

**Capacity Building of Rural Women on Enhancement of Family  
Nutrition and Livelihood Security through Consumption and  
Value Addition of Finger Millet (*Eleusine coracana(L.)Gaertn.*)**

by

**RASHMI R.**

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**THESIS**

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**COLLEGE OF AGRICULTURE**

**VELLAYANI, THIRUVANANTHAPURAM -695522**

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## **DECLARATION**

I, hereby declare that this thesis entitled “**Capacity Building of Rural Women on Enhancement of Family Nutrition and Livelihood Security through Consumption and Value Addition of Finger Millet (*Eleusine coracana(L.)Gaertn.*)**” is a bonafide record of research 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, associateship, fellowship or other similar title, of any other University or Society.

Vellayani,  
- -2014

**Rashmi R.**  
**(2012-16-104)**

## CERTIFICATE

Certified that the thesis entitled “**Capacity Building of Rural Women on Enhancement of Family Nutrition and Livelihood Security through Consumption and Value Addition of Finger Millet (*Eleusine coracana(L.)Gaertn.*)**” is a record of research work done independently by Mrs. Rashmi R. under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, fellowship or associateship to her.

Vellayani,

Date :

**Dr. B. Prasanna Kumari**

(Major Advisor, Advisory Committee)

Associate Professor

Department of Home Science

College of Agriculture, Vellayani.

## **CERTIFICATE**

We, the undersigned members of the advisory committee of Mrs. Rashmi, R., a candidate for the degree of **Master of Science in Home Science** with major in Food Science and Nutrition, agree that the thesis entitled “**Capacity Building of Rural Women on Enhancement of Family Nutrition and Livelihood Security through Consumption and Value Addition of Finger Millet (*Eleusine coracana(L.)Gaertn.*)**” may be submitted by Mrs. Rashmi R., in partial fulfillment of the requirement for the degree.

**Dr. B. Prasanna Kumari**

(Major Advisor, Advisory Committee)

Associate Professor

Department of Home Science

College of Agriculture, Vellayani.

**Dr. Mary Ukkuru**

(Member, Advisory Committee)

Professor and Head

Department of Home Science

College of Agriculture, Vellayani.

**Dr.B.Seema**

(Member, Advisory Committee)

Professor

Department of Agrl.Extension

College of Agriculture, Vellayani

**Dr. Rari John**

(Member, Advisory Committee)

Associate Professor

Department of Home Science

College of Agriculture, Vellayani.

EXTERNAL EXAMINER

(Name and Address)

*Dedicated To*  
*My Dear Son*  
*'Nivek'*

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## **LIST OF ABBREVIATIONS**

ATP	- Adenosine Triphosphate
BMI	- Body Mass Index
Ca	- Calcium
CDPO	- Child Development Programme Officer
ESR	- Erythrocyte Sedimentation Rate
FAO	- Food and Agriculture Organization
Fe	- Iron
g	- Gram
GI	- Glycemic Index
Hb	- Haemoglobin
ICDS	- Integrated Child Development Services
ICRISAT	- International Crops Research Institute for the Semi-Arid Tropics
IDA	- Iron Deficiency Anaemia
IEC	- Information, Education and Communication
KAP	- Knowledge, Attitude and Practices
mg	- Micro gram
MOHFW	- Ministry of Health and Family Welfare

## **LIST OF ABBREVIATIONS CONTINUED**

NABARD	- National Bank for Agriculture and Rural Development
NFHS	- National Family Health Survey
NGF	- Nerve Growth Factor
NIDDM	-Non Insulin Dependent Diabetes Mellitus
NIN	- National Institute of Nutrition
PDS	- Public Distribution System
PEM	- Protein Energy Malnutrition
RBC	-Red Blood Cells
RBI	- Ragi Bifunctional Inhibitors
ROS	- Reactive Oxygen Species
RS	- Resistant Starch
RTC	- Ready To Cook
RTE	- Ready To Eat
SHG	- Self Help Group
TLC	- Total Leucocyte Count
WHO	- World Health Organization



# *Introduction*

## 1. INTRODUCTION

Millet is the name given to a group of cereals other than wheat, rice, maize and barley. There are about 6,000 varieties of millet throughout the world with grains varying in colour from pale yellow, to gray, white, and red. The origin of millet is diverse with varieties coming from both Africa and Asia. They have been a part of the human food system from time immemorial.

According to Millet Network of India (2012), millets can be categorized into two, major millets and minor millets. Major millets are sorghum and pearl millet while, minor millets are proso millet, finger millet, foxtail millet, barnyard millet, kodo millet and little millet.

Among the different millets, finger millet is the most important and is also known as ragi, which occupies about 60 per cent of the area of cultivation in India and contributes to 70 per cent of small millet production. These crops are hardy and quite resilient to varied agro climatic adversities and play important role in marginal agriculture more common in hilly and semi-arid regions as important source of food grain as well as highly valued fodder (ICAR, 2010).

This crop can withstand severe drought conditions and can be grown throughout the year and is relatively free from pest and diseases. (ICRISAT, 1997). It constitutes a little over 25 per cent of the food grains grown in India. Post harvest management of finger millet is unproblematic, the seeds are seldom attacked by insects or moulds and combined with a longer shelf life make the finger millet an important crop in risk avoidance strategies for poorer farming communities (Yenagi *et al.*, 2010).

However, as the climate crisis intensifies, it is likely that rice and wheat will become unavailable as food security crops. With the projected increase of 2°C in temperature in the near future, wheat will disappear from the farming scene. Rice varieties which need standing water for their cultivation are the most dangerous emitters of methane, a green-house gas; as such, farming rice on the

present scale will be impossible in the near future. In such a scenario, millets will be the saviour of our food and farming systems (Swaminathan, 2010).

Nutritionally it is almost as good as or better than wheat or rice, being rich in protein and minerals. Due to a good amino acid mix in ragi, it is beneficial for tissue repair, to reduce the bad cholesterol. Of all the cereals and millets, finger millet has the highest amount of calcium, iron, magnesium and potassium.

Finger millet is essential in lowering the conditions like diabetes, blood pressure, blood cholesterol, heart diseases, wound healing and even cancer. If consumed regularly, finger millet could help in keeping malnutrition, degenerative diseases and premature aging at bay. Finger millet is also helpful in bone development, reducing body weight, osteoporosis and to treat anaemia. Green ragi is also recommended to lactating mothers in condition of lack of milk production.

Finger millet can be used in a variety of ways and is a great substitute for other grains such as rice and other starchy grains. Malting process improves the nutritive value of finger millet. Finger millet flour can be used for the preparation of weaning foods, ready to cook, beverages, breakfast items, bakery items etc and hence have important role in the local food culture.

