vegetable consumption

2.4   Nutrition intervention through education in schools

2.5   Garden based nutrition intervention

2.1 THE IMPORTANCE OF GOOD NUTRITION IN SCHOOL GOING CHILDREN

Nutrition is an important factor that determines health and disease at any age, particularly during adolescence, the time of growth and development. This can also be a time change in dietary habits (Ashely, 1992).

Brown (2002) concluded that hungry and undernourished children are more likely to get sick. This also leads to higher rates of school failure, poorer returns on our educational investments, and weakened workforce productivity when children reach the age of employment. Undernourishments also contribute to behavior problem in children. Compared to children who do receive proper nutrition, under nourished children have increased level of anxiety and hyperactivity and tend to be more irritable and, more aggressive.

Reshmi (2007) reported that it is a vulnerable periods of life with various health risks especially for girls. Adolescence is a period of high nutritional risk 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

Elizabeth (2001) observed that soft drinks which are highly relished at this period kill the appetite and promote skipping of meals and finally resulting in nutritional deficiency. Diet rich in fruit and vegetables contribute to healthy growth and development among youth and lower the risk of poor health conditions associated with malnutrition (Brown, 2002).

According to Ganry (2007), fruits and vegetables are important components of a healthy diet, and their sufficient daily consumption could help prevent major diseases. Djousse et al. (2004) reported consumption of fruit and vegetables can help prevent problems and promote growth and cognitive development

Fruits and vegetables are important to a healthy diet because they contain nutrients that decrease the risk for cardiovascular disease and certain cancers (Liu et al., 2000; Bazzano et al., 2002, Cullen et al., 2004, Djousse et al., 2004). Eating fresh

fruits and vegetables daily is one of the most important things for good health. Research continues to show that there are many essential nutrients in fresh fruit and vegetables that can give protection from cancer, high blood pressure, heart disease and type II diabetes.

Eating fruits and vegetables have an impact on obesity Djousse et al. (2004). Lin and Morrison (2002) an examination of the relationship between fruit and vegetable consumption and 'Body Mass Index' (BMI) was conducted by USDA researchers. Further more, Epstein et al. (2001) states that adequate fruits and vegetable consumption has been associated with decrease in children's fat and sugar intake and may also aid in the prevention of over weight and obesity (Rolls et al., 2004).

Fruits and vegetables are low in energy and good source of fiber, vitamins, minerals and biologically active substances. Anti carcinogen agents are found in fruits and vegetables, including antioxidants and phytochemicals. Phytochemicals include carotenoids, flavanoids, plant sterols, allium compounds, indoles, phenols and terpenes (IARC, 2003). Cancer prevention organizations recommend eating a minimum of five to nine serving of fruits and vegetables a day for decreasing cancer risk (NCI, 2006).

2.2 NUTRITIONAL ATTITUDES AND THE PRESENT SCENARIO OF FRUITAND VEGETABLE CONSUMPTION AMONG SCHOOL GOING CHILDREN

Food preferences, dietary habits, behaviour and lifestyle choices are all developed and established during childhood (Carter, 2002). Food preferences play a critical role in influencing food choices and consumption (Cicil, 2000).

Carter (2002) purported that many behavioural and lifestyle choices are developed while a child is in school; a student's food intake and physical activity at school are important determinants of body weight.

The eating of a particular set of food items by a person dependent on taste and availability of raw food materials is called food habit or dietary habit. According to Reshmi (2007) food habits can also be defined as the habitual decision, an individual makes when choosing what to eat.

Food preference are important determinants of food choices (Baxter et al., 2000) and enjoyment has frequently been reported as the over riding reason for choosing a particular food by people (Belton, 2003).

Many children and adults do not meet the goal set by the ICMR to consume at least five servings of fruits and vegetables daily (ICMR, 2002). A study conducted by Cullen et al. (2001) reported that the average daily fruit and vegetable intake was 2.13 servings and another study indicated that only 5% of seven to fourteen years old met the 'five a day" fruit and vegetables recommendation (St-Onge et al., 2003).

The prevalence of 'snacking' between meals and the increase in fast food consumption has leads to lower intakes of fruits and vegetables (St-Onge et al., 2003). The food habits of adolescents are mainly influenced by urban lifestyle, mass media and peers. Ogden et al. (2002) conducted nutrition epidemiological studies found a significant association between improper adolescent nutrition, over weight, obesity and related diseases.

Yamini (2004) found that children are eating more meals away from home and those meals are often high in fat and carbohydrates and low in fibre rich. In a study Kumari and Singh (2001) highlighted the fact that there is an inadequate intake of milk and milk products, green leafy vegetables, sugar and jaggery among school children.

Yet another study reveals that the intake of cereals was higher and that of green leafy vegetables, fruits, pulses root and tuber was lower than the RDI (recommended dietary index) in the diet of adolescents. 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 (Reshmi, 2007).

The findings of the study conducted by Bavedhkar et al. (1999) indicated that traditional micronutrient rich foods in India are being replaced by energy dense highly processed micronutrient poor foods with greatly increased portions contributing to a positive energy balance and consequent weight gain. High calorie snacks, junk food revolution, cola colonization, and food as rewards or demonstration of love are part of new life styles. All Indian celebrations of festivals also seem to be centered on rich foods.

Concurrent result obtained by Krishnaroopa (2003) has advocated that the intake of green leafy vegetables and fruits were low in the diets of adolescents and school children in Kerala. A Trivandrum based study (Unnithan, 2008) revealed that the diets of overweight children were comprised mostly of energy dense foods and other sugary and fatty fast foods whereas the consumption was low on vegetables and fruits etc. The study also showed that vegetable preparations especially green leafy vegetables preparations were very low in the meals of overweight as well as normal weight children.

Humulka et al. (2000) indicated that as the children get older the frequency of breakfast decreased along with the consumption of milk and milk products, vegetables and fruits; on the contrary, the intake of fat, sweets, snacks, bakery foods and soft drinks like colas increased in adolescents.

Vibha and Sibal (2003) studied the dietary perception and practices in senior secondary boys in Delhi schools and reported that the cereals, fat and oil and sugar were consumed daily by adolescence. According to Kerala Statistical Institute (2001), 98 per cent of Keralites are habituated to non vegetarian foods and consumption of fruits and vegetables is very low.

Malathi (2002) reported that a busy adolescent often skips breakfast and have snacks and soft drinks for lunch and also take junk foods for dinner. Kalpana and Lakshmi (2009) reported that 33.4 percent overweight and 20.9 per cent obese children consumed snacks and soft drinks. Intake of green leafy vegetables, other vegetables, milk and milk products was deficit in both obese and over weight children, when compared with the recommended allowance of ICMR (2002).

2.3 FACTORS INFLUENCING FRUIT AND VEGETABLE CONSUMPTION

Fruit and vegetable consumption is influenced by environmental, social, cultural, psychological, economic and behavioural factors which makes alteration of these patterns a multi- faceted challenge (Granner et al., 2004). General Influences on fruit and vegetable consumption is given in the table 1.

The review of literature available suggests that fruit and vegetable consumptions deals with multiple influences on behaviour. These influences come from the external environment, the home and school environment, preference, peer and familial pressure.

2.4 NUTRITION INTERVENTION THROUGH EDUCATION IN SCHOOLS

According to Rao et al (2007) and Nolan (2005) nutrition education is a key element in promoting sustainable healthy eating behaviour and should start from early stages of life.

Studies among adolescents showed that nutrition education in the classroom set up significantly improved their nutrition knowledge (Rao et al., 2007). It is well documented in the literature that nutrition education has been realized as one of the essential means of helping youngsters to improve or maintain their health. By improving the nutritional status of adolescents, nutritional and health status of next generation can also be improved.

Nutrition awareness through education programme can be one of the important media to promote nutritional literacy among people (Krishnaswamy and Vijayaraghavan, 2000). The school is an extra ordinary setting that can be used effectively to improve the information and knowledge of the students on various aspects of nutrition. When children receive consistent nutritional message about what is good to eat from their family, from the classroom and in the school, children got inclined is adopt positive eating behaviour.

A well designed nutrition education programme for obese children can be an effective approach to help them to reduce their obesity index and to establish desirable food attitudes.

School can make a vital contribution to countries effort to achieve food security and nutritional well being. Children must be considered as tomorrow's adult consumers. Eating habits are learnt early and schools can play an important role in promoting healthy and sustainable food selection and dietary patterns. FAO'S approach to nutrition education in schools aims to create positive attitudes, skills and promotes lifelong healthy eating behaviour. School based activities include school gardens, food processing, visit to food shops and markets, food safety and hygiene in food preparation.

The importance of early learning of nutrition-related knowledge, attitude and behaviour for future health is widely recognized. Community trials suggest that nutrition education is an accessible and effective tool in developing healthy nutrition-related practices (Rao et al., 2007). Significant gain in mean knowledge of pre-adolescents after imparting nutrition education regarding causes, symptoms and prevention of IDD through combined package of audio-visual aids i.e. charts, posters, leaflets etc.

2.5. GARDEN BASED NUTRITION INTERVENTION

2.5.1 Nutrition education using gardens

This section provides background on the use of gardens as educational tools and includes a general overview of garden-based nutrition programs and their results.

The use of gardening as an educational tool is not entirely new, and its benefits for the community include: promotion of sharing, mental health activity, increased willingness to go to school, moral development, youth crime prevention, healing and therapy, increased produce accessibility, and enjoyment of nature, etc.

(Ferris et al., 2001 and Armstrong, 2000). In recent years gardening in schools has received revitalized attention as a way to teach not only science and maths but also nutrition. This renewed attention to gardening has set the table for a number of nutrition education programs that address such issues as childhood obesity and the consumption of fruits and vegetables.

Table 2 gives an over view of the literature reviewed on the gardening programmes providing nutrition education to children. Target audiences vary as do the results of the programmes.

Table 2 clearly shows successes in affecting the attitude of program participants, mainly in the areas of fruit and vegetable consumption and nutrition knowledge. There are additional studies that examine gardening among adults or gardening programs that do not provide nutrition education and instead focus on domains such as life skills, enjoyment of school, moral development, and violence prevention (Armstrong, 2000; Alexander et al., 1995; Blair et al., 1991). However, from the studies, it is clear that gardening is being used as an intervention or teaching tool in multiple domains. Yet another study by McAleese and Rankin, (2007) nutrition education intervention revealed that learning by vegetables gardening led to increasing in take of fruits and vegetables compared to the groups with nutrition education only or no nutrition education.

2.5.2 Benefits of garden based nutrition intervention

Garden based nutrition interventions have many benefits in the realm of nutrition education especially in increasing nutrition knowledge (Jones, 2008). Some programs found an increase in fruit and vegetables consumption as well as an increase in healthy snack consumption (McAleese & Rankin, 2007).

Nutrition knowledge and consumption patterns in children are key areas that gardening programmer aim to affect. Fruits and vegetables consumption is an area of spotlight because of the low levels of fruit and vegetable intake among children and adolescents (Jones, 2008).

Nolan (2005) proposed that school gardens are a way to teach students using hands-on activities that are fun and teach skills at the same time. Gardening provides hands-on activities through the actual growing and harvesting of the vegetables, followed by preparing them for consumption.

Further more, a nutrition lesson combined with gardening increases children's preference for vegetables and has better long term effects on the students vegetable preference (Morris et al., 2002 a).

Lineberger and Zajicek (2000) reported that participation in gardening and activities significantly increased the vegetable attitude scores and fruit and vegetables snack preference scores of third through fifth grade students, but did not increase behaviour. First grade students that participated in gardening and nutrition education lessons that were integrated into the curriculum were more willing to try new vegetables than those that did not participate in garden activities (Morris et al., 2001).

Morris et al. (2002 a) also reported that nutrition lessons alone and nutrition lessons combined with gardening improved nutritional knowledge and vegetable reference of fourth grade students. However, the nutrition lessons combined with gardening increased their preferences for more vegetables and had better long term effects on the students' vegetables preferences.

According to Mason (2005) garden provides fresh fruits and vegetables and the encouragement to eat them. Garden activity can resist stress and provide nutritious food and leads to healthy life.

Morris et al., (2001) reported an increased willingness to taste vegetables grown in the garden (essential to improving food preference). Children that participated in gardening and were taught the hands-on activities in the garden curriculum (Genzer et al., 2001) had improved fruit and vegetable snacks.

Increase in nutritional knowledge and positive attitudes towards fruits and vegetables indicate that nutrition education combined with active participation in

gardening may be an effective tool to help teachers encourage students towards healthier diets (Nolan, 2005).

Gardening provides hands-on activities through the actual growing and harvesting of the vegetables. Gardening and related activities increase positive attitudes about, preference for and willingness to taste new fruits and vegetables (Morris et al., 2001; Lineberger and Zajicek, 2000).

A positive change in attitudes regarding fruits and vegetables was observed after participating in gardening and learning about health and nutrition from the garden curriculum (Genzer et al., 2001).

Elementary students who were taught about health and nutrition from the garden curriculum and who actively participated in gardening, significantly improved their nutritional knowledge and also significantly improved their attitudes towards fruit and vegetables and their preferences for choosing a fruit or vegetable snack over a non-healthy snack (Nolan, 2005).

There have been mixed finding in the research for children's fruit and vegetable preferences after an intervention. An increased attitude towards fruits and vegetables after an intervention has been found (Lineberger and Zajicek, 2000).

Materials and methods

3. MATERIALS AND METHODS

The present study makes an attempt to eventually evaluate nutrition intervention to promote fruit and vegetable consumption among school children. A general description of the methodology followed in the conduct of the study is presented in this chapter under the following heads:

3.1 Locale of the study

3.2 Selection of the sample

3.3 Tools for data collection

3.4 Conduct of study

3.5 Statistical analysis

3.1 LOCALE OF THE STUDY

Government Upper Primary School, Ambalathara and Government Model Higher Secondary School, Venganoor, Thiruvananthapuram were selected as the locale of the study. These schools were selected so as to represent an urban and a rural school respectively.

3.2 SELECTION OF THE SAMPLE

In the present study, the sample comprised of fifty school children both boys and girls in the age group 10-12 years. The children were selected from each of two schools, one rural and one urban School. The total of 100 children who formed the subjects for the nutrition intervention programme were selected using purposive sampling method.

A purposive sampling is a technique in which a designed number of sample unit is selected deliberately upon the objective of the enquiry. Purposive sampling method was selected as sampling technique in the present study because it was an action research conducted in a school and children of the same class has to be selected, for conducting the nutrition intervention.

3.3 TOOLS FOR DATA COLLECTION

Success of every research study depends upon the use of appropriate and well-designed tools or technique to elicit information from the sample.

The following tools were used in the present study.

1. Personal and socio-economic characteristics - Questionnaire

2. Food consumption pattern of the subjects – Specially prepared Rating scale

3. Fruit and vegetable consumption pattern – Diet history

4. Assessment of general health status of the subjects – Anthropometric Measurements

5. Knowledge test on basic nutrition concepts - Questionnaire

6. Participation score sheet

3.3.1 Tool 1: Personal and Socio-economic Characteristics - Questionnaire

Questionnaire is one of the tools mostly used in behavioural and educational research. The personal and socio – economic characteristic – questionnaire elicits information regarding socio–economic background of the subjects details regarding age, sex, religion, type and size of the family, number of children in the family,

ordinal position of the subject, educational status of parents, occupation of parents and total monthly family income were collected. The investigator standardized the questionnaire for the present study.

3.3.1.1 Developing of the tool personal and socio economic characteristic questionnaire

The questionnaire was developed strictly in accordance with the questionnaire construction principles. The first step in the construction of the questionnaire was to attain a thorough grasp of the field and a clear understanding of the objectives of the study and the nature of data needed.

Care was taken to satisfy the three conditions in order to make the questionnaire effective. First the respondents should understand the questions asked. Secondly the respondents should attribute the same meaning to the questions as does the investigator. Thirdly, questions need to be phrased in such a way that the respondents can answer out of his own experience or feelings and not an what he/ she thinks 'ought' to say or believes that the investigator wants him to say or thinks that someone like himself might say. The questions need to be clear and unambiguous. The stages of the making of the questionnaire are illustrated below in steps.

3.3.1.2 Collection of Statement

The first step in the preparation of questionnaire was to obtain statements. The investigator collected statements from various books, journals, magazines, as well as after discussions with specialists and experts in the field. Considering the subjects, as they are the children, investigator took care to prepare a short questionnaire.

3.3.1.3 Editing of statements for the pre-test

The statements were edited to ensure terminology consistent with the purpose to be served. Statements having even slightly doubtful presentations were dropped.

3.3.1.4 Pre-Testing

Pre testing was carried out to find out the difficulties of the samples in understanding the meaning of the terms, to find out weak or defective terms, to estimate the discrimination power of each individual item and to finalize the number of items to be included in the final schedule. The questionnaire after pre testing was found to be appropriate to elicit personal and socio economic characteristics (Appendix. I).

3.3.2 Tool 2: Food consumption pattern of the subjects – Specially prepared rating scale

3.3.2.1 Food habits and preferences

Preference for fruits and vegetables can be gauged through rating scales. Rating scales are mostly used in assessing the dietary habits and food preferences. The rating scale has items which elicit information through diet survey; the details regarding eating habits, frequency of use of different food and food preference were collected. A detailed rating scale was prepared, pre-tested and standardized before administering among the respondents (Appendix II).

3.3.2.2 Frequency of use of fruits and vegetables

Frequency of use of different food items in the dietary of the respondents clearly indicated the adequacy of the diets consumed by them. In this study food use frequency and preference were measured using a rating scale, a six point scale and

five point scale respectively. The locally popular fruits and vegetables and those frequently advertised through media were listed down and respondents use and preference for each item was rated separately. The rating scale was prepared, pre tested and standardized before administering among the subjects (Appendix III).

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

Percentage of total score for each food items

$$= \frac{R_1S_1 + R_2S_2 + R_3S_3 + \ldots\ldots\ldots\ldots\ldots R_n S_n}{n}$$

S_i: Scale of rating given for frequency of use of a food item (i = 1, 2, 3......6)

R_i: Percentage of respondents coming under each frequency group (i = 1, 2, 3......6)

n: Maximum scale rating (n=6)

The mean score was calculated using the formula given below

Mean score for each food group

$$= \frac{R_1S_1 + R_2S_2 + R_3S_3 + \ldots\ldots\ldots\ldots\ldots R_n S_n}{100}$$

The percentage of respondents using each food item and also their preference for each item were then computed.

3.3.3 Tool 3: Fruit and vegetable consumption pattern

Fruit and vegetable consumption pattern obtained from each subject during the first week of the study as a way to measure food consumption (behaviour). This is a specific type of food diary that asks individuals to remember and record all of the food and beverages that they had consumed the previous day. This study will have children record their food intake on worksheets

The fruit and vegetable consumption of the subjects was assessed by conducting diet survey. One day meal pattern along with ingredients used for preparations of the meals were collected to understand the food combinations used in their daily dietaries. Thus the quantities of meals were evaluated with regard to food growths used in the three major meals via: break fast, lunch, dinner (Appendix IV).

3.3.4 Tool 4: Assessment of General Health status- anthropometric measurements, clinical examination and morbidity pattern

The standard methods of anthropometric measurements, clinical examination and morbidity pattern was done in the present study.

3.3.4.1 Anthropometric measurement:

Nutritional anthropometry is measurement of human body at various age and levels of nutritional status, which provide information on the nutritional status of individuals. The following anthropometric measurements were taken (Bamji et al., 2003) (Appendix. V).

3.3.4.1.1 Height

The height of individual is influenced both by genetic and environmental factors. Height is affected only by long term nutritional deprivation and it is considered as index of chronic or long duration malnutrition (Srilakshmi, 2003).