Conserving finger millets is strategic in terms of their nutritional contribution and their role in local agro- ecosystems. In terms of nutrition finger millets is far more valuable than rice and wheat. The biggest advantage of the finger millets is that it can provide multiple securities like food, nutrition, fodder, fiber, health, livelihood and ecology. Inclusion of finger millet in the daily diet is the best solution for the malnutrition that affects a vast majority of the Indian population.

Despite many obvious advantages, there has been a systematic fall in the output of finger millets in India. There has been a decline of 47 per cent in finger millet consumption in urban India and 28 per cent in rural India for the past

decade as per the National Sample Survey (2006). Dietary surveys conducted in the Department of Home Science among the people of Kerala especially urban poor show that consumption of finger millet has been declining and cultivation of finger millet has also declined accordingly. Nutrition campaigns that pay attention to the specific behavioral goals of the intervention, target populations, communication activities and channels, message content and presentation as well as techniques for feedback and evaluation should be able to change nutrition behaviors. Hence the present study of “Capacity building of rural women on enhancement of family nutrition and livelihood security through consumption and value addition of finger millet” was attempted with the following objectives.

1. To promote consumption of finger millet among rural families to enhance their family nutrition and livelihood security through a campaign approach.
2. To assess the impact of the awareness programme through change in knowledge and attitude and increased consumption of finger millet.

# *Review of literature*

## 2. REVIEW OF LITERATURE

Literature available on different aspects related to the present study entitled “Capacity Building of Rural Women on Enhancement of Family Nutrition and Livelihood Security through Consumption and Value Addition of Finger Millet”. (*Eleusine coracana(L.)Gaertn.*) is reviewed under following headings.

2.1 Nutritive value of finger millet

2.2 Health benefits of finger millet

2.3 Processing of finger millet

2.4 Value addition of finger millet

2.5 Relevance of finger millet in family nutrition

### 2.1 NUTRITIVE VALUE OF FINGER MILLET

Nutritionally finger millet is almost as good as or better than wheat or rice. Finger millet is well comparable and even superior to many cereals in terms of mineral and micronutrient contents. Its major use as food has remained only in the area where it is cultivated and to the traditional preparations (Amadou *et al.*, 2011).

Bhatt *et al.* (2003) reported that non starch polysaccharide account for 20 to 30 per cent of the total carbohydrates in finger millet.

Finger millet is rich in antioxidants and all its varieties are gluten free, thus serving as a best alternative for people suffering from wheat allergy. The protein in finger millet has also a good number of essential amino acids which are essential for human body. The major proteins of finger millet are prolamines and glutenins and they are adequate in all the essential amino acids (Mbithi *et al.*, 2000).

Prolamin is the major fraction on finger millet protein, being 24.6 to 36.2 per cent of total protein (Lupien, 1990).

Antony and Chandra (1998) reported that 100 g of finger millet contains 99.1 mg soluble proteins.

Antony *et al.* (1996) reported that finger millet had sulphur containing amino acids equal to that of milk so it can be used as a good supplement for people who are suffering from milk allergies.

The finger millet contains important amino acids viz., isoleucine (4.4g), leucine (9.5g), methionine (3.1g) and phenyl alanine (5.2g) which are deficient in other starchy meals (Vachanth *et al.*, 2010).

Finger millet which is rich in calcium and iron has an important protein component, the amino acid methionine which makes it an important low cost ingredient for fulfilling the protein intake requirements of millions of poor who generally live on starchy staples (Singh and Raghuvanshi, 2012).

Singh and Srivastava (2006) reported that iron content of 16 finger millet varieties ranged from 3.61 mg to 5.42 mg/100g with a mean value of 4.40 mg/100g.

Finger millet is the richest source of calcium and iron. Calcium deficiency leading to bone and teeth disorder, iron deficiency leading to anemia can be overcome by introducing finger millet in our daily diet (Vijayakumari *et al.*, 2003).

Of all the cereals and millets, finger millet has the highest amount of calcium (344 mg) and potassium (408 mg) (Shobana *et al.*, 2013)

Finger millet contributes vitamins, minerals and fiber as it is consumed whole, in comparison to rice which is usually consumed after milling and polishing (Malleshi and Hadimani, 1993).

Bacher *et al.* (2013) conducted mineral and fiber characterizations for 30 samples of finger millet in Tunisia. Results of minerals analysis showed that calcium and magnesium were the most concentrated nutrients in all the studied samples followed by potassium, sodium and phosphorus. The anti nutrient factor which is present in finger millet such as phytates, tannins, phenols and enzymes inhibits the micronutrient contents especially Ca and Fe.

Phosphorus from millets is an important mineral for energy production and is an essential component of ATP- the energy store of the body (Shashi *et al.*, 2007).

## 2.2 HEALTH BENEFITS OF FINGER MILLET

Whole grains like millet may have health promoting effects equal to or even in higher amount than fruits and vegetables and have a protective effect against insulin resistance, heart diseases, diabetes, ischemic stroke, obesity, breast cancer, childhood asthma and premature death (Cade *et al.*, 2007).

The incidence of diabetes and obesity are increasing in an exponential manner globally and to combat them, food containing complex carbohydrates with higher levels of dietary fiber and health beneficial phyto chemicals has been in demand. Phytates, poly phenols and tannins contribute to antioxidant activity of the millet foods, which is an important factor in health, aging and metabolic diseases (Bravo, 1998).

A large population of children in the country is malnourished and deficient in calcium and protein. On the other hand, obesity has become a concerning health problem in India affecting 5 per cent of the country's population due to unhealthy food habits of the youth (Elizabeth, 2005).

Nowadays, there has been a renewed interest in polyphenols as "life span essentials" due to their role in maintaining body functions and health throughout the adult and later phases of life (Chandrasekara and Shahidi, 2010).



Polyphenols are a large and diverse class of compounds, many of which occur naturally in a range of food plants. Phenolics (hydroxybenzenes) especially polyphenols (containing two or more phenolic groups) are ubiquitous in plant foods consumed by human and animals and one of the widest groups of dietary supplements marketed worldwide (Ferguson, 2001).

The main polyphenols in cereals are phenolic acids and tannins, whilst flavonoids are present in small quantities (Rao and Muralikrishna, 2002).

Although, these compounds play no known direct role in nutrition (non-nutrients), many of them have properties, including antioxidant (Sripriya *et al.*, 1996).