To determine height, a measuring tape was fixed vertically on a smooth wall, perpendicular to the ground, taking care to see that the floor area was even and not rough. The subjects were asked to remove their foot wear and to stand with the centre of the back touching the wall, with feet parallel and heels, buttocks, shoulder and back of the head touching the wall. The head was held comfortably erect, the arms hanging loosely by the side. A smooth, thin ruler was held on the top of the head in the centre, touching the hair at right angle to the wall and the height read off from the lower edge of the ruler to the nearest 0.5 cm. Each reading was taken twice to ensure correctness of the measurement.

3.3.4.1.2 Weight

Body weight is the most widely used sensitive and simplest reproducible anthropometric measurement. It indicates the body mass and is a composite of all body constituents like water, mineral, fat, protein and bone. It reflects more recent nutrition (Srilakshmi, 2003).

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 look straight ahead. The weight was recorded to the nearest of 0.5 kg. Each reading was taken twice to ensure correctness of the measurement.

Plate 1: Weight Assessment

Plate 2: Assessment of general health status by doctor

3.3.4.1.3 Computation of body mass index

Body Mass Index (BMI) of the children was computed using the weight and height measurements. Body mass index of the participants was computed using the formula.

$$BMI = Weight\ (kg)/Height\ (m^2)$$

Based on the BMI the respondents were graded following the procedure cited by (Bamji et al 2003).

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) is used the weight and height can be plotted in the same chart and BMI can be directly read from the margin of the chart (Elizabeth, 2005).

3.3.4.2 Clinical Examination

Clinical examination is stated to be one of the most essential and the simplest methods used in the evaluation of nutritional status. It is a part of nutritional assessment through which direct information of signs and symptoms of dietary deficiencies prevalent could be obtained.

The presence or absence of clinical deficiency symptoms which is an index of nutritional status was assessed by a qualified physician using a standard proforma of ICMR (Appendix. VI).

3.3.4.3 Morbidity pattern

Morbidity means the occurrence of disease or illness and can be regarded as an indicator of over all health of an individual.

The occurrence of disease or illness among the respondents was assessed by ascertaining the occurrence of diseases or illness of the respondents in the past six months prior to the interview. This was ascertained using a check list (Appendix. VII).

3.3.5 Tool 5: Knowledge test on basic nutrition concepts - Questionnaire

To assess an individual's knowledge on the nutrition concepts, tests are conducted to elicit their knowledge level. In the present study, the investigator prepared a questionnaire with objective type questions with two wrong answers and one right answer was framed. Ten questions on basic nutrition concepts on fruits and vegetables were framed. The questionnaire was pre tested and standardized before administration. (Appendix VIII)

3.3.6 Tool 6: Participation score sheet

A participation score sheet was prepared to note the attendance and participation of each activity of the subjects in the intervention programme

The frequency of their participation in these activities was assessed by marking on a six point scale; the scores were assigned as 0 and 1. When they were attended the education and games programme, the score allotted was "1" and score "0" was allotted for those who didn't attend the programme. These scores were finally summed up to obtain an index. In gardening programme the attendance is marked by individual. Finally the two participation indexes were summed up to obtain total participation index (Appendix IX).

3.3.6.1 Education tools prepared to conduct the nutrition intervention

The following education tools were prepared by the investigator to conduct the nutrition intervention.

3.3.6.1.1 Multimedia tools: A flash movie and a power point presentation was prepared

Three minutes movie in flash was made to motivate the children towards the consumption of fruits and vegetables.

A power point presentation on the nutritional benefits on fruits and vegetables for children was prepared.

3.3.6.1.2 Education Games and Fun tools: Four games tools were developed for conducting nutrition intervention (Appendix X).

3.3.6.1.2.1 Fruit shadows

3.3.6.1.2.2 Fruit necklace

3.3.6.1.2.3 Identify fruits and vegetables

3.3.6.1.2.4 Fill a bowl with fresh fruits

3.4 CONDUCT OF STUDY

3.4.1 Pilot Study

Pilot study was undertaken to find out the reliability of the questionnaires, rating scale and check list used and to see if it yields consistent results. The pilot

study was undertaken immediately after formulating the tools for the present investigation. The pilot study was conducted on twenty children in order to find out the applicability of the formulated tools. Twenty students of 10 -12 years were subjected to pilot study. They were asked to fill the questionnaires (knowledge test on basic nutrition concepts, personal and socio-economic characteristics, food habits and preferences, food use frequency of fruits and vegetables and actual fruit and vegetable consumption.). The completed questionnaires were collected on the same day. The twenty children were subjected to the tools once again the next day and collected on the same day. The scores of the two days were consolidated and subjected to statistical analysis in order to find the reliability of the questionnaire. These was no significant difference between the two, hence the tools were considered to be reliable.

3.4.1.1 Difference between the two trials of the pre tests

Table 3: Nutrition Knowledge

Category	Number	Mean value	Standard deviation
Knowledge 1st day	20	6.60	1.569
Knowledge 2nd day	20	6.60	1.569

Table 4: Actual fruit and vegetable consumption

Category	Number	Mean value	Standard deviation
Vegetables 1st day	20	68.50	25.737
Vegetables 2nd day	20	68.50	25.737
Fruits 1st day	20	52.25	21.611
Fruits 2nd day	20	52.25	21.611

Table 5: Food use frequency of fruits and vegetables

Category	Number	Mean value	Standard deviation
Vegetables 1st day	20	3.29	0.849
Vegetables 2nd day	20	3.29	0.849
Fruits 1st day	20	3.54	0.638
Fruits 2nd day	20	3.54	0.638

Table 6: Preference for fruits and vegetables

Category	Number	Mean value	Standard deviation
Vegetables 1st day	20	3.49	0.527
Vegetables 2nd day	20	3.49	0.527
Fruits 1st day	20	4.82	0.209
Fruits 2nd day	20	4.82	0.209

From the table it is seen that there is no significant difference in the responses exhibited by the subjects in the two trials. Hence it is clear that this test is reliable.

3.4.1.2 Validity of the scales

The validity of any instrument or scale depend up on the fidelity with which it measures whatever its purports to measure. Validity is determined by companying the measure got by the given instrument/scale with a highly precise standard measure. Every instrument has certain objective of its own and is constructed for a specific purpose and hence it should be valid for that purpose.

3.4.1.3 Face validity

The scale was constructed by keeping in view their face validity requirements. The term face validity is, by restricted to the fact that a test looks valid, particularly to those who are unsophisticated in test practices at the most elementary level, it is necessary for a questionnaire to have face validity, that is each question must be related to the topic under investigation and the questions must be

clear and unambiguous. A more adequate validation requires checking the response against an external criticism the questions on opinions, attitudes and evaluation should be checked by following the questionnaire with an interview of a sample of the respondents to the whether their responses to the questionnaire actually respect their views on the subject discussed. Hence the investigator followed the questionnaire with an in-depth interview of twenty respondents from the sample, for the sake of validation.

3.4.2 Main Study

The main study was done in three phases

    3.4.2.1 Pre Intervention assessments .

    3.4.2.2 Nutrition Intervention

    3.4.2.3 Impact Evaluation of the Intervention

    3.4.2.1 Pre Intervention Assessments

The initial tests accompanied by biographical questionnaire to acquire details about the sample were done before the initiation of the nutrition intervention. The personal and socio-economic characteristics of the subjects were assessed using the questionnaire prepared by the investigator. The food habits and food preferences of the subjects were ascertained using the rating scale made by the investigator. The fruit and vegetable consumption pattern was determined using dietary recall method. The nutrition cognition on basic nutrition concepts with reference to fruits and vegetables of the subjects were appraised using a multiple objective test. Anthropometric measurements, clinical examination and morbidity pattern was also conducted to assess the general health status.

3.4.2.2 Nutrition Intervention

The nutrition intervention was conducted in different steps. At the onset the investigator developed a rapport with the subjects those were selected for the nutrition intervention programme and the intervention was carried out in the following steps.

3.4.2.2.1 Breaking Ice and Motivation Session:

In order to motivate the children a flash movie of three minutes was presented. The participation of the subjects was evaluated based on their attendance to the session.

3.4.2.2.2 Nutrition Education using Multi media approach:

The investigator presented a self explaining power point presentation on the nutritional benefits of fruits and vegetables and its significance on the growth and development of the children. The participation of the subjects in this session was evaluated based on their attendance.

3.4.2.2.3　Raising a nutrition garden:

A self explaining power point presentation on how to start gardening in a school was first shown to the children. The children were encouraged to raise a nutrition garden with the help of the teachers and a skilled labour. The nutrition garden was raised at Government upper primary school Ambalathara in five cents rectangular land. The plants were raised in sacks and gunny bags. The plants like tomatoes, lady's finger, brinjal, amaranths, green chilies and peas were raised. The mixture was prepared using coir piths compost, cow dung, neem cake and red loam soil. The mixture was filled in the sacks. The nutrition garden was raised at the second centre at Government Model Higher Secondary School Venganoor. The

Plate: 3 Nutrition Intervention Using Multimedia Tools

Plate: 4 Plants raised in gunny bags

Plate: 5 Subjects maintaining and protecting the garden

participation of the subjects was recorded by the investigator using the participation score sheet.

3.4.2.2.3.1 Maintenance and Protection of the raised nutrition garden:

The subjects selected for the intervention programme were asked to regularly maintain and protect the garden everyday for three months. The participation of the subjects in the activity was recorded by the class teacher using the participation score sheet.

3.4.2.2.3.2 Harvesting:

The yield of the fruits and vegetables were reaped and collected by the children as a team. The participation in these sessions was also recorded by the teachers.

3.4.2.2.4 Nutrition games and fun session:

The children were introduced to nutrition games and fun sessions and their participation was noted by the investigator using the participation score sheet.

3.4.2.3 Impact evaluation of intervention.

In order to evaluate the impact of the nutrition intervention, the food preference, food habits, fruit and vegetable consumption pattern and nutrition knowledge was assessed once again after the intervention. The same tools used for the pre intervention assessment were used for the impact evaluation of the intervention.

Plate: 6 A child is wearing a fruit necklace made by him

Plate: 7 Participants engaged in nutrition games –making fruit necklace

3.5 STATISTICAL ANALYSIS

The data collected were scored, coded, consolidated and subjected to statistical analysis and interpretations. The statistical procedures used in the present study were: -

Mean, percentage, correlation analysis and ANOVA. The results of the statistical analysis and findings are presented in the ensuring chapter.

Mean, percentage – for finding out frequency distribution

Correlation analysis – to find out the correlation between knowledge score of the subjects with participation index

ANOVA – to find out the significance in fruit and vegetable consumption pattern with reference to personal and socio- economic variables

Results

4. RESULTS

In order to facilitate better understanding and for convenience the results of the present study are presented under the following sessions.

4.1   Personal and socio-economic characteristics of the subjects

4.2   Food consumption pattern of the subjects

4.3   Assessment of general health status of the subjects

4.4   Participation index of the subjects

4.5   Impact evaluation of nutrition intervention

4.6   Knowledge gain with reference to biographical variables

4.7   Fruit and vegetable consumption pattern with reference to biographical variables

4.1 PERSONAL AND SOCIO-ECONOMIC CHARACTERISTICS OF THE SUBJECTS

Personal and socio-economic characteristics of the selected hundred subjects which include sixty two pre adolescent boys and thirty eight girls were assessed in order to elicit information regarding their age, religion, type of family, family size, number of siblings, ordinal position, family income and educational status of the family members. The distribution of the subjects based on their personal and socio-economic characteristics are shown in Table 7, 8, 9 and 10.

4.1.1 Age of the subjects

Table 7 shows that among the subjects surveyed, fifty six per cent belonged to the age group of 10 and 11 years, and forty four per cent were in the age group of 12 years.

4.1.2 Religion

Religion plays a vital role in the food habits and preference. Table 7 depicts the religion wise distribution of the subjects. Fifty per cent of the subjects were Hindus, while thirty four per cent belonged to Muslim and remaining sixteen per cent belonged to Christian community.

4.1.3 Type of family

Family type has been classified into nuclear, joint and extended based on the composition. Joint families included parents, children, grand parents and other relatives where as extended families have parents, their children and one or two relatives residing with the family. Nuclear families have only parents and their children living under the same roof. In this study seventy four subjects were found to come from nuclear families, fourteen per cent from extended families and twelve per cent from joint families.

Table 7: Distribution of subjects based on their personal and socio-economic characteristics (n =100)

Variables	Category	Percentage
Age (years)	10	28
	11	28
	12	44
Gender	Male .	62
	Female	38
Religion	Hindu	50
	Christian	16
	Muslim	34
Type of family	Nuclear	74
	Joint	12
	Extended	14
Family size	Small (1 – 4)	51
	Medium (5 - 7)	41
	Large (>8)	8
No. of siblings	None	4
	One	57
	Two	29
	Three	6
	Four	3
	Five	1
Ordinal position	1st	38
	2nd	43
	3rd	19

4.1.4 Family size

Table 7 indicates that majority i.e. fifty one per cent of the subjects belonged to small family category with one to four members. Forty one per cent of the subjects belonged to the medium sized families with five to seven members and eight per cent had more than or equal to eight members in the family.

4.1.5 Sibling

Data regarding number of sibling and ordinal position of the subjects in the families of the subjects are furnished in Table 7.

4.1.5.1 Number of siblings

The results furnished in the Table 7 shows that majority of the subjects (57 per cent) had only one sibling. Twenty nine per cent had two siblings while four per cent were the only child in the families and rest ten per cent had more than two siblings.

4.1.5.2 Ordinal position

The results show in Table 7 that forty three per cent of the subjects were middle born while thirty eight per cent were first born and nineteen per cent were last born.

4.1.6 Educational status of parents

The educational status of parents of the subjects when assessed was seen to range from lower primary to college education. When father's educational status was assessed, it was revealed that in majority of the subjects, the father's were

educated up to high school level i.e., sixty eight per cent. While nineteen per cent were educated only up to upper primary level. Seven per cent had studied up to college level where as only four per cent had studied up to lower primary level. When educational status of the mothers of the subjects was assessed, it was found that sixty per cent of them had high school education while nineteen per cent had studied up to college level. Eighteen per cent were found to be educated up to upper primary and three per cent up to lower primary as indicated in the Table 8. None of the parents of the subjects were illiterate.

Table 8: Distribution of subjects based on the education status of parents (n=100)

Educational level	Percentage of educational status	
	Father	Mother
Lower primary	4	3
Upper primary	19	18
High school	68	60
College	7	19

4.1.7 Employment status of parents

Assessment of the employment status of the parents of the subjects revealed that sixty four per cent of subject's fathers were casual labourers while twenty two per cent were self employed. Seven per cent were working in private firms and five per cent in government organizations. None of the father's of the subjects was found to be unemployed.

Table 9: Employment status of parents of the subjects (n=100)

Employment	Percentage of employment status	
	Father	Mother
Unemployment	-	78
Self employment	22	12
Casual labour	64	3
Private	7	4
Government	5	3
Not specified	2	-
Total	100	100

In case of mother's employment status the majority of them were found to be house wives. Twelve per cent of the mothers were self employed while four per cent were working in private firms. Three per cent of the mothers were casual labourers and three per cent were government employees.

4.1.8 Monthly family income of the subjects

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

Table 10: Monthly family incomes of the subjects (n= 100)

Total monthly income (Rs.)	Percentage of families
2500-3500	31
3501-4500	34

4501-6000	10
6001-8500	7
> 8501	18

Monthly income of the families ranged between Rs. 2500 – 8501 and the details of the families belonged to different income levels were given in the above table.

Table 10 reveals that thirty four per cent of subjects belonged to Rs. 3501 – 4500 income groups and thirty one per cent of the subjects belonged to Rs. 2500 – 3500 income groups. While eighteen per cent were from Rs. > 8500 income group.

4.2 FOOD CONSUMPTION PATTERN OF THE SUBJECTS

Diet survey was conducted as a primary step to determine the dietary profile of the subjects. The diet survey revealed information regarding food habits, food preference and frequency of use of fruits and vegetables. The results obtained from the diet survey are furnished in Table 11.

4.2.1 Food habits of the subjects

An enquiry on the food habits of the subjects under study revealed that all the subjects, i.e. hundred per cent were non-vegetarians. Though they were all branded non-vegetarians it was observed that fish was the single non-vegetarian foods that are most frequently consumed.

4.2.2 Frequency of use of fruits and vegetables by the subjects

Frequency of use of various fruits and vegetable items among the subjects were assessed by assigning scores ranging from one to six depending upon frequency of use viz, daily, by-weekly, weekly, fortnightly, monthly, occasionally and never.

Data collected based on these scores to determine the frequency of use of fruit and vegetable items in the daily diet is presented in Table 11.

Green leafy vegetables like amaranth, agathi and drumstick leaves was found to be consumed only by four per cent, one per cent and four per cent of the subjects respectively on daily basis. It may be noticed that most of the subjects (15 per cent) consumed amaranth only by-weekly, followed by occasionally (38 per cent) while only twenty seven per cent consumed weekly. Around fifty six per cent of the subjects never consumed agathi leaves. Curry leaves was consumed by seventy four per cent of the subjects, whereas other green leafy vegetables like cabbage were consumed weekly (29 per cent) and occasionally (22 per cent) by the subjects. Drumstick leaves were also consumed occasionally by (32 per cent) of the subjects. Curry leaves is the most frequently used and agathi, the least frequently used green leafy vegetables by the subjects.

In the present study the results reveals from the table 11, that frequency use of roots and tubers are comparatively higher than the green leafy vegetables. It was found that onion was the most frequently used and colocasia the least frequently used. As far as the frequency of consumption of roots and tubers is considered, twenty two per cent of the subjects consumed carrot, twenty nine per cent consumed onion, twenty four per cent consumed potato, seventeen per cent consumed tapioca and five per cent consumed sweet potato on daily basis. It may be noticed that forty three per cent of the subjects occasionally used sweet potato.

On assessing the frequency use of other vegetables among the subjects, the most frequently used vegetables in their daily diet are found to be cucumber (15 per cent), ladies finger (25 per cent), drumstick (127 per cent) and plantain (15 per cent). The least frequently used vegetable daily was ash gourd (3 per cent).

With regard to frequency of use of ash gourd, forty one per cent of the subjects were never consumed ash gourd in their diet. It is evident that bitter gourd was occasionally used by twenty one per cent of the subjects. It was found that seventeen per cent of subjects used tomato occasionally in their diet.

Data pertaining to the frequency of use of fruits was also found to be low in the present study. Fifty one per cent of the subjects reported that they consumed banana daily in their diet. Amla were used daily by twelve per cent of subjects, while guava was used occasionally by twenty five per cent of the subjects in their diet. The least frequently used fruits in their daily diet by the subjects are orange (12 per cent), pineapple (11 per cent). The seasonally available water melon and jack fruit was found to be ten per cent and seven per cent of the subjects respectively. In their diet. It may be noticed that twenty per cent of the subjects never consumed orange.

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

Table 12: Food frequency percentage score for vegetables and fruits by the subjects

Food Items	Percentage food frequency
Amaranth	59
Curry leaves	87
Cabbage	68
Drum stick leaves	52
Beetroot	70
Carrot	79
Colocasia	54
Onion	76
Potato	74
Sweet Potato	50
Tapioca	77
Yam	70
Ashgourd	38
Beans	63
Bittergourd	41
Brinjal	64
Cauliflower	42
Cucumber	79
Drumstick	69
Ladies finger	72
Plantain	53
Pumpkin	51
Raw mango	65
Snake gourd	54
Tomato	67
Amla	67
Apple	60
Banana	82
Grapes	66
Guava	64
Jack fruit	53
Mango	71
Oramge	50
Papaya	66
Pineapple	63
Seethafal	47
Watermelon	68

Based on the percentage frequency, fruits and vegetables included in the daily diet by the subjects were classified as most frequently used (70-90 percentage score) medium frequently used (60-70 percentage score) and less frequently used (30-60 percentage score).