Finger millet is known for several health benefits and some of the health benefits are attributed to its polyphenol and dietary fiber contents. Polyphenols have anti-oxidant, anti-mutagenic, anti-carcinogenic, anti-inflammatory and inhibitory activity that might potentially be beneficial in preventing or minimizing the incidence of diseases (Ferguson, 2001).

Shobana *et al.* (2010) provided evidence for hypoglycaemic, hypocholesterolaemic, nephroprotective properties of finger millet, the health grain.

The tiny finger millet is rich in polyphenols compared to many other continental cereals such as barley, rice, maize and wheat (Viswanath *et al.*, 2009).

The presence of phytates is beneficial for their contribution to health benefits such as antidiabetic, antioxidant and anticancer effects (Thompson, 1993).

Balasubramanian (2009) studied the total phenolic content and antioxidant activity of various pulses, legumes, cereals, including millets and it was found that

finger millet and rajmah were highest in antioxidant activity while finger millet and black gram dhal had the highest total phenolic content.

The low GI foods reduce hunger and increase satiety (Toeller, 1994). Studies have indicated advantages of inclusion of low GI foods in both diabetics and non-diabetics to lower the fasting blood glucose (Lawes *et al.*, 2004).

Diabetes is rising rapidly in India, as it is in many nations. Finger millet is a humble grain with low glycaemic index which makes it more suitable for diabetic patients (Pradhan *et al.*, 2010).

The glycaemic effect of millet incorporated breakfast items on 24 NIDDM patients was studied by Geetha and Parvathy (1990) who reported that supplementation of diets with ragi for a month showed a higher reduction of fasting and post prandial glucose levels than did supplementation with other millets. The millets like ragi, maize, jowar and proso millet were administered to the patients in the form of traditional breakfast items at 20 per cent level of incorporation for a period of one month. The study revealed that millets have great potential in controlling blood glucose level and hence, could form an integral part of diet of diabetics.

Lakshmi and Sumathy (2002) studied the effect of consumption of finger millet on hyperglycemia in six NIDDM men and reported that glycaemic responses were lower in whole finger millet based roti and dosa and germinated finger millet roti.

According to Khodr and Khalil (2001) the perfect wound healing process is interrupted in diseased conditions like diabetes and age associated biochemical phenomenon due to increased level of ROS.

The diabetic conditions had a deleterious influence on the wound healing process through abnormal physiological response. Free oxygen radicals damage the cells in the zone of stasis, which lead to necrosis and conversion of superficial

wound into a deeper wound. Antioxidants significantly prevent tissue damage and stimulate the wound healing process (King, 2001).

Rajasekharan *et al.* (2004) studied the antioxidant effects of finger millet on the dermal wound healing process in diabetes induced rats. It was found that finger millet played an important role on skin antioxidant status, NGF production and wound healing parameters. It is attributed that the phenolic antioxidants present in finger millet partially protected the insulin producing cells from alloxan mediated cell damage, and hence promoted the healing process.

Formation of the resistant starch also contributes towards dietary fibre content and complements the health benefits of the finger millet (Shobana and Malleshi, 2007).

The resistant starch can be quantified in the soluble dietary fiber residue and is highly susceptible to fermentation in the large intestine. RS, a functional fiber fraction is also present in ragi, which escapes the enzymatic digestion imparts beneficial effects by preventing several intestinal disorders (Gee *et al.*, 1992; Annison and Topping 1994). In addition to its therapeutic effects, resistant starch in ragi provides better appearance, texture, and mouth feel than conventional fibers (Martinez *et al.*, 1999).

Similar to oligosaccharides, especially fructo oligosaccharides, it escapes digestion and provides fermentable carbohydrates for colonic bacteria. It has also been shown to provide benefits such as the production of desirable metabolites, including short-chain fatty acids in the colon, especially butyrate, which seems to stabilize colonic cell proliferation as a preventive mechanism for colon cancer (Englyst *et al.*, 1992).

With the changes in scenario of utilization pattern of processed products and awareness of the consumers about the health benefits, finger millet has gained importance because of its functional components, such as slowly digestible starch and resistant starch (Wadikar *et al.*, 2006).

Recently the anti- cancer activity of ragi seed extract on K562 chronic myeloid leukemia cells was explored. The anti- proliferative potential of RBI from edible ragi seeds, might provide a future preventive as well as curative natural solution for chronic myeloid leukemia (Sen and Dutta, 2012).

Finger millet is rich in phytochemicals, which is believed to lower cholesterol, and phytate, which is associated with reduced cancer risk (Shashi *et al.*, 2007).

According to Millet Network of India (2012) daily consumption of finger millet will help our body in the following ways.

- Aids in bone development: Ragi, an excellent source of calcium, contributes towards bone health. The cereal is beneficial for growing children and older people who need a constant supply of calcium for healthy growth and maintenance of bones. Consumption of ragi can reduce the risks of fractures and osteoporosis to a considerable extent.
- Aids in weight loss: Tryptophan, an amino acid, present in ragi, reduces excess appetite and helps to control weight gain. Fibers in ragi give a feeling of fullness, and the slower digestion rate of the cereal reduces calorie intake which supports the process of weight loss.
- Acts as a relaxant: The amino acid tryptophan present in ragi acts as an excellent natural relaxant and helps to fight anxiety, insomnia and depression. The amino acid also helps in treating migraine headaches.
- Reduces high glucose levels in the blood: Ragi shows antioxidant properties, and its phytochemicals contribute towards a slow digestion process. Hence it helps to control blood glucose levels in a diabetic. The presence of antinutritional factors in whole finger millet flour which reduces starch digestibility and absorption.
- Acts as a good source of protein/amino acids: Ragi is a rich source of amino acids which is beneficial for the human body. The list

includes valine, tryptophan, isoleucine, threonine and methionine. Valine is an essential amino acid which helps in repairing tissues, metabolism and muscle coordination and is also vital for maintaining the nitrogen balance of the body. Methionine is another essential amino acid lacking in most of the other cereals. Methionine helps the body process and eliminate fat, and is the primary source of sulfur in the body (sulfur is required for the production of the body's most abundant natural antioxidant, glutathione). Isoleucine is good for blood formation, muscle repair, bone and skin health.

- Lowers blood cholesterol levels: The essential amino acids, lecithin and methionine present in ragi, help to reduce cholesterol by removing excess fat from the liver. Threonine, another amino acid, prevents the formation of fat in the liver and this, in turn, brings down the cholesterol level in the body.
- Prevents and treats anemia: Ragi, being a good source of iron, can be considered as a useful cereal for anemic patients.
- Acts as remedy for various health conditions: Regular intake of ragi can prevent many health conditions such as malnutrition, premature ageing and the development of degenerative diseases. Green ragi is a remedy for blood pressure, heart weakness, liver disease, asthma and lack of milk production during lactation period.

However, its high intake could increase oxalic acid in the body. Therefore it is not advised to patients having kidney stones.

### 2.3 PROCESSING OF FINGER MILLET

Food uses of millets have, however, been confined only to traditional consumers; limited especially to areas of their cultivation, and still have remained underutilized. Processing them using traditional as well as contemporary methods for preparation of value added and convenience products would certainly diversify their food uses. Their exploitation for preparation of ready-to-use or ready-to-cook products would help in increasing the consumption of millets among non-millet consumers and thereby nutritional security.

Small millets containing large portion of husk and bran require dehusking and debranning prior to consumption. In the process of milling of food grains, the main objective is to remove the coarse fibrous bran or the seed coat. Grinding/milling, fermentation, roasting, popping/puffing, malting these are some of the traditional methods used for the processing of millets (Hulse *et al.*, 1980).

Traditionally ragi is processed either by malting or fermentation. Malting of finger millet improves its digestibility, sensory and nutritional quality as well as pronounced effect in lowering the antinutrients (Rao *et al.*, 2001).

Malting characteristics of finger millet are superior to other millets and ranks next to barley malt (Pawar and Dhanvijay, 2007).

There are various benefits of malting such as vitamin C is elaborated, phosphorus availability is increased and lysine and tryptophan are synthesized (Desai *et al.*, 2010).

The malted and fermented ragi flour are extensively used in preparation of weaning food, instant mixes, beverages and pharmaceutical products (Rao *et al.*, 2001).

Malting process involves the following steps:

- Cleaning the grains by removing the stone and mud
- Washing thoroughly in water
- Soaking the grains for one day
- Drain the grains and tie them in clean cloth for germination
- Shade dry the sprouted grains for 2-3 days
- Roast the grains till it gives good aroma
- Rub the roasted grains by hand
- Grind the grains in to flour

Significantly higher concentrations of riboflavin (0.62 mg/100g), pantothenic acid (1.6 mg/100g), and niacin (4.2 mg/100g) was found in the fermented finger millet than in raw grains. It was also observed that cyanocobalamin was synthesized during finger millet fermentation (Basappa *et al.*, 1997).

Gahlawat and Sehgal (1994) reported that weaning foods prepared by roasting of barnyard and finger millet increased iron bioavailability

Popping or puffing of finger millet is one of the popular traditional methods of processing and the popped millet and its flour is a RTE product with pleasing texture and appealing flavour. Popping improves the nutritional value by inactivating some of the anti nutritional factors and thereby enhancing the protein and carbohydrate digestibility (Nirmala *et al.*, 2000).

Puffed finger millet grains can be converted into powder by simple grinding which can be further be enriched with additional ingredients. The selection and combination of the ingredients is done based on the requirement of the target group like children, pregnant and lactating mothers (Edem *et al.*, 2001).

During sprouting of finger millet growth of lactic acid bacteria, a desirable micro flora has been reported. The associate changes are beneficial in the development of traditional foods (Varadaraj and Horigane, 1998).

#### 2.4 VALUE ADDITION OF FINGER MILLET

Finger millet can be used in a variety of ways and is a great substitute for other grains such as rice and other starchy grains. However, not much scientific studies have been carried out about their preparation and meaningful popularization on large scale (Verma and Patel, 2013).

A study was undertaken to enhance the income of finger millet growing farmers by strengthening their capacity for value addition and marketing of value added products. It was found that there was positive impact on income generation and improved nutrition and economic status (Vijayalakshmi *et al.*, 2010).

Value addition to millet is a highly strategic intervention in the popularization of nutritionally rich crops (Yenagi *et al.*, 2010).

Finger millet is normally consumed in the form of flour based foods such as roti, mudde and ambli and each of these foods have their characteristic features (Malleshi *et al.*, 2007).

Addition of finger millet as one of basic ingredient to the tune of 15 to 20 per cent along with other essential ingredients such as black or green gram, rice and spices has become a tradition in millet growing areas of South India. According to a report, addition of finger millet up to 60 per cent in papad is possible and practiced in some parts of Karnataka. Papad from finger millet flour is also prepared in which it is used as base material mixed with spices and salt. The protein quality of the papad was improved due to the complimentary action of millet and pulse protein. The product was highly acceptable initially as well as on storage (Begum *et al.*, 2007).



Shanthi *et al.* (2005) in a study on the effect of incorporation of finger millet in pasta products found that incorporation of finger millet up to 30 percent and soya flour up to 10 per cent was acceptable.

Mittal (2002) prepared various convenience mixes using finger millet and developed various food products viz halwa, laddu, biscuits and found them to be nutritionally superior than their respective controls.

Desai *et al.* (2010) reported that attempts have been made to improve the nutritional quality of cakes with respect to the minerals and fibre content by supplementing with malted finger millet flour.

Iron rich biscuits using finger millet can be effectively used for supplementary feeding programs among children (Singh and Srivastava, 2007).

Finger millet or the ragi is usually used for preparation of flour, pudding, porridge and roti (Chaturvedi and Srivastava, 2008).

Thanuja (2012) introduced many ways to include the finger millet in the daily diet:

- Incorporation in the other cereals such as rice and wheat in traditional dishes like idli, dosa, puttu, roti etc.
- Incorporation of finger millet flour in the bakery products like cakes, laddoos, biscuits, murukku etc.
- Health drinks using finger millet like porridge, ragi malt, ragi chocolate milk shake.
- Ready to cook foods like ragi idli mix, ragi dosa mix, flours, noodles and vermicelli.

## 2.5 RELEVANCE OF FINGER MILLET IN FAMILY NUTRITION

Ragi can be considered as an ideal food for all stages of the life cycle starting from infancy to old age. Ragi is an ideal first food after an infant reaches at least 6 months of age. Sprouting ragi increases the bioavailability of its iron to 88 per cent, comparable only to mother's milk (Patil and Sawant, 2012).

Flour made from malted ragi is traditionally used for weaning and helps in the nourishment of infants and invalids (Chandrashekhar, 2010).

A study was conducted to evaluate the effect of combination of millet and legume and processing on digestibility, biological value and net protein utilization using albino rats. The millets and legumes selected were sorghum, pearl millet, finger millet, chick pea and green gram. The processes tested include dehulling, boiling, roasting, malting and baking. Results of biological study on biscuits prepared by using millet and legume combination flours indicated the biscuits to be of good protein quality (Geervani *et al.*, 1996).