Table 13: Use of fruits and vegetables by subjects based on percentage frequency

Particulars	Most frequently used foods (score70 – 90)	Medium frequently used foods (score 60 -70)	Less frequently used foods (score 30 -60)
Before intervention programme	Ladies finger	Cabbage	Amaranth
	Carrot	Beans	Drumstick
	Beetroot	Drumstick	Colocacia
	Onion	Raw mango	Ash gourd
	Potato	Tomato	Bitter gourd
	Tapioca	Brinjal	Cauliflower
	Yam	Apple	Plantain
	Curry leaves	Amla	Pumpkin
	Banana	Grapes	Snake gourd
	Mango	Guava	Sweet potato
		Papaya	Jack fruit
		Pineapple	Orange
		Water melon	Seethaphal

The above table indicates that among subjects, vegetables like ladies finger, carrot, beet root, potato, tapioca, onion, yam, curry leaves and fruits like, banana, mango are the most frequently used food items. Use of cabbage, beans, drumstick, raw mango, tomato, brinjal and fruits like amla, apple, grapes, guava, papaya, pineapple, water melon were found to be medium frequent used. Less frequently used vegetables like amaranth, drumstick, colocasia, ash gourd, bitter gourd, cauliflower, plantain, pumpkin, snake gourd, sweet potato. And fruits like jack fruit, orange and seethaphal to be less frequently used.

4.2.3 Food preference of the subjects

Food preference of the subjects of foods from different food groups was assessed using a rating scale. Preference score of different fruit and vegetable were calculated using the method as suggested by Reaburn et al. (1979).

Preferences for food by the subjects were gauged using a five point scale. It was apparent from the table 14 that all the subjects preferred ice-cream. Food items like sweets (93 per cent), honey (92 pre cent), cake (95 per cent), egg (80 per cent), tea (85 per cent), and coffee (84 per cent) were also marked as food that they "liked very much" by the subjects of the present study.

With regard to fruits and vegetables, apple and grapes were the only two fruits which was highly preferred by all the subjects (100 per cent), followed by guava (92 per cent), banana (90 per cent), amla (77 per cent) and pine apple (76 per cent). Only very few vegetables were preferred by the subjects. Ripe tomato was preferred by fifty two per cent of the subjects followed by carrot by forty six per cent and amaranth by forty per cent of the subjects. The table 14 clearly depicts that only very few vegetables and fruits are preferred by the subjects.

Table 15: Percentage score of the subjects for food preference for fruits and vegetables

Food items	Percentage food preference
Amaranth	78
Drumstick	74
Cabbage	78
Ash gourd	64
Lady's finger	77
Cucumber	89
Bitter gourd	56
Pumpkin	70
Cauliflower	64
Drumstick	72
Carrot	36
Beet root	70
Snake gourd	65
Brinjal	65
Amla	95
Apple	100
Banana	98
Grapes	100
Guava	98
Mango	93
Orange	82
Papaya	88
Pineapple	95
Tomato ripe	88

Based on the percentage preference, fruits and vegetables in the daily dietaries by the respondents were classified as most preferred (above 85 per cent) medium preferred (70-85 per cent) less preferred (55-70 per cent).

Table 16: Preference for fruits and vegetables by subjects based on percentage preference

Particulars	Most preferred (above 85 per cent)	Medium preferred (70 – 85 per cent)	Less preferred (55 – 70 per cent)
Before intervention programme	Cucumber	Amaranth	Ash gourd
	Carrot	Drumstick leaves	Bitter gourd
	Amla	Cabbage	Brinjal
	Apple	Ladies finger	Cauliflower
	Banana	Pumpkin	Snake gourd
	Grapes	Drumstick	
	Guava	Beet root	
	Mango	Orange	
	Papaya		
	Pineapple		
	Tomato ripe		

The above table indicates that vegetables like cucumber, carrot and fruits like amla, apple, banana, grapes, guava, mango and papaya were most preferred. The medium preferred vegetables were amaranth, drumstick leaves, cabbage, ladies finger, pumpkin, drumstick and beet root. Orange was also found to be medium preferred. Other vegetables like ash gourd, bitter gourd, cauliflower, snake gourd and brinjal were less preferred by the subjects.

4.2.4 Fruit and vegetable consumption pattern of the subjects

The fruit and vegetable consumption of the subjects was assessed by conducting diet survey.

Table 17: Distribution of subjects based on meal composition pattern   (n =100)

Meal composition	Breakfast (percentage)	Lunch (percentage)	Dinner (percentage)
Cereals alone	20	10	7
Cereals + pulses	42	58	50
Cereals + pulses + vegetables	28	27	31
Cereals + vegetables + fruits	10	5	12
Total percentage	100	100	100

Among the various food item consumed by the subjects, the intake of cereals, pulses are found to be higher. Fruits, green leafy vegetables and other vegetables were very poor. And most of them consumed bakery items like biscuits, cake, candies, chips and fast foods which give some calories and fats with little protein. Many of them consumed soft drinks and snack items which give only empty calories

It was also noticed that milk intake was more common among the subjects. Rice with fish curry is most common at lunch and evening tea with energy dense bakery items and fast food items were common Dinner comprised of items like rice, chappathi, fish, chicken etc. vegetable preparation especially green leafy vegetables were very low in the meals of the subjects.

4.3 ASSESSMENT OF GENERAL HEALTH STATUS OF THE SUBJECTS

Assessment of general health status of the subject in this study was done using anthropometry, clinical examination and morbidity pattern.

4.3.1 Anthropometric measurements.

The anthropometric measurements of the subjects recorded in the present study were height, weight and BMI.

4.3.1.1 Height and Weight of the subjects

Height and weight of the subjects in the present study were measured The table 18 shows that, only six per cent of the 10 and 11 years old boys has normal weight. But in case of girls, only one per cent of 10 year old girl has normal weight and all 11 years old girls are below the standard weight. Nineteen per cent of 12 years boys are below standard weight and height and twelve per cent of girls are also below standard weight and height.

Twelve per cent of the 10 year old boys and seven per cent girls are of normal height. Only five per cent of the 11 years old boys and three per cent girls are of normal height.

4.3.1.2. Body Mass Index (BMI)

Body Mass Index of the subjects was computed in order to classify them according to different categories like 'Chronic Energy Deficit' (CED), normal and obese; Table 19 depicts the distribution of subjects based on their BMI.

Table 19: Distribution of subjects based on their BMI (n=100)

BMI classification*	Percentage
<15 CED	48
15-22 Normal	50
>22 over weight	1
>25 obese	1

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

Table 19 shows that fifty per cent of the subjects were normal and forty eight per cent were severe chronic energy deficit (CED). Only one per cent was over weight and one per cent obese.

4.3.2 Clinical examination

Examination of the subjects for the incidence of clinical signs and symptoms of the deficiency disease indicated that about twenty one percent did not show any clinical symptoms of the deficiency diseases. Table 20 depicts those clinical symptoms of deficiency diseases.

Table 20: Distribution of subjects based on the incidence of clinical symptoms

Clinical symptoms	Percentage
Emaciation	18
Conjunctival xerosis	14
Bitot's spot	2
Corneal xerosis	1
Paleness of eyes	29
Pigmentation	29
Phrynoderma	2
Gums – spongy bleeding	14
Dental caries	29
Mottled enamel	11
No clinical symptoms	21

It can be seen from table 20, twenty nine per cent of the subjects were found to have paleness of eyes, pigmentation and dental caries. In eighteen per cent of the subjects, emaciation was seen and fourteen per cent had conjunctival xerosis and spongy bleeding gum. Eleven per cent of the subjects showed symptoms of mottled enamel. Clinical symptoms like corneal xerosis, Bitot's spot and phrynoderma were present only in one, two and two per cent of subjects respectively.

4.3.3 Morbidity Pattern of the subjects

Morbidity pattern of the subjects was studied in order to ascertain their general health condition. Table 21 depicts the morbidity pattern as reported by the subjects.

Table 21: Distribution of subjects based on morbidity

Morbidity	Percentage
Minor ailments	43
Vomiting	3
Fatigue	5
Flatulence	1
Suffocation	6
Throat pain	6
Chest pain	6
Chest infection	7
Stomach pain	4
Vision disorder	7
Hearing problem	3
Skin disease	3
No morbidities	48

Morbidity or minor ailments commonly present among the subjects were forty three per cent. Chest infection and vision disorder was found in seven per cent of the subjects. Morbidity pattern indicated that about forty eight per cent did not show any morbidity pattern.

4.4 Distribution of the subjects based on participation index

Participation of the subjects in the present study, subjects was operationalised as the involvement of the subjects in the programme related activities. A scale was constructed to assess the rate of participation of the subjects. For this the different activities which involves the participation of the subjects such as participation in education programme, participation in games and participation in raising a nutrition garden programme.

The frequency of their participation in these activities was assessed by marking on a six point scale; the scores were assigned as 0 and 1. When they were

attended the education and games programme, the score allotted was "1" and score "0" was allotted for those who didn't attend the programme. These scores were finally summed up to obtain an index. In gardening programme the attendance is marked by individual. Finally the two participation indexes were summed up to obtain total participation index.

Based on the mean and standard deviation the subjects were classified as having high rate of participation, medium participation and low participation in nutrition education and games

Table 22: Participation of subjects in nutrition education, games and nutrition gardening (n=100)

Participation index	Percentage	Mean ± S.D
High	15	> (82 + 11)
Medium	74	Between (82 ± 11)
Low	11	< (82 - 11)

Distribution of the subjects based on their participation index is given in the table 22. The mean value of participation index of the subjects was 82 and the standard deviation (S.D) was 11. The subject were classified based on their participation index as those above mean + S.D as high, those between mean ± S.D as medium and below mean − S.D as low participation index.

The table 22 depicts that seventy four per cent of the subjects had medium level of participation, fifteen per cent had high participation and eleven per cent had low level of participation in nutrition education, games and nutrition gardening session.

4.4.1 Correlation between knowledge score of the subjects with participation index

In order to find out the relationship of knowledge gained of the subjects with participation index level, correlation coefficient was computed and the results are presented in table 23.

Table 23: Correlation between knowledge score of the subjects with participation index.

Level of participation index with knowledge score	Coefficient of correlation
High [> (82 + 11)]	0.2385
Medium [Between (82 ± 11)]	0.1953
Low [< (82 - 11)]	-0.0627

Table 23 reveals that there is positive correlation between participation index and knowledge gain after the nutrition intervention programme.

4.5 IMPACT EVALUATION OF NUTRITION INTERVENTION

4.5.1 Frequency of use of fruits and vegetables

Ideally, the summative evaluation is meant to show whether or not there is a change in fruit and vegetable consumption after the subjects participated in the nutrition intervention programme. Pre and post intervention scores of the frequency percentage of vegetable and fruit consumption in the table 24 reveals that there is an increase in the frequency of use of vegetables and fruits. The results indicate as slight increase in the frequency use of most of the vegetables and fruits (3 – 4 per cent) by the subjects who participated in the nutrition intervention programme.

Based on the percentage frequency, fruits and vegetables included in the daily diet by the subjects were classified as most frequently (70-90 percentage score) medium frequently used (60-70 percentage score) less frequently used (30-60 percentage score).

Table 25: Use of fruits and vegetables by subjects based on percentage frequency, before and after the intervention programme

Particulars	Before the intervention programme	After the intervention programme
Most frequently used food (70 – 90 per cent)	Carrot	Beet root
	Beet root	Cabbage
	Ladies finger	Carrot
	Onion	Cucumber
	Potato	Curry leaves
	Tapioca	Drumstick
	Yam	Ladies finger
	Curry leaves	Onion
	Banana	Potato
	Mango	Tapioca
		Tomato
		Yam
		Amla
		Banana
		Mango
		Guava
Medium frequently used food (60 – 70 per cent)	Cabbage	Amaranth
	Beans	Beans
	Drumstick	Brinjal
	Raw mango	Colocacia

	Tomato	Drumstick leaves
	Brinjal	Plantain
	Apple	Pumpkin
	Amla	Raw mango
	Grapes	Snake gourd
	Guava	Sweet potato
	Papaya	Apple
	Pineapple	Grapes
	Water melon	Jack fruit
		Orange
		Papaya
		Pineapple
		Water melon
Less frequently used food (30-60 percentage score)	Amaranth	Ash gourd
	Drumstick	Bitter gourd
	Colocacia	Cauliflower
	Ash gourd	Seethaphal
	Bitter gourd	
	Cauliflower	
	Plantain	
	Pumpkin	
	Snake gourd	
	Sweet potato	
	Jack fruit	
	Orange	
	Seethaphal	

The table 25 shows that there were only ten fruit and vegetable which were most frequently used before the intervention programme, namely carrot, beet root, ladies finger, onion, potato, tapioca, yam, curry leaves, banana and mango. After the nutrition intervention it is clearly evident from the table that the most frequently used fruits and vegetables increased from ten to sixteen numbers namely beet root, cabbage, carrot, cucumber, curry leaves, drumstick, ladies finger, onion, potato, tapioca, tomato, yam, amla, banana, mango and guava.

The table 25 also depicts that around thirteen fruits and vegetables namely cabbage, beans, drumstick, raw mango, tomato, brinjal and fruits like amla, apple, grapes, guava, papaya, pineapple, water melon were the medium frequently used food by the subjects before the intervention programme. After the intervention programme ten vegetables namely amaranth, beans, brinjal, colocasia, drumstick leaves, plantain, pumpkin, raw mango, snake gourd, sweet potato were stated as medium frequently used food. And seven fruits like apple, grapes, jack fruit, orange, papaya, pineapple, water melon became the medium frequently used foods.

The less frequently used fruits and vegetables after the nutrition intervention programme were agathi, ash gourd, bitter gourd, cauliflower and seethaphal.

4.5.2 Food preference of the subjects

The fruit and vegetable preference by the subjects, who participated in the nutrition intervention increased and it is apparent from the Table 26. Marked preference increase can be observed in vegetables like cabbage, bitter gourd, ladies finger, ash gourd, brinjal and snake gourd.

Table 26: Food preferences of the subjects for fruits and vegetables before and after the intervention

Food items	Food preference for fruits and vegetables before the intervention	Food preference for fruits and vegetables after the intervention
Amaranth	78	85
Drumstick	74	80
Cabbage	78	83
Ash gourd	64	71
Ladies finger	77	82
Cucumber	89	92
Bitter gourd	56	60
Pumpkin	70	74
Cauliflower	64	70
Drumstick	72	79
Carrot	86	90
Beet root	70	79
Snake gourd	65	73
Brinjal	65	71
Apple	100	100
Banana	98	100
Goose berry	95	99
Grapes	100	100
Guava	98	99
Mango	93	99
Orange	82	97
Papaya	88	95
Pineapple	95	98
Tomato ripe	88	98

Based on the percentage preference, fruits and vegetables in the daily dietaries by the subjects were classified as most preferable (above 85 per cent) medium preferable (70-85 per cent) less preferable (55-70 per cent).

Table 27: Preference for fruits and vegetables by subjects based on percentage preference before and after the intervention

Particulars	Before intervention programme	After intervention programme
Most preferred (above 85 per cent)	Cucumber Carrot Amla Apple Banana Grapes Guava Mango Papaya Pineapple Tomato ripe	Amaranth Cucumber Carrot Amla Apple Banana Grapes Guava Mango Orange Papaya Pineapple Tomato ripe
Medium preferred (70-85 per cent)	Amaranth Drumstick leaves Cabbage Lady's finger Pumpkin Drumstick Beet root Orange	Drumstick leaves Cabbage Ash gourd Lady's finger Pumpkin Cauliflower Drumstick Beet root Snake gourd Brinjal
Less preferred (55-70 per cent)	Ash gourd Bitter gourd Brinjal Cauliflower Snake gourd	Bitter gourd

Table 27 indicates that there is a change in the preference of the fruits and vegetables by the subjects of the present study. The most preferable vegetables by the subjects before the intervention were only cucumber and carrot. Amaranth, drumstick leaves, cabbage, ladies finger, pumpkin, drumstick and beet root were vegetables which were medium preferred before the intervention. Ash gourd, bitter gourd, brinjal, cauliflower and snake gourd were least preferred by the subjects.

After the intervention there is a change of preference towards amaranth, ash gourd, brinjal, cauliflower, snake gourd and orange. Amaranth and orange were only medium preferred before the intervention and the two items has become most preferable after the intervention. Similarly ash gourd, brinjal, cauliflower and snake gourd were less preferred before the intervention and these has become medium preferable after the intervention.

4.5.3 Fruit and vegetable consumption change of the subjects

After the intervention programme, the fruit and vegetable consumption of the subjects was assessed once again by conducting diet survey

Table 28: Distribution of subjects based on meal composition pattern   (n =100)

Meal composition	Breakfast (percentage)	Lunch (percentage)	Dinner (percentage)
Cereals	10	4	5
Cereals + pulses	35	46	32
Cereals + pulses + vegetables	37	35	41
Cereals + vegetables + fruits	18	15	22
Total percentage	100	100	100

Change in fruit and vegetable consumption pattern of the subjects was observed after the intervention programme. After the intervention, among the various food items along with fruit and vegetable consumption pattern of the subjects were increased in their daily diet.

4.5.4 Distribution of subjects based on knowledge score

The data on the distribution of subjects based on knowledge score are presented in Table 29. A pre and post experimental design was used to study the impact of intervention on the knowledge gain of the subjects.

Table 29: Distribution of subjects based on knowledge score (n = 100)

Category	Distribution of subjects in percentage	
	Pre intervention (K0)	Post intervention (K1)
Low	17	4
Medium	43	18
High	40	78

Pre intervention (K0)-Mean (5.96)   ± S.D   (5.96 ± 1.56)

Post intervention (K1)-Mean (9.37)   ± S.D   (8.37 ± 1.16)

Based on the results of pre intervention knowledge (K0) score, it can be seen from Table 29 that forty three per cent of the subjects had medium level of knowledge score, while forty per cent had high knowledge score and seventeen per cent of the subjects had low knowledge score before participating in intervention programme.

The results of post intervention knowledge (K1) scores indicates that seventy eight per cent had high score, eighteen per cent had medium score and only four per cent had low knowledge score after the intervention programme.

4.6 KNOWLEDGE GAIN WITH REFERENCE TO PERSONAL AND SOCIO – ECONOMIC VARIABLES

The results shown in the table 30 indicates that the knowledge score of the subjects who participated in the nutrition intervention was increased by 3.41 points. Based on this findings additional comparison were made to investigate the difference between pre and post nutritional knowledge scores with respect to religion, family type , family size, educational status of parents and family income.

Table 30: Average knowledge gain with reference to personal and socio – economic variables

Variables	Number	Mean Gain-knowledge
Religion		
Hindu	50	2.98
Christian	16	3.31
Muslim	34	4.09
F value		5.39**
Family type		
Nuclear	74	3.51
Joint	12	2.92
Extended	14	2.29
F value		0.77
Family size		
Small	51	3.22
Medium	41	3.63
Large	8	3.50
F value		0.79
Educational status Father Lower primary		
Upper primary	4	3.00
High school	19	3.53
College	68	3.43
	7	3.00
F value		0.47
Mother		
Lower primary	3	4.00
Upper primary	18	3.83
High school	60	3.35
College	19	3.11
F value		0.82
Family income (Rs.) 2500-3500		
3501-4500	31	31
4501-6000	34	34
6001-8500	10	10
>8501	7	7
	18	18
F value		2.50*

The descriptive statistics of the subjects based on religion indicates that a remarkable increase in knowledge score was seen among the Muslims (4.09 points), followed by Christians (3.31 points) and then in Hindus (2.98 points).

Table 30 reveals that subjects hailing from nuclear family exhibited greatest increase in nutrition knowledge score after participating the nutrition intervention programme. Subjects coming from medium size families showed greatest increase in nutrition knowledge (3.63 points) when compared to their counterparts.

When the educational status of father and mother of the subjects were taken into account with respect to their knowledge score increase, the results reveals that subjects whose father were qualified up to upper primary school showed the greatest increase (3.53 points). Whereas the subject's mothers who were qualified up to lower primary showed the greatest increase (4.00 points).

The descriptive statistics of nutrition knowledge score of the subjects with respect to family income reveals that the subjects belonging to the income category (Rs 3501 – 4500) showed remarkable increases in knowledge score when compared to other income category.

4.7 FRUIT AND VEGETABLE CONSUMPTION PATTERN WITH REFERENCE TO PERSONAL AND SOCIO – ECONOMIC VARIABLES

Analysis of the data reveals that all subjects irrespective of their religion showed a change in the consumption pattern score for vegetables, fruits and vegetables + fruits. The Table 31 depicts that subjects from Christian families showed more changes with regard to vegetable and fruit consumption when compared to other religions. Similarly subjects hailing from joint families exhibited more changes in the vegetable and fruit consumption pattern when compared to nuclear and extended families. Subjects belonging to large size families showed more increase in the

vegetable and fruit consumption patterns when compared to small and medium size families.

Table 31: Fruit and Vegetable consumption pattern with reference to personal and socio – economic Variables after intervention programme

Mean				
		Food consumption level		
Variables	Number	Vegetables	Fruits	Vegetable + fruit
Religion				
Hindu	50	20.90	38.30	59.20
Christian	16	28.75	46.88	75.63
Muslim	34	21.32	28.68	50.00
F value		0.93	1.94	2.95
Family type				
Nuclear	74	20.88	33.85	54.73
Joint	12	27.50	44.17	71.67
Extended	14	25.36	43.21	68.57
F value		0.70	0.89	1.83
Family size				
Small	51	23.73	30.78	54.51
Medium	41	19.39	42.20	61.59
Large	8	28.13	42.50	70.63
F value		0.84	1.59	0.94
Educational status				
Father				
Lower primary				
Upper primary	4	16.00	36.00	52.00
High school	19	12.11	36.58	48.68
College	68	26.54	34.71	61.25
	7	16.43	57.86	74.29
F value		2.57*	1.15	1.56
Mother				
Lower primary	3	23.33	45.00	68.33
Upper primary	18	22.22	35.00	57.22
High school	60	21.50	34.83	56.33
College	19	24.74	41.32	66.05
F value		0.12	0.27	0.44

Family income (Rs.)				
2500-3500				
3501-4500	31	19.19	47.58	66.77
4501-6000	34	20.15	29.41	49.56
6001-8500	10	25.00	26.50	51.50
>8501	7	45.71	27.14	72.86
	18	21.11	39.44	60.56
F value		2.75*	1.80	1.37

Educational status of the parents of the subjects was also observed and also its relation with the vegetable and fruit consumption pattern. Table 30 reveals that subjects with father of college level educational qualification showed a higher increase in the changes of vegetable and fruit consumption pattern. Similarly subject's mother with lower primary education qualification exhibited greater increases in the changes of vegetable and fruit consumption pattern when compared to others.

The table shows that the subjects belonging to the income group Rs. 6001--8500 showed a remarkable change in the vegetable consumption and fruit consumption after participating in the nutrition intervention programme. The table also reveals that subjects belonging to the income group of Rs. 2500 -- 3500 made a greater change in the fruit consumption after participating in the nutrition intervention programme in the present study.

Discussion

5. DISCUSSION

This chapter presents, explores, describes and discusses the results of the study "promoting fruit and vegetable consumption in children through nutrition intervention programme".

5.1   Personal and socio-economic characteristics of the subjects

5.2   Food consumption pattern of the Subjects

5.3   Assessment of general health status

5.4   Participation index of the subjects

5.5   Impact Evaluation of Nutrition Intervention

5.6   Knowledge gain with reference to biographical variables

5.7   Fruit and Vegetable consumption pattern with reference to Biographical Variables

5.1   PERSONAL AND SOCIO-ECONOMIC CHARACTERISTICS OF THE SUBJECTS

A heterogeneous group of children participated in this research study. They represented different socio-economic and personal variables such as age, religion, family size, type of family, number of siblings, ordinal position, educational status of parents, employment status of parents and family income.

Hundred children were selected as samples and they participated in the nutrition intervention programme. More males (62 per cent) than females (38 per cent) participated in the intervention programme. This is probably owing to a

naturally smaller component of females attending the school in Venganoor village. The age of respondents ranged from ten to twelve years, with the majority (44 per cent) being 12 years old and rest being ten and eleven years, which were equally distributed (28 per cent).

Majority of the respondents (50 per cent) belonged to Hindu religion. This is may be because; the Census data 2001 shows that Thiruvananthapuram district is predominated by Hindu religion. The rest of the subjects were Muslims (34 per cent) and Christians (16 per cent). Most of the Muslim children hailed from the urban areas and the Christians from the rural areas. Majority of the children (74 per cent) lived in nuclear family which is referred to the independent family consisting of a father, a mother and their children. A number of children lived in extended families (14 per cent) while the rest (12 per cent) in the joint family (fig.1).

It is observed by many researchers that the concept of nuclear family is becoming more and more common in our society and joint family system is fast disappearing. The similar reports were given by Krishnaroopa (2003) and Renjini (2008) in their studies done in Thiruvananthapuram district. Joint family is declining these days especially in city like Thiruvananthapuram where the dwellers are mostly working class people migrated from different parts of Kerala.

More than half (51 per cent) of the subjects hailed from small family consisting of one to four members. The rest of the subjects (41 per cent) belonged to middle size families with 5 to 7 members. Only eight percent of the subjects came from large size families and had more than or equal to eight members in the family. Similar reports are given by Krishnaroopa (2003). Kerala is a state with high literacy and people are exposed to the benefits of having small family. Regarding the family size, Park (1997) had reported that average family size in India is four.
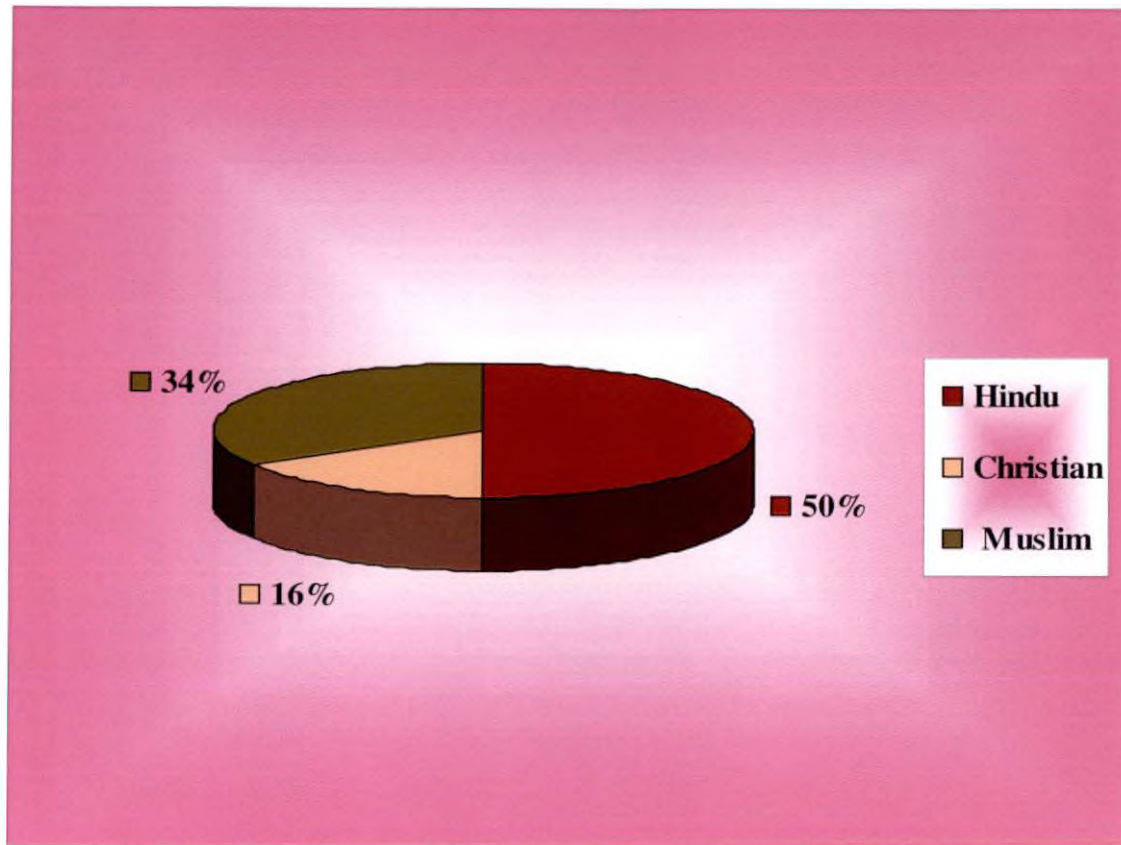
Figure: 1 Religion wise distribution of the subjects

Interestingly, forty three per cent of the subjects studied in the present study are found to be middle born and fifty seven per cent of them have at least one sibling in the family and rest are either first born (thirty eight per cent) or last born (nineteen per cent). Twenty nine per cent of them have one or more siblings.

The educational distribution of the parents of the subjects varied and it was found that majority of the subject's parents has been educated up to high school level and none of the parents were found to be illiterate (fig. 2). As far as the employment profile of the subjects parents were considered, majority of the fathers, sixty four per cent were casual labourers and twenty two per cent were self employees. Only a small percentage of mothers (12 per cent) were self employees, and the rest were government employees (3 per cent) or working in private firms (4 per cent). Majority of the mother's of the respondents were unemployed (fig.3).

The employment status of the population is an important determining factor with respect to health and nutritional status as reported by Reddy et al. (1993). The literacy rate being high in Kerala, it has also affected the family size as the family planning policy of Indian government has been implemented successfully. The present study also agrees with the earlier observation and census data available which indicates that the work participation rate of females has not increased as much as male in last decades in Kerala particularly in Thiruvananthapuram district (Eapen, 2000)

The economic profile of the subjects were also studied and the results shows that majority of the subjects (34 per cent) hailed from Rs. 3501 – 4500 income group, and thirty one per cent from Rs.2500 – 3500 income group. While eighteen per cent belong to Rs. > 8501 income group. Only seven per cent belong to upper middle income (6001-8500).
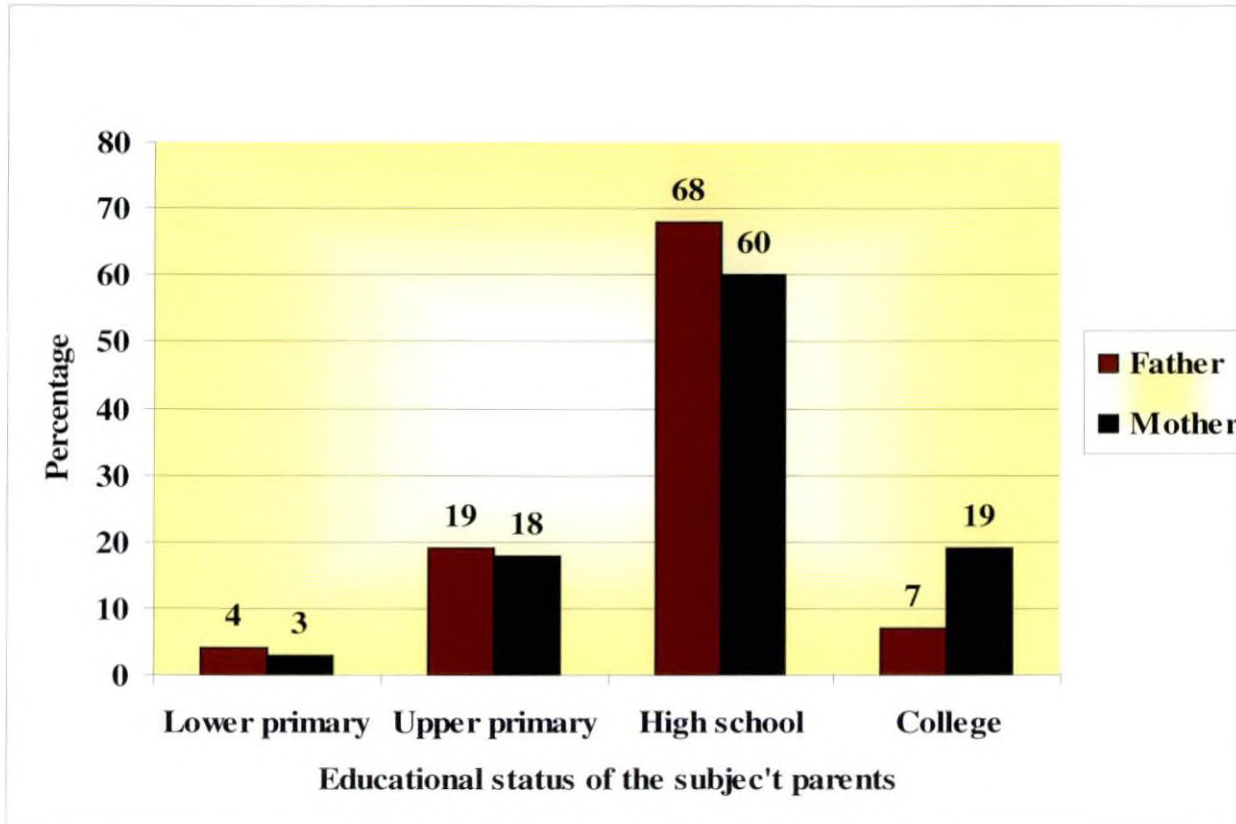
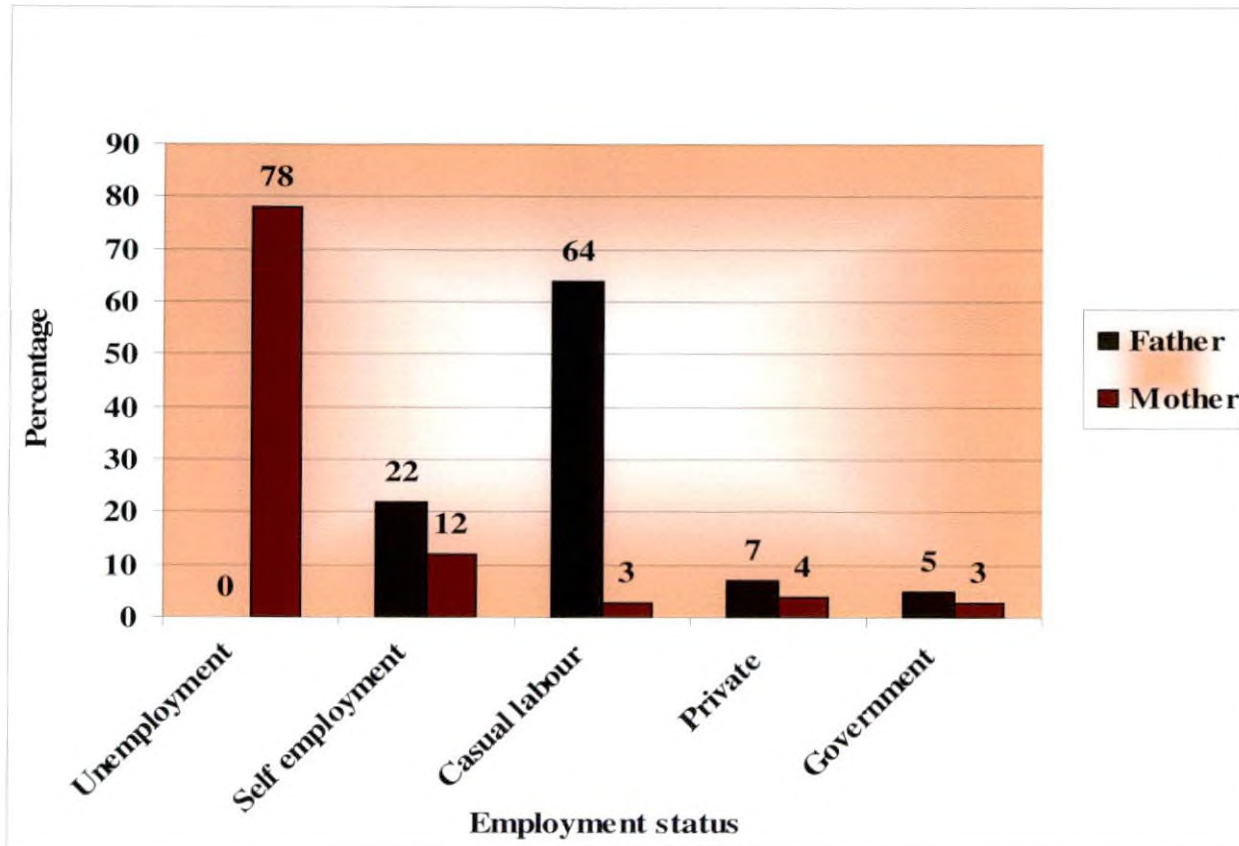Figure: 2 Educational status of the subject's parents

Figure: 3 Employment status of subject's parents

The results may be due to the type of school selected for the present study. The schools selected were government schools and it is noticed that mostly low income and lower middle income group children attend these schools because the school did not have student fees.

5.2 FOOD CONSUMPTION PATTERN OF THE SUBJECTS

Food consumption and nutrient intake have remain the subject of intense research over the last decade, not only because of their importance in children's growth and development, but also because of the increasing realization that eating habits in the early stages of life may be important determinants in the prevention of the so- called chronic degenerative diseases .

The present study reveals the food habits, food preference and food use frequency of the subjects to get an idea on their food consumption pattern.

Mony (1993) opined that biological and psychological development changes during the adolescent period have a dynamic effect on the food preference, food habits and eating behavior of adolescents.

5.2.1 Food habits

Robinson (1998) opined that a dietary habit of an individual in general has influence on his or her nutritional status. Although food habits are not stable during a person's lifetime, a base for healthy habits can be created in early childhood (Hursti, 1999). Health related behaviours and beliefs formed during adolescence and pre adolescence have been linked to patterns of behaviour in adulthood. Dietary habits of adolescents may be maintained into adult lives (Lien et al., 2001).

The results of the present study reveals that all the subjects were non vegetarians. Consumption pattern of Keralities as reported by Kerala Statistical Institute (2000) also revealed that ninety eight percent of the Keralities are habituated to non- vegetarian foods. Similar results were observed by Unnithan (2008), Reshmi (2007), Krishnaroopa (2003) and Beatrice (1999) in their studies undertaken in Thiruvananthapuram district where majority of adolescents were noted as non vegetarians. Kerala being land near to the seas, the availability of sea food is high and that could be the reason for the non vegetarian habit being more prevalent.

5.2.2 Frequency of use of fruits and vegetables

Vegetables and fruits are rich in phytochemicals and antioxidants like β carotene, vitamin C, vitamin E and flavanoids. Observational studies were found that person whose diet is deficient of antioxidants and phytochemicals exhibits an increased risk of several chronic diseases including cancer (Edge, 1997). Phytochemicals have a protective role against disease such as lung cancer and heart disease (Schwatz, 1993).

The results of the present study also reveal the frequency of use of fruits and vegetables were less than the recommended intake by the ICMR. Data shows that even low cost and locally available leafy vegetable like amaranth, drumstick leaves, agathi and cabbage was not consumed daily by the majority of the subjects. Consumption of roots and tubers, as well as other vegetables are also reported to be less by majority of the subjects.