Malted weaning food was developed using malted ragi and green gram to evaluate the nutritional quality by rat feeding trials. It was observed that nutritional quality of the roller dried proprietary weaning food and malted weaning food were comparable (Malleshi, 2003).

A study was conducted to develop an indigenous weaning food based on ragi flour. Six combinations of weaning formulae were developed using green gram, sesame, tapioca and skim milk powder along with ragi. It is found that the bland porridge was highly acceptable among pre schoolers (Jessy, 1987).

Nagammal (1989) studied the impact of ragi based food supplement on the nutritional status of selected preschool children. 40 children were fed with the supplements for six months. It was found that there was marked increase in the weight, height and haemoglobin level of the children.

Supplementation of ragi vermicelli in school children showed a significant (3.31 percent) increase in the body weight as well as a (2.65 percent) significant increase in the BMI at the end of the supplementation period. The results showed a non-significant increase in the hematological parameters (Kathy *et al.*, 2013).

A study by Kamini and Saritha (2011) on quality characteristics of finger millet based baby food preparation revealed that roasted malted finger millet, roasted malted wheat, roasted green gram flour and skimmed milk powder in the ratio 30:30:25:15 obtained the highest acceptability among the different baby foods studied. The baby food prepared from finger millet after roasting exhibited higher content of protein, calcium and iron but low in vitro protein digestibility as compared to malted finger millet.

Administration of ragi satwa (starch) for 90 days to school children showed a significant increase in mean score of BMI, height for age, weight for height, mid arm circumference, weight for age and abdominal girth. It also enhanced biochemical parameters like haemoglobin, RBC, TLC, ESR, serum protein, serum albumin and it was concluded that ragi starch is an effective, safe, and herbal formulation for the growth of children (Patil and Sawant, 2012).

Tatala *et al.* (2007) conducted a study on the effect of germination of finger millet on nutritional status of Tanzanian children. The food consisted of finger millet flour, kidney beans, ground peanuts and dried mangoes at predetermined proportions of 75:10:10:5 respectively. It was found that the haemoglobin level and anthropometric indices of children improved.

Preschool children, pregnant women and lactating women were selected in a study and fed with ragi malted mix and wheat malted mix respectively. It was observed that the weight and hemoglobin level of preschool children, pregnant and lactating women was significantly increased after supplementation. Considerable reduction (50 per cent) in the incidence of PEM, vitamin A, B vitamins, vitamin C and iron deficiency was also observed (Khader *et al.*, 2012).

Flour from the malted finger millet makes a healthy food for elderly people (Goel *et al.*, 2007). In older people especially women during the menopausal stage, there is a chance of developing osteoporosis. Being rich in Ca, consumption of ragi can reduce the risk of fractures and osteoporosis to a considerable extent (Reshmi, 2013).

# *Materials and Methods*

### 3. MATERIALS AND METHODS

This chapter deals with the methodology followed in this study entitled “Capacity Building of Rural Women on Enhancement of Family Nutrition and Livelihood Security through Consumption and Value Addition of Finger Millet”. The methodology is discussed under the following headings.

- 3.1 Locale of the study
- 3.2 Selection of the respondents
- 3.3 Conduct of the study
  - 3.3.1 Socio economic profile of the respondents
  - 3.3.2 Food consumption pattern with special reference to finger millet
  - 3.3.3 Nutritional status assessment of the respondents
  - 3.3.4 Prevalence of life style diseases
  - 3.3.5 Acceptability studies on finger millet recipes
  - 3.3.6 Consumer preference tests
  - 3.3.7 Research instruments used for the study
  - 3.3.8 Development of educational materials for campaign
  - 3.3.9 Conduct of awareness programme and exhibition
  - 3.3.10 Impact assessment of the programme
- 3.4 Data processing and analysis

#### 3.1 LOCALE OF THE STUDY

The study was conducted in three anganwadi centers selected at random from Kalliyoor panchayath which comes under Nemom ICDS Block in Thiruvananthapuram district.

#### 3.2 SELECTION OF THE RESPONDENTS

One hundred rural women who are beneficiaries of the ICDS programme were selected from the three anganwadi centers and formed the study sample.

The services of ICDS functionaries comprising of CDPO, supervisors and anganwadi workers were also utilized for the conduct of the study.

### 3.3 CONDUCT OF THE STUDY

#### 3.3.1 Socio Economic Profile of the Respondents

In this study the socio economic profile of the each respondent was collected by means of a questionnaire. Details such as age, religion, caste, educational status, type of family, occupational status, family income, live stock possessed and type of house were collected. On the basis of their socio economic status the respondents were categorized as follows.

##### 3.3.1.1 Age

It refers to the number of calendar years completed by the respondents at the time of interview. This variable was measured by directly asking the respondent the number of years she had completed at the time of investigation. The respondents were categorized as below for statistical analysis following the scoring pattern suggested by Devi (2004) adopted with slight modification. One, two and three scores were allotted to the young middle and old respondents respectively for the purpose of combination of data.

Category	Age	Score
Young	$\leq 35$ years	1
Middle	36-55 years	2
Old	$>55$ years	3

### ***3.3.1.2 Religion***

Religion play a dominant role in the process of socialization and it helps to maintain the stability of social system and social relationship. All the respondents were categorized according to their religion. Hindu's were given the score as 'one', Muslim's score as 'two' and Christian's score as 'three'.

<b>Religion</b>	<b>Score</b>
Hindu	1
Muslim	2
Christian	3

### ***3.3.1.3 Caste***

The categorization followed in the Census Report of India (2011) was adopted in this study. All the respondents in the study population were classified into following category and scores were assigned as indicated against each for the purpose of classification.

<b>Category</b>	<b>Score</b>
Forward caste	3
OBC	2
SC/ST	1

### ***3.3.1.4 Educational Status***

It is defined as the formal education attained by the respondent (Jayalekshmi, 2001). Educational status of the respondents was measured using a scoring system developed by National Family Health Survey 2 (1999) as listed below.



<b>Educational status</b>	<b>Score</b>
Illiterate	0
Upper primary	1
High school	2
Pre- degree	3
Degree/Diploma/Professional course	4
PG and above	5

### ***3.3.1.5 Type of Family***

<b>Category</b>	<b>Score</b>
Nuclear	1
Joint	2

In this study family type refers to nuclear family or joint family. Nuclear family consists of husband, wife and their unmarried children whereas joint family is comprised of grandparents and married sons and daughters with their spouses. The respondents were asked to indicate the type of family whether nuclear or joint type. A nuclear family was given the score as 'one' and joint family score as 'two'.