Fifty one per cent of the subjects reported that they consumed banana daily. Other fruits were also not consumed by majority of the subjects.

Similar results were found in studies by Mony (1993) which showed that the roots and tubers were consumed less frequently by adolescents. A study reported by Krishnaroopa (2003) reveals that fruits are less frequently consumed by children.

Vegetables and fruits intake was too low among the adolescents reported by Humulka (2000). Similar study done by Kumari and Singh (2001) on secondary school children also reported that green leafy vegetables, other vegetables and fruits are inadequate in adolescent diet.

Although recommendations have been published in many countries, surveys have reported that fruit and vegetable consumption is lower than the recommended amount 400 g. Authors found that the mean intake of vegetables and fruits was marginal or below the minimum recommended level for most ages (Starkey et al., 2001)

Similar results were found in other countries (Cullen, 2001; St-Onge et. al., 2003; Blumenthal, 2002). Data from the 2003 youth Risk Behaviour Surveillance Survey in the United States showed that fewer than twenty two per cent of students in grades 9 through 12 (aged approximately 14 to 18 years) ate at least 5 servings per day of fruits and vegetables during the 7 days preceding the survey. Of all the food groups, adolescents were most likely to have an insufficient numbers of servings from the fruits and vegetable groups (Grunbaum et al., 2004)

Worldwide consumption of fruit and vegetable in the majority of the regions is below the minimum per capita intake as recommended by the World Health Organization (WHO).

Fruit and Vegetable intake appears to have declined in the past 10 years (Marganey et al., 2001). This is the global scenario and the present study also shows similar results in Thiruvananthapuram context.

A variety of intrinsic and extrinsic factors that influence adolescents eating behaviour have been identified, including gender, age, race, nutrition knowledge level, media influence, cultural beliefs, parental and maternal food preferences. It was noted in this study that fifty one per cent of the subjects consumed banana on daily basis. Banana was the only fruit which was reported by fifty one per cent of the subjects probably due to its availability and comparatively lower cost could be the etiology behind that but many other vegetables, roots and tubes as well as fruits in spite of being locally available and low cost was consumed by the majority of the respondent on a daily basis. Hence it is not just the availability and cost is the factor for the consumption.

Based on the results of the present study it can be concluded that frequency of fruit and vegetable intake among the subjects falls short of current recommendations. Knowledge of factors associated with fruit and vegetable intake frequency may help to guide initiatives aiming to promote consumption of fruit and vegetables by the population of Thiruvananthapuram district.

Awareness, nutrition knowledge and inertest have to be created among the children and adolescent to enhance the fruit and vegetable consumption.

In the present study the frequency of use of fruits and vegetables that was locally available was studied. However the availability and types of fruits and vegetables depends on the season. The favourable climate of Kerala allows for growing fruits such as mangoes, banana and papaya. Green leafy vegetables like

amaranth and drumstick leaves, other vegetables like ash gourd, bitter gourd, ladies finger, pumpkin and plantain are grown in Kerala.

The frequency of use of fruits and vegetables before the nutrition intervention was studied in the present investigation. The present study reveals that more than fifty eight per cent of the subjects never used green leafy vegetables like agathi. Vitamin A rich leafy vegetables like amaranth, cabbage and drumstick leaves which is locally available was also only occasionally used by the subjects. Only curry leaves was used daily by seventy four per cent of the subjects. Curry leaves being used for seasoning in most of the Kerala dishes and that may be the reason for it being daily used. But it has to be noticed that curry leaves are not consumed, it is only used as a flavouring agent.

Green leafy vegetables play a vital role in the adolescent nutrition especially since it is a good source of many vitamins and minerals such as vitamins A, C, and K, folate, iron and calcium. They are also great sources of fiber. Green leafy vegetables like amaranth can be cultivated in the backyard and kitchen garden also. In spite of green leafy vegetable being low cost and locally available, the consumption is found to be less among the subjects.

Similar results have been reported in studies of Unnithan (2008) and Humulka (2000). Similar study done by Kumari and Singh (2001) on secondary school children also reported that green leafy vegetables, other vegetables and fruits are inadequate in adolescent diet.

Roots and tuber are good source of carbohydrates. It is also a significant item to be included in the diet of the adolescents. This study shows that only forty two per cent of the subjects consumed carrot daily in their diet. The locally available tubers like tapioca, sweet potato and yam is also consumed only by thirty seven per cent, eleven per cent and twenty three per cent respectively by the subjects, daily in

their diet. It was noticed that forty three per cent of the subjects occasionally used sweet potato, in spite of it being low cost and locally available. Study by Unnithan (2008) and Mony (1993) also reveals that green leafy vegetables, roots and tubers were consumed less frequently by adolescents. Mothers who were educated reported that most of children were reluctant to consume vegetables as such or vegetable preparations along with rice or chapathi. Mothers also complained that most of the children had the habit of separating the vegetables from curries like sambar and their vegetable consumption is low. Hence the mothers who were very much aware of the importance of including greens and vegetables in the diet reported that they cut, mash and grind the vegetables and add to gravies of different preparations without the knowledge of the children. Similar results were obtained in a study done by Krishnaroopa (2003) in adolescent children of Trivandrum district.

On assessing the frequency use of vegetables among the subjects it was found that majority of the subjects did not include vegetables in their daily diet. The most frequently used vegetables in the daily diet by the subjects are found to be cucumber (30 per cent), ladies finger (25 per cent) and plantain (20 per cent). The least frequently used vegetables in the daily diet by the subjects are ash gourd (3 per cent), bitter gourd (7 per cent) and cauliflower (3 per cent).

The taste of bitter gourd being not appealing for the adolescents could be the reason for it being the least frequently used, in spite of bitter gourd being locally available.

Cauliflower is a vegetable grown in cold climate and it is not grown in Kerala, though it is available in the local market. The cost factor of cauliflower may owe to being the least frequently used vegetable by the adolescents.

Studies done by Unnithan (2008), Krishnaroopa (2003) and Humulka (2000) also showed similar results and states that consumption of vegetables among the adolescents is low.

Frequency of fruit consumption was also found to be low in the present study. Banana was the only fruit that was daily consumed by the subjects. Fifty one per cent of the subjects reported that they consumed banana daily which may be due to the availability and low cost. Papaya, guava, jack fruit, mango, pineapple, and amla are locally available. The factor of being locally available and low cost did not contribute to the frequency of its use by the adolescent subjects in the present study.

A study reported by Krishnaroopa (2003) reveals that fruits are less frequently consumed by the children. Humulka (2000) and Kumari and Singh (2001) also report that fruits are inadequate in adolescent diet.

The present study reveals that the frequency use of fruits and vegetables is low. This may be due to lack of awareness of the importance of fruits and vegetables in the diet. Cost of fruit and vegetable may also be a factor contributing to this, hence cultivation of fruits and vegetables at house or school is required.

5.2.4 Fruit and vegetable consumption pattern of the subjects

Among the various food item consumed by the subjects, the intake of cereals, pulses are found to be higher. Intake of Fruits, green leafy vegetables and other vegetables were very poor. And most of them consumed bakery items like biscuits, cake, candies, chips and fast foods which give some calories and fats with little protein. Many of them consumed soft drinks and snack items which give only empty calories.

It was also noticed that milk intake was more common among the subjects. Rice with fish curry is most common for lunch and evening tea with energy dense bakery items and fast food items were common. Dinner comprising items like rice, chappathi, fish and chicken etc. vegetable preparation especially green leafy vegetables were very low in the meals of the subjects.

Similar results done by Krishnaroopa (2003) and Unnithan (2007) reveals that fruits and vegetables are less frequently consumed by the children in their studies done by Thiruvananthapuram.

5.2.3 Preference for fruits and vegetables

Preference for and positive attitude about fruits and vegetables have been major predictors of fruit and vegetable consumption (Domel et al., 1993; Resnicow et al., 1997; Cullen et al., 2000)

Preference for fruit and vegetables of the subject was gauged through a five point rating scale. The highly preferred was rated as "liked very much" followed by "liked" and "just liked", the least preferred were rated as "Disliked" and "not at all liked".

The results of the present study reveals that subjects showed preference to food rich in sugar and fat compared to that of fruits and vegetables.

Cent percent of the subjects reported that they "liked very much" apples and grapes. Seventy six percent reported that they "liked very much" pineapple. The analysis shows that fruits like apple, grapes, pineapple, guava, amla and banana are highly preferred. Whereas vegetables are not preferred by the majority of the subjects.

Only forty per cent of the subjects stated "liked very much" for amaranth, fifty seven per cent and forty six per cent stated "like very much" for cucumber and carrot respectively. The analysis of the present study shows that majority of the respondents did not show high preference towards leafy vegetables, other vegetables as well as roots and tubers.

Similar results were furnished in other studies which state the adolescents show least preference for vegetables and low preference for fruits when compared to other food groups (Carter, 2002; Kirby et al., 1995; Cullen et al., 2001; St-Onge, 2003; Nolan, 2005; Jones, 2008). Several studies show that taste preference along with cost and availability are found to be related to fruit and vegetable intake of adolescence.

Increasing evidence suggests that dietary patterns and preferences are established in childhood and adolescence (Kirby et al., 1995; Carter, 2002; Lien et al., 2001). There is a great concern that the food preferences of adolescents are putting them at risk for developing chronic diseases (Lien et al., 2001 and Munoz et al., 1997).

It is during this developmental phase, negative dietary habits and preferences can become the foundation of lifestyle in later years (Beech et al., 1999). It is therefore important for adolescents to develop healthy eating habits and preference towards fruits and vegetables, which will benefit them long term.

Another study by Cullen et al., (2000) found that most of the children preferred starches over vegetables and most reported that they ate out for dinner at least twice a week.

5.3 GENERAL HEALTH STATUS

5.3.1 Anthropometry

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 measurement viz, height and weight were taken in to account for assessing the nutritional status of the subjects.

The table 18 shows that, only six per cent of the 10 and 11 years old boys has normal weight. But in case of girls, only one per cent of 10 year old girl has normal weight and all 11 years girls are below the standard weight. Nineteen per cent of 12 years old boys are below standard weight and height and twelve per cent of girls are also below standard weight and height.

Twelve per cent of the 10 year old boys and seven per cent girls are of normal height. Only five per cent of the 11 years old boys and three per cent girls are of normal height.

Several studies have shown that growth pattern among well nourished Indian children of higher socio-economic group are comparable to western reference standard such as that of NCHS. Besides, India being a vast country with varied culture and diet habits, the standard developed in one state may not be applicable in another state. So this NCHS standard and standard developed for an affluent child is used generally for comparison (Ghosh, 1992).

However, when assessed by the Eliza Health Path for Adolescents (EHPA) designed by Child Development Centre, a different picture is obtained. It is found
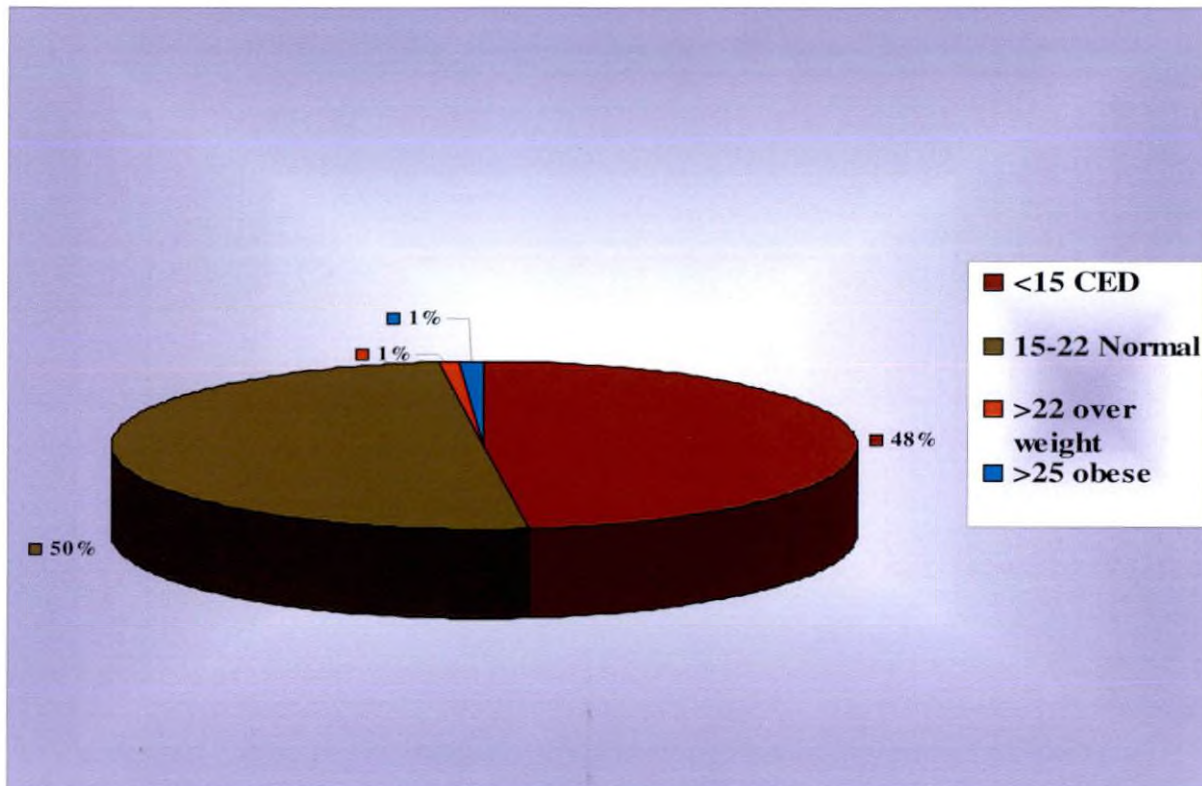
Figure: 4 Distribution of subjects based on their BMI

that fifty per cent of the subjects under study are normal, whose BMI level is between 15-22 kg/m^2. Whereas forty eight per cent are chronic energy deficit, only one per cent is overweight and one per cent is obese (fig. 4).

The prevalence of overweight was found only in one per cent of the participants. In a study done by Ramachandran (2002) on 13-18 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. The prevalence of under nutrition was found to be forty eight per cent. Whereas only one per cent was found to be obese in the present study.

5.3.2 Clinical examination

The results depicts that subjects exhibited micronutrient deficiency and it could be because of inadequate intake of fruits and vegetables.

In the present study, it was seen that anaemia is the most common nutritional deficiency symptom. The similar report was also given by Reshmi (2007) in Trivandrum district shows that twenty nine per cent of the subjects were anaemic. Other clinical symptoms like pigmentation and dental caries, emaciation was found in fourteen per cent.

The deficiency symptoms shown by the subjects may be due to the inadequate and unbalanced diet with low intake of fruits and vegetables which led to micronutrients deficiency that may result in deficiency symptoms and poor work efficiency.

5.3.3 Morbidity pattern

Assessment of morbidity of the subjects in the present study during the past six months revealed that majority subjects reported cold, head ache and fever. These

morbidities are associated with one another and the occurrence of one leads to another. Vision disorders were reported among seven per cent of the subjects. The reason for vision disorder may be due to the low consumption of green leafy vegetables. Chest infection associated with fever, cold and cough was also reported. Fatigue was also reported. It may be noted that fatigue is associated with anaemia and in this study majority of the subjects were anaemic. Morbidity pattern indicated that about forty eight per cent did not show any ailments.

5.4 LEVEL OF PARTICIPATION OF THE SUBJECTS IN THE NUTRITION INTERVENTION PROGRAMME

The mean participation index was taken to classify the subjects as those having high participation, medium participation and low participation. The results revealed that seventy four per cent of the subjects had medium participation index, fifteen per cent had high participation index and eleven per cent had low participation index.

Ukkuru (1993) through her study on the participation of beneficiaries in the ICDS programme in Malappuram found that only sixty three per cent of the respondents regularly participated in the nutrition and health education classes.

A study conducted by Bhuvaneshwari (2007) in Trivandrum district, the participation index of the beneficiaries in the programme related activities of PHC revealed that fifty eight per cent had medium level of participation index, twenty six per cent had high level of participation index and sixteen per cent had low level of participation index. The result is almost similar in the present study.

Since the subjects were of the age group of 10 -12 years, it was necessary to constantly motivate the children to participate in the nutrition intervention

programme. Gardening activities and games were more interesting for the children when compared to the nutrition education session.

5.4.1 Correlation between knowledge score of the subjects with participation index

A positive association of participation index of the subjects with knowledge score was found in the present study. Bhuvaneshwari (2007) also found similar results, the participation index of the beneficiaries in the programme related activities of PHC.

5.5 IMPACT EVALUATION OF NUTRITION INTERVENTION

The analysis of the present study reveals that majority of the selected subjects reported low consumption of fruits and vegetables. The subjects also showed low preference for vegetables. On assessing the anthropometric and clinical examination it was also clear that the twenty nine per cent of the subjects were anaemic and fifty four per cent had micro deficiency diseases.

The nutrition intervention was designed including nutrition education using multimedia tools, gardening, providing hands on activities through the actual growing and harvesting of fruits and vegetables followed by nutrition games.

Ideally the summative evaluation is meant to show whether or not there is a change in fruit and vegetable consumption in the subjects after participating in the nutrition intervention programme.

5.5.1 Frequency of use of fruit and vegetable

The result shows that the frequency of use of fruit and vegetable of the subjects who participated in the nutrition intervention increased significantly in the present study. After the nutrition intervention proramme the most frequently used vegetables and fruits were beet root, cabbage, carrot, cucumber, curry leaves, drumstick, ladies finger, onion, potato, tapioca, tomato, yam, amla, banana, mango and guava (fig. 5a , 5b & 6.). Similar studies of (Lineberger and Zajicek, 2000; Genzer et al., 2001; Nolan, 2005) also shows that students who participated in nutrition intervention with gardening improved their frequency of fruits and vegetables.

5.5.2 Fruit and vegetable consumption pattern of the subjects

After the intervention programme, the fruit and vegetable consumption of the subjects was assessed once again by conducting diet survey. Change in fruit and vegetable consumption pattern of the subjects was observed after the intervention programme. After the intervention, the fruit and vegetable consumption pattern of the subjects were increased along with their daily diet.

The results of the present study shows an increase in the actual fruit and vegetable consumption after nutrition intervention may be due to the increase in the nutrition knowledge and preferences.