### ***3.3.1.6 Occupational Status***

The occupation is defined as the position of the respondent, which acts as a source of income in which he spends major part of his time and attention. The

occupational status of the different family members was assessed and grouped as follows.

<b>Occupational status</b>	<b>Score</b>
Unemployed	0
Government sector	1
Private sector	2
Casual labourer	3

### ***3.3.1.7 Family Income***

Monthly family income from all sources was taken into account for measuring this variable. The scoring procedure was adopted from modified socio-economic status scale of Kuppaswamy (1981).

<b>Family income (Rupees)</b>	<b>Score</b>
$\geq 979$	0
980-2935	1
2936-4893	2
4894-7322	3
7323-9787	4
9788-19574	5
$\leq 19575$	6

### ***3.3.1.8 Livestock***

<b>Livestock possessed</b>	<b>Score</b>
Nil	0
Animal rearing	1
Poultry rearing	2

The respondents were asked about the possession of their livestock. A score of one was given for animal rearing, two for poultry rearing. A score of zero was assigned for non possession of livestock.

### **3.3.1.9 Type of House**

Type of house of the respondents was assessed and grouped as follows.

<b>Type of house</b>	<b>Score</b>
Own	1
Rented	2
Leased	3

### **3.3.2 Food Consumption Pattern With Special Reference to Finger Millet**

Data regarding the food habits, frequency of use of different food items and consumption practices of finger millet in the different stages of the life cycle from infancy to old age as well as specific conditions like obesity, diabetes was collected from the respondents by means of a questionnaire and also by interviewing them.

### **3.3.3 Nutritional Status Assessment of the Respondents**

Nutritional status of the population can be assessed directly by clinical assessment and nutritional anthropometry. Anthropometry refers to the measurement of the human body and reflects changes in morphological variation due to inappropriate food intake or malnutrition (Srilakshmi, 2002).

Park and Park (1991) have stated that haemoglobin level is a useful index of the overall state of nutrition irrespective of its significance in anaemia.

Classification of the respondents based on haemoglobin level was done as recommended by NIN (1986).

In this study anthropometric measurements like height and weight of the respondents were assessed. The haemoglobin status of the respondents was assessed for obtaining data regarding micronutrient deficiencies such as anaemia. Based on their anthropometric measurements BMI was calculated. The classification of BMI are as follows.

### ***3.3.3.1 BMI of the Respondents***

BMI can be used to grade Chronic Energy Deficiency (CED) and is regarded as a good indicator of nutritional status. BMI, which is expressed as the ratio of weight to height square is an indicator of general obesity and also gives the magnitude of protein calorie malnutrition (WHO, 2005). The BMI of the respondents are showed in Appendix VIII. The classification of BMI is as follows.

**Table 1: Classification of BMI**

<b>Classification</b>	<b>BMI (kg/m<sup>2</sup>)</b>
CED grade III severe	<16
CED grade II moderate	16 – 17
CED grade I mild	17- 18.5
Low weight- normal	18.5- 20
Normal range	20-25
Obese grade I	25-30
Obese grade II	≥30

(Source: Srilakshmi, 2002)

### 3.3.3.2 Haemoglobin Status of the Respondents

Blood samples of the subjects were collected and their haemoglobin status was assessed. The Hb levels of respondents are presented in Appendix VII. According to their haemoglobin level they were classified as follows.

**Table 2: Classification of haemoglobin levels**

Hb level (gm/dl)	Classification
<7.9	Severe
8-9.9	Moderate
10-10.9	Mild
11-11.9	Marginal
>12	Non anaemic

(Source: NIN,1986)

### 3.3.4 Prevalence of Life Style Disease

Disease history of the respondents, like diabetes, hypertension, and other cardio vascular problems were collected from the respondents by interviewing them.

### 3.3.5 Acceptability Studies on Finger Millet Based Recipes

As part of the study, ten finger millet based recipes were collected from among those already developed by institutions like NIN, CFTRI and Food and Nutrition Board. In order to carry out sensory evaluation of the products prepared from finger millet, the five point scale proforma as suggested by Amerine *et al.* (1965) was utilized. Ten products namely roti, laddu, pudding, pakoda, cake, health drink, cutlet, chocolate milk shake, halwa, dosa were prepared and served to 15 judges. A five point score card was used to evaluate the ragi preparations. The scores were assigned based on the five attributes like appearance, colour,

**ROTI**



**LADDU**



**PUDDING**



**PAKODA**



**CAKE**



**Plate 1: Products Subjected for Acceptability Test**

**CUTLET**



**DOSA**



**HALWA**



**CHOCOLATE MILK SHAKE**



**HEALTH DRINK**



**Plate 1: Products Subjected for Acceptability Test (continued)**

flavour, taste and texture. Those recipes which obtained high acceptability scores were selected. Thus among the ten products, four products were selected to be demonstrated during the awareness programme. The five point scale is given in Appendix V. The four recipes selected were

1. Ragi laddu
2. Ragi halwa
3. Ragi pakoda
4. Ragi chocolate milk shake

### **3.3.6 Consumer Preference Tests**

Consumer preference study was conducted among hundred anganwadi workers in order to assess the suitability of these products from the consumer's point of view. Preference tests allow consumers to express a choice between samples, one sample is preferred and chosen over another or there is no preference (Watt, 1999). A preference test was conducted by asking the consumers to rank or score the products served in the sequence of their liking. The preference evaluation was made in order to select the most promising products for large scale production.

Consumer preference was assessed by Hedonic rating test. The hedonic rating test is used to measure the consumer acceptability of food products. The selected sample were served to the panelist in one session and were asked to rate the acceptability of the product on a scale, usually of 9 points, ranging from 'like extremely' to 'dislike extremely'. Scales with different ranges and other experience phrases could also be used. For the study a five point scale was used ranging from 'like extremely' to 'neither like or dislike'. The five point scale is given in VI.





**Plate 2: Products Selected for Consumer Preference Test**

### **3.3.7 Research Instruments Used for the Study**

1. An interview schedule to elicit information on the socio economic background, personal characteristics as well as dietary habits of the respondents.
2. A knowledge test to determine the knowledge level of the rural women about the finger millet and its nutritional significance.
3. An attitude scale to assess the attitude of the rural women towards consumption of the finger millet.

#### **3.3.7.1 Interview Schedule**

Interviewing is considered as one of the reliable methods of collecting data (Rangaswamy, 1989). Besides, this technique also permits exchange of ideas and information (Sindhu, 1984).

An interview schedule was constructed to collect information about the personal variables like age, sex, family type, family size, family income and educational status of the respondents. Information was also collected about the socio economic variables like occupational status, monthly income, type of house etc. from the respondents. The interview schedule is given in Appendix I.