The nutrition knowledge and preference when increased in the subjects would have given them an insight in the consumption pattern. The awareness of the change required in the consumption pattern by the subjects after participating in the nutrition intervention would be the reason for the results observed in the present study.
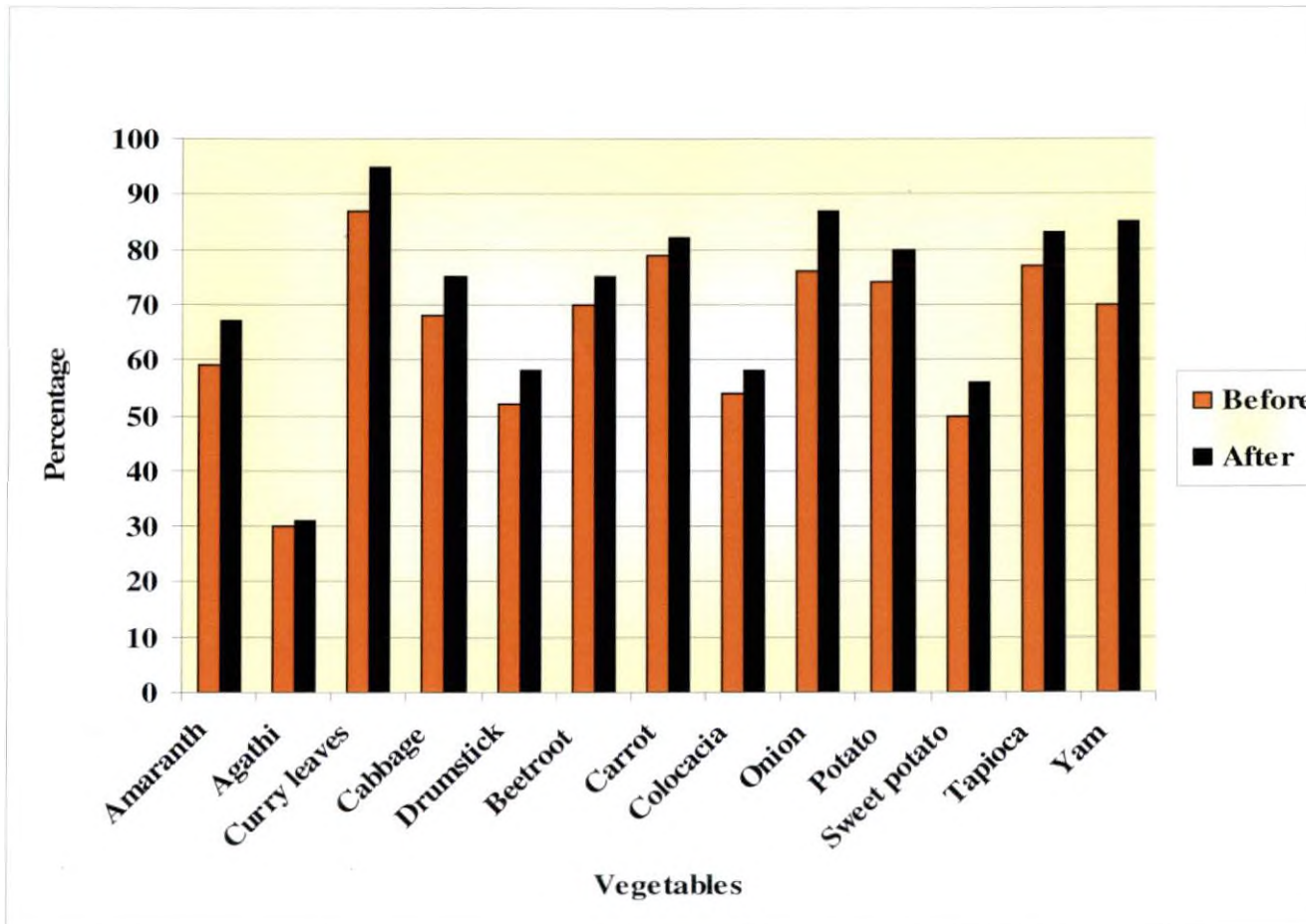
Figure: 5 a. Frequency use of vegetables before and after the intervention by the subjects
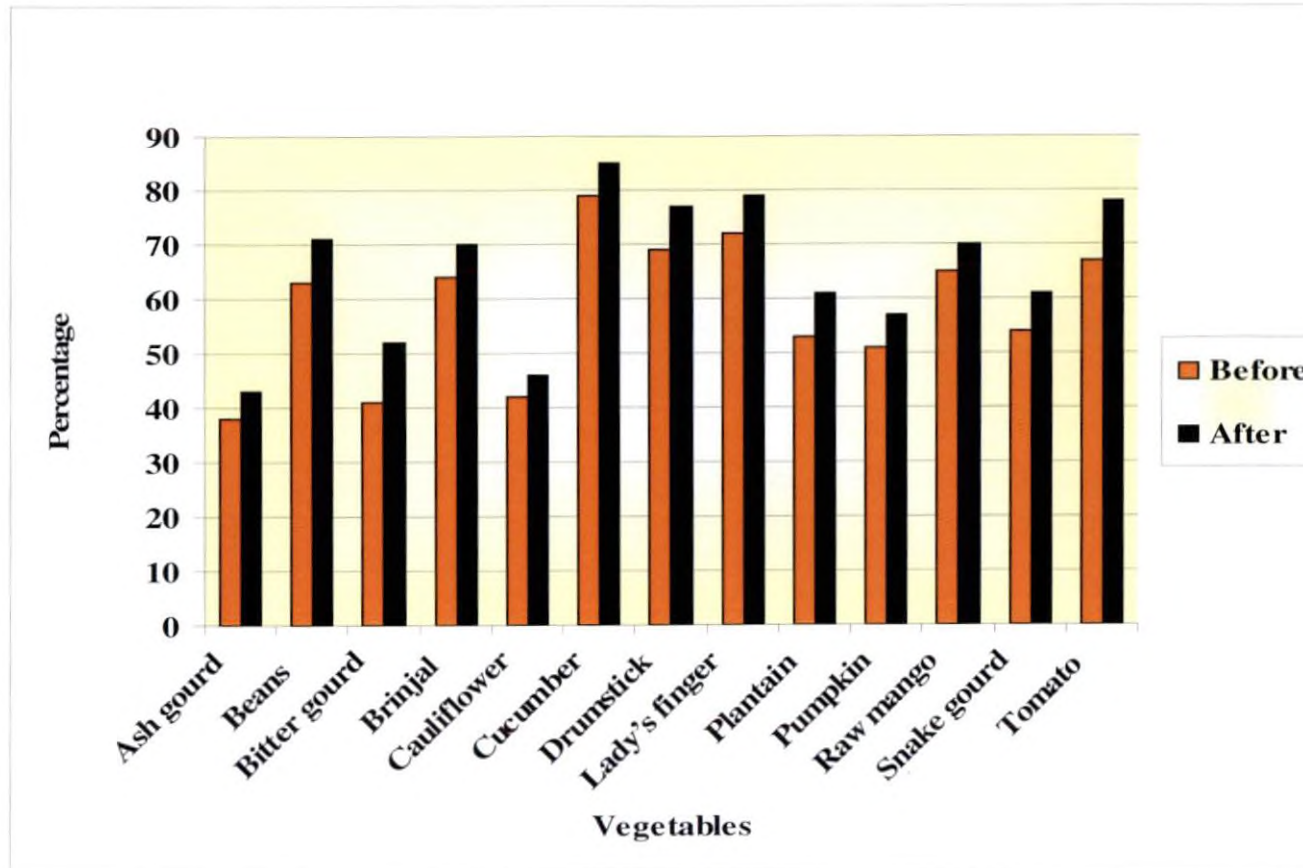
Figure: 5 b. Frequency use of vegetables before and after the intervention by the subjects
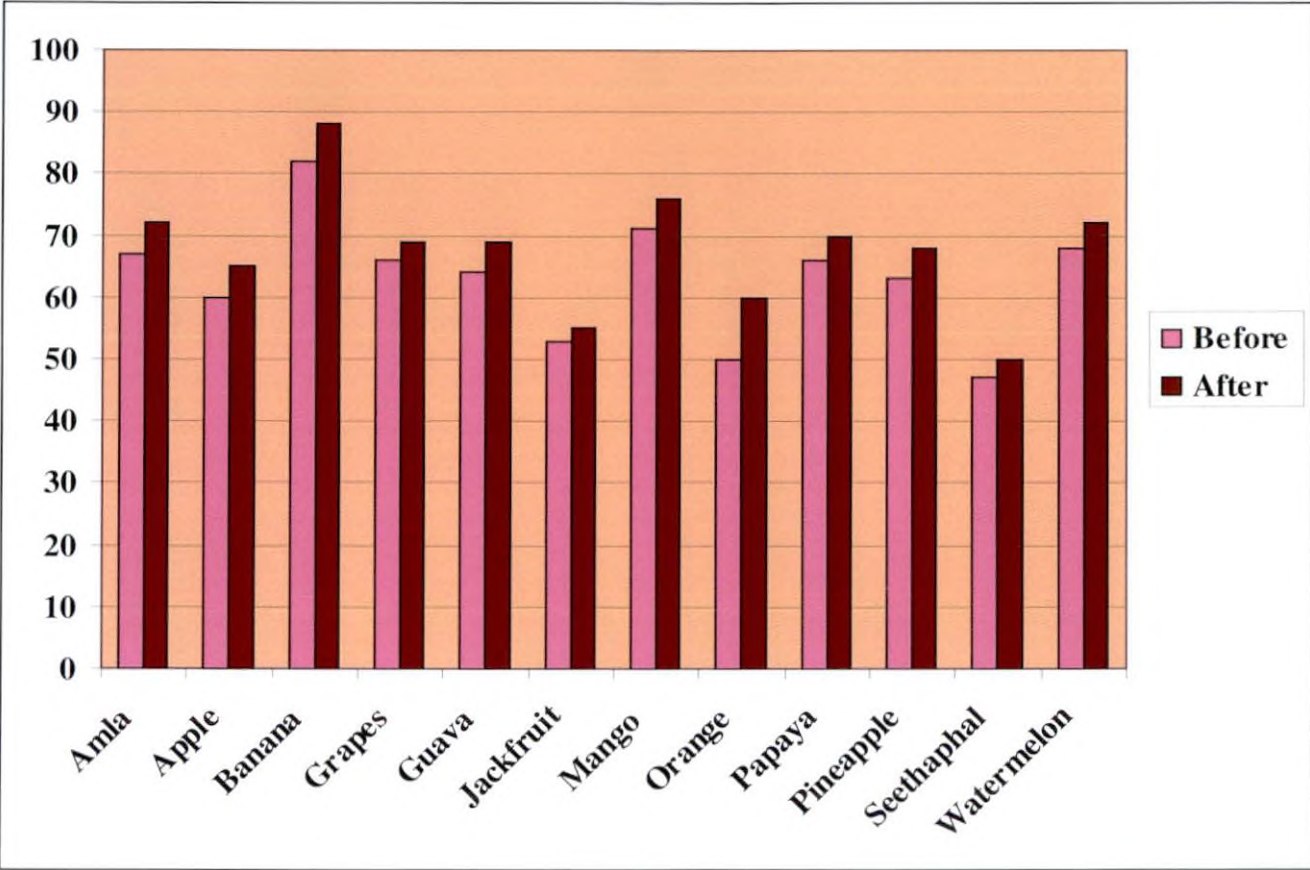
Figure: 6 Frequency use of fruits before and after the intervention by the subjects

The present results agree with other similar studies done by McAleese and Rankin (2007) which states that nutrition gardening increases fruit and vegetable consumption as well as increase healthy snack consumption.

5.5.3 Food preference of the subjects

The results shows that the fruit and vegetable preference score of the subjects who participated in the nutrition intervention increased significantly in the present study. There have been mixed findings. There was an increase in preference score for amaranth, cucumber, carrot, amla, apple, banana, grapes, guava, mango, orange, papaya, pineapple, and tomato ripe. Fruits and vegetables like drumstick leaves, cabbage, ash gourd, lady's finger, pumpkin, cauliflower, drumstick, beet root, snake gourd, brinjal were medium preferred after the nutrition intervention by the subjects. Whereas bitter gourd remain least preferred even after the nutrition intervention (fig. 7 & 8).

An increase in preference for a fruit and vegetable has been reported after attending nutrition intervention. (Domel et al., 1993) and no change in preference after the intervention has also been found (Lineberger and Zajicek, 2000).

Nutrition education is able to increase nutritional knowledge and cause a positive attitude change towards healthy eating (Contento et al., 1992). Furthermore nutrition lesson combined with gardening, increases children's preferences for vegetables and has better long term effects on the student's vegetable preference (Morris et al., 2002).

The total nutrient and energy demands are higher in adolescence than during any other time in life cycle because of the rapid physical growth and development. During this period, adolescents tend to search for independence, from their own life style and individualism in food choice (Story & Renick, 1986)
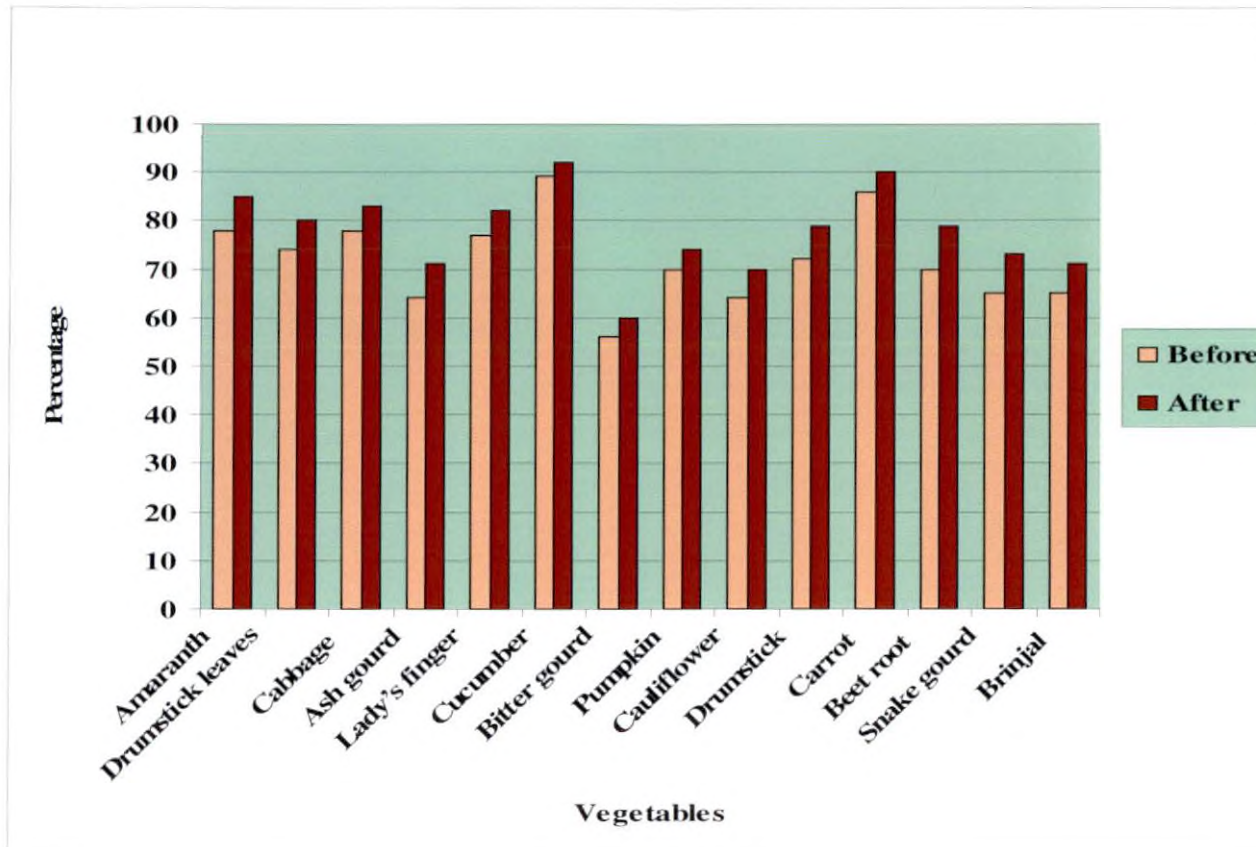
Figure: 7 Preference score of the subjects for vegetables before and after the intervention
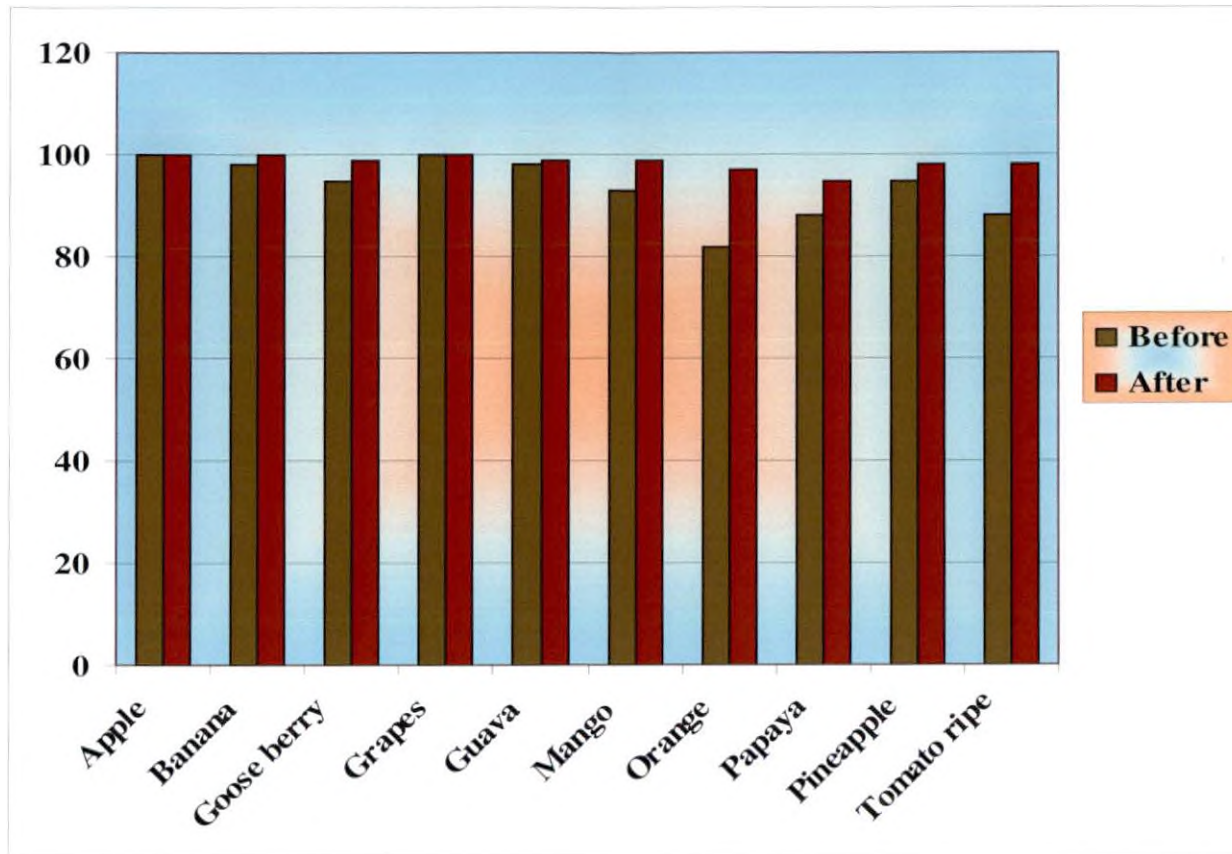
Figure: 8 Preference score of the subjects for fruits before and after the intervention

The present study shows that the subjects showed a positive change in their preference towards fruits and vegetables. Preference for and positive attitudes about fruits and vegetables have been major predictors of fruit and vegetable consumption (Domel et al., 1993; Resnicow et al., 1997; Cullen et al., 2000), therefore it is important to increase the preference towards fruit and vegetable, to increase the consumption.

Garden based nutrition interventions have many benefits in the realm of nutrition education especially in increasing nutrition knowledge and preference towards fruits and vegetables. Several studies found changes in attitudes and an increased willingness to taste vegetables (Cason, 1999; Morris et al., 2002; Morris & Zidenberg-Cherr, 2002) after garden based nutrition intervention.

Research shows that increasing exposure of foods, affects preference scores for that food in a positive direction (Frost, 2006; Cooke, 2007; Wardle et al., 2003). When gardening is included in the nutrition intervention programmes, it gives an opportunity for the participants to get exposed to the fruits and vegetables, enjoy the growing and harvesting activities. This can be the reason for the positive change found in the preference towards fruits and vegetables by the subjects after the intervention

Nutrition games also were prepared to bring the participants more closely to the fruits and vegetables. The games might also have shown its impact on the positive change towards fruits and vegetables by the subjects.