Data on the dietary habits and nutrition related practices of the respondents was assessed using a questionnaire. Frequency of use of food commodities with special reference to finger millet was also assessed. The questionnaire was pre-tested and standardized before administering to the respondents (Appendix II). The percentage of total score of food commodities used by respondents was calculated using the formula suggested by Reaburn *et al.* (1979)

Percentage of total score for each food commodity was calculated using the Reaburn scale as follows:

$$R_1S_1+R_2S_2+R_3S_3+\dots\dots\dots R_nS_n$$


---

n

S<sub>i</sub>: Scale of rating given for frequency of use of foods (i=1, 2 ....5)

R<sub>i</sub>: Percentage of respondents coming under each frequency group (i=1, 2 ....5)

n: Number of respondents (n=100)

The consumption practices of finger millet by the rural women were assessed with the help of a questionnaire, in which the scores assigned were 'daily'-7, 'alternative days' -6, 'twice in a week'-5, 'once in a week'-4, 'once a month'-3, 'once in three months'-2, 'once in six months'-1. Finally the scores were added up to get the score for each respondent. There was thus a possibility for a respondent receiving a maximum score of 28 and a minimum score of 0. The questionnaire was administered to each respondent before and after the awareness programme for calculating the difference in their consumption practices.

### ***3.3.7.2 Construction of Nutrition Knowledge Test***

In order to measure the knowledge level of the rural women regarding finger millet, a nutrition knowledge test was developed by means of a simple objective type test constructed following the procedure adopted by Kumar (2000) with slight modifications. Care was taken to ensure that the questions covered the entire range of subject matter selected for the study.

An item pool of 35 statements relevant to finger millet on selected areas such as nutritive needs, nutritive value and health benefits was prepared. These

statements were prepared from relevant literature. Both positive and negative statements were formed. Care was taken to use simple and clear statements with no ambiguity in language or idea to avoid confusion and doubts. A jury of subject experts analyzed the statements. In light of suggestions made by experts, 20 statements were selected and were pre-tested. Based on the result of the pre-test five statements were discarded and remaining 20 items were selected for constructing the knowledge test.

The responses were collected in a dichotomous pattern i.e., Yes or No. Each correct response was given a score of one and the incorrect response was given a score of zero. Finally the scores were added up to get the knowledge score for each respondent. The maximum score for the test developed was 20 and the minimum score was 0. The constructed knowledge test administered is given in Appendix III.

### ***3.3.7.3 Measuring Attitude of the Respondents towards Finger Millet***

Eagly and Chaiken, (1998) defined attitude as a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor. Attitudes can be difficult to measure because measurement is arbitrary, meaning people have to give attitudes a scale to measure it against, and attitudes are ultimately a [hypothetical](#) construct that cannot be observed directly (Wood, 2000).

Attitude of the respondents towards consumption of finger millet was measured by an attitude scale following Edward's method (1957). For measuring the attitude of the respondents towards consumption of finger millet an attitude scale was constructed. For these 40 statements showing both positive and negative attitude towards consumption of finger millet were collected from available literature. These were later circulated among the faculty members and students for selecting the most appropriate statements for the scale. Finally twenty two statements, fourteen positive and eight negative statements were

selected for the attitude scale. Responses for each item were obtained on a five point scale ranging from 'strongly agree' to 'strongly disagree'

The scores assigned were "strongly agree- 5", "Agree- 4", "Undecided- 3", "Disagree-2", "strongly disagree- 1". Negative statements were scored in the reverse manner. The attitude score of the respondents was obtained by adding up the score corresponding to their response pattern for each statement. There was thus a possibility for a respondent receiving a maximum score of 110 and a minimum score of 0. The attitude scale developed is presented in Appendix IV. The attitude scale developed was administered to the respondents.

### **3.3.8 Development of Educational Materials**

#### **3.3.8.1 Folder**

A folder entitled "Ragi poshakasamrudham" was prepared in malayalam showing the health and nutritional significance of finger millet and importance of including it in the diet during the different stages of life cycle as well as its therapeutic uses. Details regarding different techniques in processing of finger millet like malting, fermentation and their importance were also included in the folder. A copy of the folder is attached in Appendix IX.

#### **3.3.8.2 Booklet**

A booklet entitled "Ragi upayogichulla chila pachaka kurippukal" was prepared in Malayalam. The booklet included 25 recipes based on finger millet with their ingredients and mode of preparation. A copy of the booklet is attached in Appendix X.

#### **3.3.8.3 Slide show**

A slide show may be a presentation of images purely for their own visual interest or artistic value, sometimes accompanied by description or text, or

it may be used to clarify or reinforce information, ideas, comments, solutions or suggestions which are presented verbally.

For the purpose of awareness programme a slide show was also produced under the present study. The title of the slide show was “Ragi kazhikku arogyam samrakshikku”. Slides were prepared on different types of millets especially finger millet its nutritional significance, its importance in prevention of life style diseases, processing, value added products from finger millet and its significance in different stages of life cycle. Photos of the slide show is attached in Appendix XI.

#### ***3.3.8.4 Poster and Chart***

A chart entitled “Ragi kazhikku arogyam samrakshikku” was prepared forming the theme of the exhibition. A chart was also prepared showing the different steps of preparation of ragi malt.

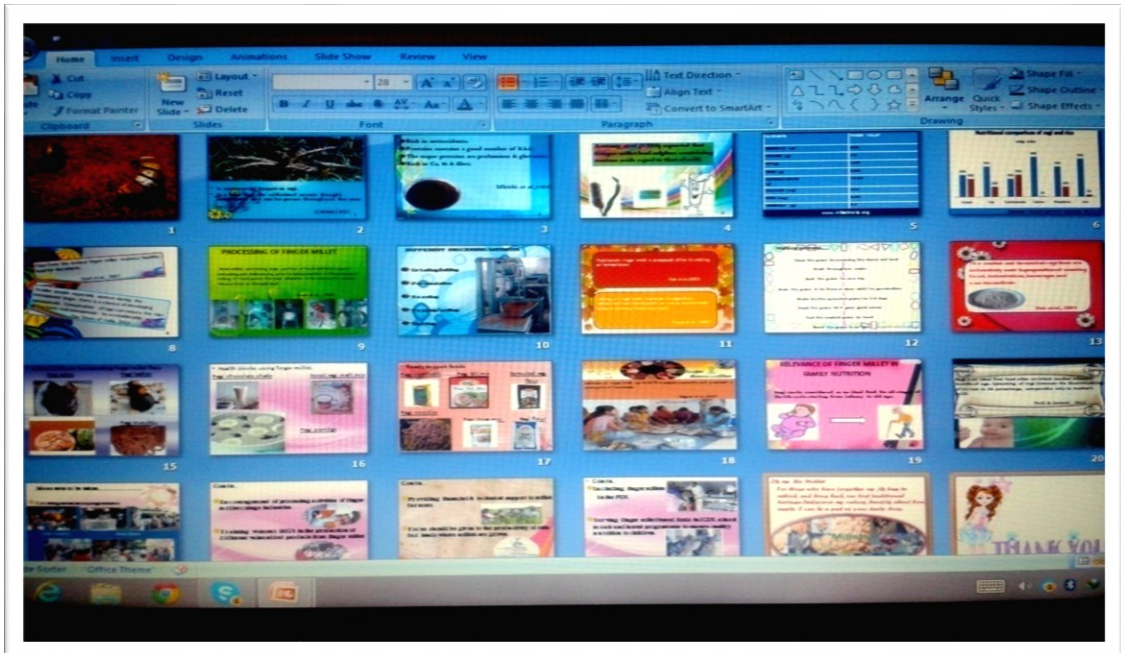
#### **3.3.9 Conduct of the Nutrition Education Programme**