5.5.4 Nutrition knowledge

A knowledge test was administered to the subjects before and after the intervention to measure if there is any increase in their knowledge level of fruit and vegetable. The results of the present study indicate that after the subjects participated in the nutrition intervention, their nutrition knowledge increased. This may be because of the effectiveness of intervention programme. Moreover the subjects were exposed to multimedia education programme like a power point presentation and flash video which enable them to understand the matter easily as well as to understand the importance of fruits and vegetables. The intervention also included gardening and games (fig 9).

The results of the present study indicate that there is an increase in knowledge after having completed nutrition intervention and actively participating in gardening.

Several studies have shown that nutrition education and intervention increases the nutrition knowledge of the subjects (Morris et al., 2002; Razeena, 2000; McAleese and Rankin, 2007). Kumar et al. (2003) has reported that video film was an effective material for imparting nutrition education to school children which result in improving their knowledge on healthy eating habits.

The nutrition education in the present study had a two minute flash video which attracted the subjects and also sparkled motivation. It also created curiosity and interest among the subjects towards the nutrition intervention programme.

Gardening has proved to be a way to teach students the importance of fruits and vegetables (Nolan, 2005 and Jones, 2008). The present study also reveals similar results that participation in gardening and related activity increased the nutrition cognition among the subjects.
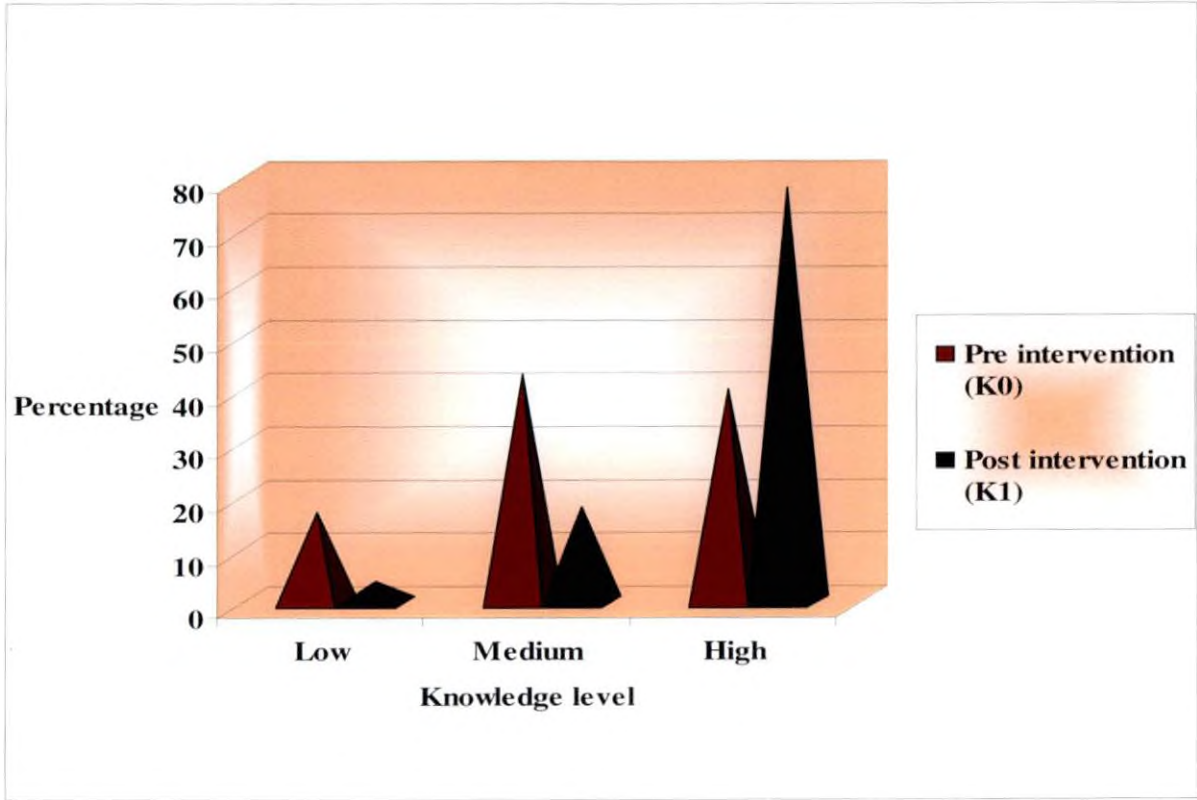
Figure: 9 Distribution of subjects based on knowledge score

5.6 KNOWLEDGE GAIN WITH REFERNCE TO PERSONAL AND SOCIO - ECONOMIC VARIABLES

In the present study it can be seen that the religion and family income had significant change in the gain knowledge of the subjects. Religion wise mainly in Muslims (5.39**) at one percent level and the income level in upper low income families (2.50*) at five per cent level. Other variables like family type, family size, and education status of family members did not show any significant change with the knowledge of the subject.

5.7 FRUIT AND VEGETABLE CONSUMPTION PATTERN WITH REFERNCE TO PERSONAL AND SOCIO - ECONOMIC VARIABLES

The descriptive statistics of biographical variables and its influence in the impact of nutrition intervention was studied in this intervention.

The results indicates that subjects whose fathers with education status up to high school level showed remarkable significant changes in the fruit and vegetable consumption pattern after attending the nutrition intervention. Similarly subjects hailing from upper middle income group showed significant changes in the fruit and vegetable consumption after the nutrition intervention.

Other variables like religion, family type and family size did not show any influence on the change in the fruit and vegetable consumption of the subjects after attending the nutrition intervention programme.

Socio economic status remains a persistent and pervasive predictor of variations in health outcomes. Often fruits and vegetables are not available in the home of low income children (Kirby et al., 1995, Baranowski et al., 2000, Cullen et al., 2003) and as a result, low income population have lower levels of fruit and

vegetable consumption compared to higher income population (Treiman, 1996). Fruits and vegetables are often though of as too expensive in the low socio economic status groups.

A study conducted by Rahman and Rao (2000) found that although the mothers had positive perception of fruits they said they were too expensive, hard to select and difficult to store and these were the reasons, they did not purchase fruits for their families often. They also considered vegetables to be healthy but felt that vegetables were difficult to prepare and they were not well liked by their family members.

Research by Morton and Guthrice (1999) found similar results, that low income respondents with children reported that the only purchase is usually the child's favorite fruit or vegetable.

The present study shows that children coming from upper middle income group were subjected to fruit and vegetable consumption pattern change. Children hailing from lower income group did not show any change. Therefore nutrition awareness has to reach the parents to bring a change in the children's fruit and vegetable consumption pattern. Due to time constraint the present study did not involve the parents in the nutrition intervention programme.

Similarly education levels of the parents also have an inverse affect in the fruit and vegetable consumption. Several studies have shown that children with history of malnutrition are usually born into families with the lowest level of income and with the lowest level of education.

Socio economic factors have an important influence on fruit and vegetable intake and, as these are subject to intervention they can contribute to the adoption of healthy eating habits.

Socio economic status based on parental education and employment status has been demonstrated to influence adolescent fruit and vegetable consumption (Johansson et al., 1999). Several studies have reported low socio economic status as a predictor of low fruit and vegetable consumption. Roos et al. (2001) revealed positive associations between house hold education level and the daily consumption of raw vegetables. Consumption of raw vegetables daily was reported by those with a higher house hold educational level than by those with a lower educational level.

Summary

6. SUMMARY

This chapter contains a summary of chapter 1 through 5 and will include with recommendations for future practice and research.

The present study entitled "Promoting fruit and vegetable consumption among school children through nutrition intervention programme" was conducted with an objective to promote fruit and vegetable consumption among pre-adolescent school children in the age group of 10 – 12 years through nutrition intervention.

The nutrition intervention included nutrition education using multimedia tools, nutrition gardening and games. The purpose of the study was also to evaluate the impact of the intervention in fruit and vegetable preference, knowledge and consumption of the subjects who participated in the intervention.

This research was conducted with students of pre - adolescent children in the age group of 10- 12 years. The subjects were selected using purposive sampling from Government U.P.S Ambalathara and Government Model Higher Secondary School Venganoor of Thiruvananthapuram District.

Tools were constructed to ascertain the demographic information's, food consumption pattern, assessment of general health status, attitude towards fruits and vegetables, preference towards fruits and vegetables, knowledge towards fruits and vegetables and fruits and vegetable consumption pattern. The tools were subjected to reliability and validity tests before the study.

The majority of the subjects (50 per cent) belonged to Hindu community, nuclear family (74 per cent) and middle born (43 per cent). Majority of the parents

(68 per cent) of the subjects were educated up to high school level. When the employment status of the parents of the subjects were analysed, fathers of the majority of the subjects (64 per cent) were found to be casual labours and mothers were unemployed. Majority of the subjects belonged to lower middle income group with monthly income in the range of Rs. 3501- 4500.

The present study was carried out in three sessions, the first session was pre test, done, before the intervention, the second session was during the intervention and third session was the post test after the intervention. Pre test was administered in September 2009, the nutrition intervention was carried from November 2009 till may 2010, and post test was administered in June 2010.

All the subjects in the present study were reported to be habitual non vegetarians.

Data shows that even low cost and locally available leafy vegetable like amaranth, drumstick leaves and cabbage were not consumed daily by the majority of the subjects. Consumption of roots and tubers, as well as other vegetables were also reported to be less by majority of the subjects. This may be due to lack of awareness of the importance of fruits and vegetables in the diet. Cost of fruit and vegetable may also be a factor contributing to this, hence cultivation of fruits and vegetables at house or school is required.

Frequency of fruit consumption of the subjects was also found to be low in the present study. Banana was the only fruit that was daily consumed by the subjects. Fifty one per cent of the subjects reported that they consumed banana daily, this may be due to the availability and low cost. Papaya, guava, jack fruit, mango, pineapple, and amla are locally available.

The results of the present study reveals that subjects showed preference to food rich in sugar and fat compared to that of fruits and vegetables. The hundred per cent of subjects reported that they "liked very much" apples and grapes. Seventy six per cent of the subjects reported that they "liked very much" pineapple. The analysis shows that fruits like apple, grapes, pineapple, guava, amla and banana are highly preferred. Majority of the subjects did not show high preference towards leafy vegetables, other vegetables as well as roots and tubers.

Assessment of general health status of the subject in this study was done using anthropometry, clinical examination and morbidity pattern.

Height and weight of the subjects in the present study were measured, only six per cent of the 10 and 11 years old boys has normal weight. But in case of girls, only one per cent of 10 year old girl has normal weight and all 11 years old girls are below the standard weight.

Nineteen per cent of 12 years boys are below standard weight and height and twelve per cent of girls are also below standard weight and height. Twelve per cent of the 10 year old boys and seven per cent girls are of normal height. Only five per cent of the 11 years old boys and three per cent girls are of normal height.

However, when assessed by the Eliza Health Path for Adolescents (EHPA) designed by Child Development Centre, a different picture is obtained. It is found that 50 per cent of the subjects under study are normal, whose BMI level is between 15-22 kg/m^2. Whereas forty eight per cent are chronic energy deficit, only one per cent is overweight and one per cent is obese.

Clinical examination of the subjects revealed that anaemia is common among twenty nine per cent. And other clinical symptoms are dental caries, pigmentation, emaciation are to be found.

Morbidity pattern of the subjects were assessed to know the occurrence of disease during past six months, indicated that minor ailments like cold, head ache, cough and fever were reported among the subjects. Vision disorder was also reported by a small percentage of the subjects (seven per cent) and forty eight per cent of them did not show any ailments.

The mean participation index was taken to classify the subjects as those having high participation, medium participation and low participation. The results revealed that seventy four per cent of the subjects had medium participation index, fifteen per cent had high participation index. And positive associations of participation index of the subjects with knowledge score were also found.

Ideally the summative evaluation is meant to show whether or not there is a change in fruit and vegetable consumption in the subjects after participating in the nutrition intervention programme. The result shows that the frequency of use of fruit and vegetable of the subjects who participated in the nutrition intervention significantly increased. Considering these facts the results of the present study which depicts an increase in the fruit and vegetable consumption after nutrition intervention may be due to the increase in the nutrition cognition, knowledge and preferences.

There is an increase in knowledge after having completed nutrition intervention and actively participating in gardening. The intervention programme had significant effect on the gain in knowledge as well as change in preference score for fruits and vegetables.

RECOMMENDATION FOR PRACTICE

The significant improvement for nutritional knowledge scores, fruit and vegetable preference score as well as fruit and vegetable consumption among the subjects indicate that the nutrition intervention using multimedia tools, combined with active participation in gardening can be used to influence pre adolescent's preferences and consumption regarding fruits and vegetables and improve their knowledge about nutrition.

It is recommended that nutrition education combined with gardening when implemented in a school programme should involve student's parents. Parental involvement could include gardening with the child or giving fliers that include recipes and tips about how to consume more fruits and vegetables in a daily basis with nutritional facts. This information would help inform parents of what their child is learning in school, giving parents the opportunity to reinforce the information at home.

RECOMMENDATION FOR RESEARCH

This research concentrated on assessing the participant's nutritional knowledge consumption and preference for fruits and vegetables. It did not measure nutritional behavior. Repetition of this study using different evaluation tools that include behaviour should be conducted. Examples of possible ways to measure changes in behaviour might include having the student actually choose a snack, telling the student they have ten rupees and ask them what they would buy with that ten rupees.

In addition, repetition of the study should be conducted using students of different ages and populations. These may include kinder garden and first grade students, juniour high, and/or high school aged students. Future research could also look at different socio-economic status populations to determine how a gardening curriculum would affect their nutritional knowledge, attitudes and behaviour.

References

7. REFERENCE

Alexander, J., North, M., and Hendren, D.1995. Master gardener classroom garden project: An evaluation of the benefits to children. Children's Environments. 12 (2): 123-133

Ard, J. D., Fitzpatrick, S., Desmoad, R. A., Sutton, B. S., Pisu, M., and Allison, D. B. 2007. The impact of cost on the availability of fruits and vegetables in the homes of school children in Birmingham, Alabama. Am. J. Public Health. 97 (2): 367-372

Armstrong, D. 2000. A survey of community gardens in upstate New York: implications for health promotion and community development. Health Place. 6 (4): 319 – 327

Ashley, A., Andrew, R. G., Timathy, B., David, A. and Allan, H. 1992. Nutritional intake, height and weight of 1-2 years old Northumbrion children in 1990 compared with information obtained in 1980. Br. J. Nutr. 68: 543 – 563

Bamji, M. S. Rao, P. N. and Reddy, V. 2003. Text book on human nutrition. Second edition. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, p: 507

Baranowski, T., Davis, M., Resnicow, K., Baranowski, J., Doyle, C., and Lin, L. 1993. Gimme 5 fruit, juice, and vegetables for fun and health: Out Came Evaluation. Health Educ. Behav. 27: 96- 111

Bavedhkar, A., Yajnik, C. S., Cardine, H. D., Bapat, S., Paudit, A., and Desspande, V. 1999. Insulin resistance syndrome in a year-old Indian Children – Small at birth, big at 8 years or both. Diabetes. 48: 2422 – 2429

Baxter, S.D., Thomson, W.O. and Davis, H.C. 2000. Fourth grade children have observed consumption of preference for school lunch foods. Nutr. Res. 20: 439-443

Bazzano, L., He, J., Ogden, L., Loria, C., Vupputuri, S., Myers, L., and Whetton, P. 2002. Fruit and vegetable intake and risk, of cardiovascular disease in U.S. adult; The first National Health and Nutrition Examination Survey Epidemiologic Follow-up Study. Am. J. Clin. Nutr. 76: 93-99

Beatrice, P. J. 1999. Nutritional adequacy of diets in selected hostel messes. M.Sc (FS&N) thesis. Kerala Agricultural University, Thrissur

Befort, C., Kaur, H., Nollen, N., Sullivan, D. K., Nazir, N., and Choi, W. S. 2006. Fruit, vegetable and fat intake among non – Hispanic black and non- Hispanic white adolescents: associations with home availability and food consumption settings. J. Am. Diet. Assoc. 106(3): 367-373

Belton, T. 2003. Exploring Attitude to eating fruits and vegetables in food, science and society. Exploring the gap between expert advice and individual behaviour. P: 126

Bhuvaneshwari, P. 2007. Nutritional awareness among the participants of national nutritional anaemia prophylaxis programme. Msc. (FS&N) thesis, Keala Agricultural University, Thrissur.

Blair, D., Giesecke, C. C., and Sherman, S. 1991. A dietary, social and economic evaluation of the Philadelphia Urban Gardening Project. J. Nutr. Edu. 23 (4): 161-167

Blanchette, L and Brug, J. 2005. Determinants of fruit and vegetable consumption among 6-12 year- old children and effective interventions to increase consumption. J. Hum.Nutr. Dietet. 18: 431-443

Blumenthal, S. J., Hendi, J. M., Marsillo, L. 2002. A Public Health Approach to Decreasing Obesity. JAMA. 288: 2178

Brown, J. L. 2002. The consequences of hunger and food insecurity for children. Evidence from recent scientific studies. Centre on Hunges and Poverty, Heller School for Social policy and management, Brandcis University. 1-12

Bull, N. L. 1988. Studies of the dietary habits, food consumption and intakes of adolescents and young adults. World Review of Nutrition and dietetics. 57: 54-74

Carter, R. C. 2002. The impact of Public Schools on childhood obesity. J. Am. Med. Assoc. 288: 2180

Cason, K. L. 1999. Children are "Growing Healthy" in South Carolina. J. Nutr. Edu. 31: 235

Census Report. 2001. Government of India, population project, Statistics for planning, p: 118

Chandran, S. 2001. Learning disabilities in malnourished children. M.Sc. thesis Kerala Agricultural University, Thrissur. p: 204

Choudhary, M., and Solanki, H. 1999. Body Mass Index (BMI) an indicator of energy store and body proportions in female labourer. Dairying Fd. Home Science. 18(2):109 - 112

Cicil, M. J. 2000. Impact of Nutrition Education on Mushroom Consumption. M.Sc. thesis Kerala Agricultural University, Thrissur. p: 175

Contento, I. R., Manning, A., and Shannon, B. 1992. Resarch perspective on school based nutrition education. J. Nutr. Edu. 24: 247-260

Cooke, L. 2007. The importance of exposure for healthy eating in childhood: A Review. J. Hum. Nutr. Diet. 20: 294- 301

Cullen, K. W., Baranowski, T., Owens, E., Marsh, T., Rittenberry, L., and De Moor, C. 2003. Availability, accessibility, and preference for fruit, 100 per cent fruit juice, and vegetables influence children's dietary behaviour. Health Educ. Behav. 30 (5): 615-626

Cullen, K.W., Baranowski, T., Owens, E., De Moor, C., Rittenberry, L., Olvera, N., and Resnicow, K. 2002. Ethnic differences in social correlates of diet. Health Education Research. 17: 7-18

Cullen, K.W., Baranowski, T., Rittenberry, L., Cosart, C., Herbert, D. and De Moor, C. 2001. Child-reported family and pees influences on fruit, juice and vegetable consumption: Reliability and validity measures. Health Education Research. 16 (2): 187-200

Cullen, K.W., Baranowski, T., Rittenberry, L., Cosart, C., Ownes, E.., Herbert, D., and De Moor, C. 2000. Socio environmental Influences on children's fruit, juice and vegetable consumption as reported by parents. Reliability and validity of measures. Public Health Nutr. 3: 345-456

Dittus, K. L., Hillers, V. N., and Beerman, K. A. 1995. Benefits and barriers to fruit and vegetable intake: Relationship between attitudes and consumption. J. Nutr. Edu. 27 (3): 120-126

Djousse, L. D., Arnett, H., Coon, M., Provilce, L, Moore and Cellisol. 2004. Fruit and vegetable consumption and LDL cholesterol: The National Heart, Lung, and Blood Institute Family Heart Study. Am. J. Clin. Nutr. 79: 213-217

Domel, S. B., and Thompson, W. O. 2002. Fourth- grade children's consumption of fruit and vegetable items available as part of school lunches in closely related to preferences. J. Nutr. Edu. Behav. 34: 166-171

Domel, S. B., Baranowski, T., Davis, H., Leonard, S., Riley, P., and Baranowski, J. 1993. Measuring fruit and vegetable preferences among 4th and 5th – grade students. Preventative medicine. 22: 866-879

Eapen, M., Chattopadhyay, S. and Elamon, J. 2000. Development perspective. First step in formulation of district plan. People's plan campaign. State Planning Board, Kerala. p: 492

Edge, R., McGravy, P. J. and Truscoh, T. G. 1997. The carotinoids as antioxidants. A review. J. Photochem. Photobio. 141:189- 200

Eggert, L.L .1984. Psychological development in adolescence. Nutrition in Adolescence. Times Mirror / Mosky College Publication. p: 23

Elizabeth, K. E. 2001. Adolescent Nutrition. Teens. J. Teenage care pre- marital counseling. 1:1-5

Elizabeth, K. E. 2005. Nutrition and Child Development Paras. Medical Publishers. Hyderabad.

Epstestin, L. H., Gordy, C. C., Daynor, H. A., Beddonr, M., Kilanowski, C. K., Paluch, R. 2001. Increasing fruit and vegetable intake and decreasing fat and sugar intake in families at risk for childhood obesity. Obese Res. 9: 171-178

Ferris, J., Norman, C., and Sempik, J. 2001. People, land and sustainability: community garden and the social dimension of sustainable development. Social Policy and Administration. 35 (5): 559-568

Frost, B. M. 2006. Liking and exposure: First, Second and Tenth Time Around. Physiology and Behavior, 89:47-52

Ganry, J. 2007. Fruits and vegetables for healthy diet in developing countries. Acta Hort. 744: 55-60

Genzer, S., Seagraves, R., Whittlesey, L., Robinson, C.W., and Koch, S. 2001. Junior Master Gardenersm. Level I Golden Ray – Health and Nutrition from the garden Newman Publishing; Bryan, TX.

Ghosh, S. 1992. The feeding and care of infants and young children. Voluntary health association of India. J. Hum. Nutr. Dietet. New Delhi, p: 215

Gift, H. H., Washbon, M. B., and Haronson, G. G. 1972. Nutrition in adolescence, nutrition, behaviour and change. Englowood Cliffs, N. J. Prentice Hall, London, p: 155

Granner, M.L., Sargent, R. G., Calderon , K. S., Hussey, J.R., Evans, A. E., and Watkins, K.W. 2004. Factors of fruit and vegetable intake by race, gender and age among young adolescents. J. Nutr. Edu. Behav. 36(4): 173-180

Grunbaum, J. A., Kann, L., Kinchen, S., Ross, J., Hawkins, J. G., Lowry, R., Harris, W. A., McManus, T., Chyen, D., Collins, J. 2004. Youth risk behavior surveillance--United States, 2003. Morbidity and Mortality Weekly Review, 53(2): 1-29

Howison, D., Niedermyer, F., and Shortridge, R. 1988. Field testing a fifth grade nutrition education programme designed to change food. Selection behaviour. J. Nutr. Edu. 20: 82-86

Humulka, J., Sengar, G. A. and Witkowska, K. 2000. Frequency of intake and energy value of breakfast for students selected from primary schools in Warsaw. Rocz Panstaw Zaki Hig. 51: 279-290

Hursti, U. K.1999. Factors influencing children's food choice. Annuals of medicine. 31: 26 – 32

IARC (International Agency for Research on Cancer). 2003. IARC hand books of cancer prevention Vol. 8. Fruit and vegetables, Lyon. France, IARC, press.

ICMR. 2002. ICMR Bulletin, Indian Council of Medical Research. New Delhi. p: 24

Johansson, L., Thelle, D. S., Solvoll, K., Bjorneboe, G and Drevon, C. A., 1999. Healthy dietary habits in relation to social determinants and lifestyle factors. Br. J. Nutr. 81: 211–220

Jones, K. I. 2008. Gardening and Nutrition. A systems approach to an Intervention and Evaluation Master of Public Health (MPH), University of Pittsburgh.

Kalpana, C. A., and Lakshmi, U. K., 2009 Nutritional profile of selected over weight and obese school going children of Coimbatore City. Ind. J. Nutr. Diet. 46(13): 91-99

Kerala Statistical Institute 2001. Socio-economic change in Kerala. A study based on selected localities. Thiruvananthapuram.

Kirby, S. D., Baranowski, T., Reynolds, K. D., Taylor, G., and Brinkley, D. 1995. Children,s fruit and vegetable intake: Socioeconomic, adult-child, regional, and urban-rural influences. J. Nutr. Educ. 27: 261-271

Koch, S., Waliczek, T. M., and Zajick, J. M. 2006. The effect of a summer garden program on the nutritional knowledge, attitudes and behaviors of children. Hort. Tech. 16(4): 620-625

Krishnaroopa. 2003. Determinants of dietary profile of Higher Secondary Children M.Sc. (FS&N) thesis. Kerala Agricultural University, Thrissur.

Krishnaswamy, K. and Vijayaraghavan, K., 2000. Diet and Nutrition situation in rural India with reference to South East Asia. Nutr. Res. 40:160

Kumar, A., Gupta, S., Gupta, N., and Singh, B. B. 2003. Production and impact study of vitamin A related video film for school children. J. Nutr. Dietet. 40 (6): 225

Kumari, S. and Singh, S. 2001. Nutritional status of children (6-12 years) belonging to scheduled caste. A study is Samstipur District of Bihar. Indian J. Nutr. Dietet., 38: 428-436

Lautenschlager, L., and Smith, C. 2007. Understanding gardening and dietary habits among youth garden programme participants using the Theory of Planned Behaviour. Appetite, 49 (1): 122-130

Lawatsch, D. E. 1990. A comparision of two teaching strategies on nutrition knowledge, attitudes and food behaviour of preschool children. J. Nutr. Edu. 22: 117-123

Lien, N., Friestad, C., Klepp, K. I., 2001. Adolescents' proxy reports of parents' socioeconomic status: How valid are they. J. Epidemiol. Community Health. 55: 731–7

Lin, B., and Morrison, R. M., 2002. Higher fruit consumption linked with lower body mass index. Food Review. 25: 28-32

Lineberger, S., and Zajicek, J. M. 2000. School Garden: Can hands on teaching tool affect student's attitudes and behaviors regarding fruits and vegetables Hort. Tech. 10: 593-597

Liu, S., Manson, J., Lee. L., Cole, S., Hennekens, C., Willett, W., and Buring, J. 2000. Fruit and vegetable intake and risk of cardiovascular disease. The woman's Healthy study. Am. J. Clin. Nutr. 72: 922-928

Magarey, A, Daniels, LA and Smith, A 2001, 'Fruit and vegetable intakes of Australians aged 2–18 years: an evaluation of the 1995 National Nutrition Survey data', Australia and New Zealand J. Pub. Health. 25: 155–61

Malathi, K., 2002. Bhakshanaseelangal Nirnayakam.Arogyamasika. 12: 14 – 17

Mason, R. S. and Diamond, T. H. 2005. Vitamin D deficiency and multicultural Australia. Medi J Aust. 175: 236–7

Maynard, M., Gunnell, D., Emmett, P., Frankel, S., Smith, D. G. 2003. Fruit, vegetables, and antioxidants in childhood and risk of adult cancer: the Boyd Orr cohort. J. Epidemiol. Community Health. 57: 218-225

McAleese, J. D., and Rankin, L. L. 2007. Garden based nutrition education affects fruit and vegetable consumption in sixth. Grade adolescents. J. Am. Diet. Assoc. 107(4): 662-665

Molaison, F. E., Connell, C. L., Stuff, J. E., Yadrick, M. K., and Bogle, M. 2005. Influences on fruit and vegetable consumption by low income black American adolescents. J. Nutr. Edu. Behav. 37 (5): 246-251

Mony, E. P. 1993. Food preference and dietary habits of Adolescents among Agricultural labourers. M.Sc. thesis Kerala Agricultural University, Thrissur. p: 80

Morris, J. L., Neustadfer, I. A., and Zidenberg – Cherr. S. 2001. first- grade gardeners are more likely to taste vegetables California Agriculture, 55: 43- 46

Morris, J. L., and Zidenberg – Cherr. S. 2002 a. Garden enhanced nutrition curriculum improves fourth – grade School children's knowledge of nutrition and preferences for some vegetables. J. Am. Diet. Assoc. 102(1): 91-93

Morris. J. L., Neustadfer, I. A., and Zidenberg- Cherr. S. 2002 b. Garden enhanced nutrition curriculum improver fourth grade schools children's knowledge of nutrition preferences for some vegetables J. Am. Diet. Assoc. 102: 91-103

Morton, J. F and Guthrie, J. F. 1999. Diet related knowledge attitudes and practices of low income households with children. J. Early Education and Family Review. 6: 26-33

Munoz, K. A., Krebs-Smith, S. M., Ballard-Barbash, R., 1997 Food intake of US children and adolescents compared with recommendations. Pediatrics. 100: 323–329

Nagaraj, N. and Reddy, H.N. 1999. Indian J. Ext. Edu. 21 (4): 43-52

NCI (National Cancer Institute). 2006. Five day for better health programme: Division of Cancer control and population services, from http://dccps.nci.nib.gov/5ad-2evi.html or www.5.a.day.com, accessed May 30, 2006

NNMB.2002. Diet and Nutritional status of rural population. National Nutrition Monitoring Bureau. Technical report No.21, Hyderabad, p: 5

Nolan, G. A. 2005. The effect of Nutrition Education and Gardening on attitudes, preferences and knowledge of 2nd – 5th grades in Hidalogo Country Texus Regarding Fruits and Vegetables M.Sc. Thesis. Texas A & M University. Dept. of Horticultural Science

O'Brien, S. A., and Shoemaker, C. A. 2006. An after school gardening club to promote fruit and vegetable consumption among fourth grade students: The assessment of Social Cognitive Theory constructs. Hort. Tech. 16 (1): 25-29

O'Toole. T. P., Anderson, S., Miller, C., and Guthrie, J. 2007. Nutrition services and foods and beverages available at school: results from the School Health Policies and Programs Study 2006. J. Sch. Health. 77 (8): 500-521

Ogden, C.L. 2002. Obesity on the rise. J. Am. Med Assoc. 288: 1728-1732

Ozer, E. J. 2007. The effects of school gardens on students and schools: conceptualization and considerations for maximizing healthy development. Health Edu. Behav. 34 (6): 846-863

Park, K. 1997. Park's Text book of preventive and social medicine. M/S Banarsidas Bhanot Publiser, Jabelpur. p: 629

Rahman, M and Rao, V. 2000. Pattern of food consumption and nutrient adequacy. A case study of adults by religion. Indian J. Nutr. Dietet. 39: 292- 300

Ramachandrn, A., Snehalatha, C., Vinitha, R., Thayiil, M., Kumar, C.K., and Sheeba, L. 2002. Prevalance of overweight in urban India adolescent school children. Diab. Res. Clin. Pract. 57:185 – 190

Rao, K. V. 1996. An evaluation of relationship between nutritional status and anthropometric measurements. Am. J. Clin. Nutr. 23: 83 - 93

Rao, S.G.M., Vijayapushpam. T., Raghunatha Rao, D., and Vinod Pavarala 2007. Nutrition Education for adolescents in class room settings. Different approaches and lesson learnt, Nutrition News. Vol. 28(2): 1

Razeena, R. A. 2000 Impact of educational programmes on the health and dietary practices of the workers of sewage farm in Thiruvananthapuram Corporation. M.Sc (FS&N) thesis, Kerala Agricultural University, Thrissur, p: 80

Reaburn, J. A., Krondle, M., and Lau, D., 1979. Social determinants in Food Selection. J. Am. Dietet. Assoc. Vol. 74(6): 637 - 641

Reddy, V., Rao, N.P., Sastry, J.G. and Kashinath, K., 1993. Nutrition trends in India. Indian Council of Medical Research, Hyderabad. p: 45

Reinaerts, E., de Nooijier, J., Candel, M & de Vries, N. 2007. Explaning school children's fruit and vegetable consumption: The contribution of availability, accessibility, exposure, parental consumption and habit in addition to psychosocial factors. Appetite, 48 (2): 248-258

Reniscow, K., Baranowski, T. and Hearn, M. 1997. Social cognitive predictors of fruit and vegetable intake in children. Health Psychology. 16: 272- 276

Renjini, R., 2008. Diet, life style pattern and health profile of professionals in software industry. M.Sc. (Home Science) thesis Kerala Agricultural University, Thrissur

Reshmi, R. 2007. Age of Menarche and nutritional Status of urban School girls. M.Sc. (Home Science) thesis Kerala Agricultural University, Thrissur

Robinson, K., Arheart, K., Refsum, H., Brattstrom, L., Boers, G., Ueland, P., Rubba, P., Palma-Reis, R., Meleady, R., Daly, R., Witterman, J., & Graham, I. 1998. Low circulating folate and vitamin B6 concentrations: Risk factors for stroke, peripheral vascular disease, and coronary artery disease. Circulation, 97: 437–443

Rolls, V. J., Ello-Martin, J. A., and Tohill, B. C., 2004. What can intervention studies tell about relationship between fruit and vegetable consumption and weight management Nutr. Rev. 62:1-17

Roos, E. B., Hirvonen, T., Mikkila, V., Karvonen, S., Rimpela, M., 2001. Household educational level as a determinant of consumption of raw vegetables among male and female adolescents. Prev. Med. 33: 282–291

Schwartz, J. 1993. Regression of experimental hamster cancer by beta- carotene and alage extracts. J. Oral Marillo facial Surg. 45: 510-515

Srilakshmi, B. 2003. Nutrition Science. New Age International (P) Ltd. Publication. p: 383

St-Onge, M., Keller, K. L., and Heymsfield, S.B., 2003. Changes in childhood food – consumption patterns: A cause for concern in light of increasing body weights. Am. J. Clin. Nutr. 78: 1068-1073

Starkey, L., Johnson-Down, L., Gray-Donald, K. 2001. Food habits of Canadians: comparison of intakes in adults and adolescents to Canada's Food Guide to Healthy Eating. Can. J. Diet. Pract. Res. 62: 61–69

Story, M. and Resnick, M. D. 1986. Adolescents' views on food and nutrition. J. Nutr. Edu. 18: 188-192

Sylvestre, M. P., O'Loughlin, J., Gray – Donald, K., Hanley, J., and Paradis, G. 2007. Association between fruit and vegetable consumption in mothers and children in low income, urban neighborhoods. Health Edu. Behav. 34 (5): 723-734

Thimmayamma and Rao. 2003. Text Book of Human Nutrition. Bamji, M. S., Prahlad Rao., Vindini Reddy (eds.). Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi. p.535

Treiman, K., Freimuth, V., Damron, D., Lasswell, A., Anliker, J., Havas, S., Langenberg, P. and Feldman, R. 1996. Attitudes and behaviors related to fruits and vegetables among low income women in the WIC program. J. Nutr. Edu. 28, 149–156

Ukkuru, M. P. 1993. Nutritional status of ICDS beneficiaries. PhD. (FS&N) thesis, Kerala Agricultural University, Thrissur.

Unnithan, A.G. 2008. Contributing factors and problems associated with overweight among rural and urban School Children, Ph.D. thesis KAU, Thrissur. 140-157

Vibha and Sibal, B. 2003. Dietary perceptions and practices of Senior Secondary School boys in Delhi Schools IX Asian Congress of Nutrition. Nutrition goals for Asia, 23-27, February 2003. Nutrition foundation of India. New Delhi. Abstract :186

Wardle, J., Herrera, M. L., Cooke, L. and Gibson, E. L. 2003. Modifying children's food preferences: the effects of exposure and reward on acceptance of an unfamiliar vegetable. Eur. J. Clin. Nutr. 57(2): 341- 348

WHO, 2003. Promoting healthy life, a disturbing increase in the prevalence of overweight among adults in developing countries as diverse as India, Mexico, and Nigeria

Wiecha, J. L., Finkelstein, D., Troped, P. J. Fragala, M., and Peterson, K. E. 2006. School vending machine use and fast- food restaurant use are associated with sugar-sweetened beverage intake in youth. J. Am. Diet. Assoc. 106 (10): 1624-1630

Yamini, R. 2004. Prevalence of overweight and obesity among School and College going adolescents in rural and urban Thiruvananthapuram District, Kerala, India working paper series No.7. Achuthamenon Centre for Health Science Studies, Institute of Medical Science and Technology

Abstract

PROMOTING FRUIT AND VEGETABLE CONSUMPTION AMONG SCHOOL CHILDREN THROUGH NUTRITION INTERVENTION PROGRAMME

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Abstract of the
thesis submitted in partial fulfillment of the requirement
for the degree of

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Abstract

The over arching goals of this study was to promote the fruit and vegetable consumption among school children through nutrition intervention programme. Recent literature shows that the consumption of fruits and vegetables among school children are inadequate and the trend of junk food eating habit is increasing alarmingly. A wealth of anecdotal evidence reveals that nutrition intervention programmes with gardening effect multiple domains in the lives of the subjects.

The objective of the present study is to promote the fruit and vegetable consumption among the school children through nutrition intervention programme. It also investigates the impact of the nutrition intervention on the knowledge, preference and consumption towards fruits and vegetables.

Tools were constructed to ascertain the demographic information's, food consumption pattern, assessment of general health status, preference towards fruits and vegetables, knowledge towards fruits and vegetables and fruits and vegetable consumption pattern. The tools were subjected to reliability and validity tests before the study.

The present study was carried out in three sessions, the first session was pre test, done, before the intervention, the second session was during the intervention and third session was the post test after the intervention.

All the subjects in the present study were reported to be habitual non vegetarians. Data shows that even low cost and locally available leafy vegetable like amaranth, drumstick leave and cabbage were not consumed daily by the majority of the subjects. Consumption of roots and tubers, as well as other vegetables were also

reported to be less by majority of the subjects. Frequency of fruit consumption of the subjects was also found to be low. Banana was the only fruit that was daily consumed by the subjects. .

The results of the present study reveals that subjects showed preference to food rich in sugar and fat compared to that of fruits and vegetables. Majority of the subjects did not show high preference towards leafy vegetables, other vegetables as well as roots and tubers.

The nutrition intervention was designed including nutrition education using multimedia tools, gardening, providing hands on activities through the actual growing and harvesting of fruits and vegetables followed by nutrition games. The frequency use of fruits and vegetables of the subjects who participated in the nutrition intervention programme significantly increased.

The intervention programme had significant effect on the gain in knowledge as well as change in preference score for fruits and vegetables of the subjects who participated in the nutrition intervention. Positive associations of participation index of the subjects with knowledge score are also found. Hence it can be concluded that nutrition intervention with nutrition education, gardening and games can promote the fruit and vegetable consumption, preference and knowledge of the pre adolescent.

Appendices

APPENDIX I
KERALA AGRICULTURAL UNIVERSITY
COLLEGET OF AGRICULTURE
VELLAYANI
DEPARTMENT OF HOME SCICENCE

QUSETIONNARIE TO ELICIT THE INFORMATION ON THE SOCIO ECONOMIC AND PERSONAL PROFILE OF THE SUBJECTS

1. Name of the student   :

2. Name of school   :

3. Sex   :

4. Date of birth   :

5. Age   :

6. Religion   :   Hindu/ Muslim/ Christian

7. Type of family   :   Nuclear/ Joint/ Extended

8. Family size   :   Small/ Median/ Large

9. Ordinal position   :   First/ Middle/ Last

10. Number of siblings   :