An awareness programme was conducted for the selected hundred rural women who are participants of the ICDS programme. The awareness programme was carried out by the method as suggested by (Sheth *et al.*, 2006) with some modifications in the following manner.

Session 1: In this session first the respondents were given a brief introduction of the awareness programme. This session included a lecture on the importance of the finger millet in human nutrition and their role in preventing life style diseases. A slide show on finger millet was also included in this session. Nutritive value, health benefits, processing and different preparations were incorporated in the slide show. At the end of the session the prepared folder was given to the respondents.



**Plate 3: Conduct of Awareness Programme**



**Plate 4: Slide show during the awareness programme**



Plate 5: Chart Showing the Process of Malting of Finger Millet





**Plate 6: Anthropometric Assessment of the Respondents**



**Plate 7: Haemoglobin Estimation of the Respondents**



**Plate 8: Exhibition of Finger Millet Products**



**Plate 9: Demonstration of Finger Millet Recipes**

Session 2: Anthropometric measurements of the respondents to assess their BMI. In this session blood samples were collected from the selected one hundred respondents to measure their haemoglobin status.

Session 3: Exhibition and demonstration of finger millet products during the awareness programme. Care was taken to see that there was good participation of the respondents in the session.

Session 4: At the end of the awareness programme, information imparted in the previous three sessions was summarized. A booklet consisting of 25 ragi recipes was also distributed to each respondent.

### **3.3.10 Impact Assessment of the Programme**

In order to evaluate the impact of awareness programme, change in knowledge, attitude and consumption practices of finger millet was assessed after a gap of one month. For the knowledge test, attitude scale and consumption practice of finger millet was once again administered to the respondents for the post test and the scores were calculated as done earlier. Based on the anthropometric measurements their BMI was calculated and data regarding their haemoglobin status and BMI were handed over to each respondent.

## **3.4 DATA PROCESSING AND ANALYSIS**

The data collected were scored, coded, consolidated and subjected to statistical analysis and interpretations. The statistical procedures used in the present study were frequency, percentage, mean score, standard deviation and paired 't' test.

1. Mean and percentage – for finding out frequency distribution.
2. Mean  $\pm$  standard deviation - for categorizing the respondents.

3. Paired 't'- test: In order to compare observations in respect of each respondent before and after exposure to nutrition education, paired t-test was applied.

4. Formula used:  $t = \frac{\bar{d}}{S/\sqrt{n}}$   $d \sim t$  with (n-1) degrees of freedom

Where:  $d$  = difference of two exposure levels and

$n$  = total number of respondents in a group.

$$S^2 = \frac{\sum (d_i - \bar{d})^2}{n-1}$$

This calculated 't' value was compared with the table value of 't' at (n-1) degrees of freedom and  $\alpha$  level of significance.

# *Results*

## 4. RESULTS

The present study focused on the utilization of finger millet as a source of micro-nutrients and preventive measure against life style diseases to ensure the family nutrition and livelihood security. A group of rural women were given nutrition education through campaign approach by means of discussions, demonstrations, slide show, booklets and folders to improve their knowledge as well as nutritional status through consumption of finger millet and create awareness on its marketing potential. The results obtained are presented under the following headings.

- 4.1 Personal characteristics of the respondents
- 4.2 Socio-economic characteristics of the respondents
- 4.3 Food consumption pattern with special reference to finger millet
- 4.4 Nutritional status assessment of the respondents
- 4.5 Prevalence of life style diseases
- 4.6 Acceptability studies on finger millet recipes
- 4.7 Consumer preference tests
- 4.8 Impact assessment of the awareness programme

### 4.1 PERSONAL CHARACTERISTICS OF THE RESPONDENTS

Personal characteristics of selected one hundred respondents with reference to age, religion, caste, family type and educational status were assessed.

#### 4.1.1 Age of the Respondents

Table 3, revealed that majority of the respondents (70 per cent) belonged to middle age group (thirty six to fifty five years), thirty per cent of the respondents belonged to the young age group (less than or equal to thirty five years) and nobody belonged to the old age group of above fifty five years.



#### **4.1.2 Religion of the Respondents**

Table 3, indicated that the majority i.e. eighty per cent of the respondents were Hindus. Six per cent of the respondents were Muslims and fourteen per cent constituted Christians.

#### **4.1.3 Caste of the Respondents**

The caste wise distribution of the respondents as depicted in Table 3 proved that majority of the respondents (forty six per cent) belonged to forward communities and forty four per cent were from backward communities. Only ten per cent respondents belonged to scheduled caste groups.

#### **4.1.4 Educational Status of the Respondents**

The educational status of the respondents was assessed and was seen to range from upper primary to post graduation and above. The educational status of the respondents revealed that sixty three per cent had studied up to pre-degree and 20 per cent had studied up to high school. Fifteen per cent had studied up to degree level and only two per cent had studied up to upper primary level. None of the respondents were post graduates.

#### **4.1.5 Family Type**

Table 3, depicted that majority of the respondents (eighty per cent) belonged to nuclear family and twenty per cent belonged to joint family.

### **4.2 SOCIO ECONOMIC CHARACTERISTICS OF THE RESPONDENTS**

Socio-economic characteristics of selected one hundred respondents with reference to employment status, monthly income, type of house and livestock possessed were assessed.

**Table 3: Distribution of Respondents Based on their Personal Characteristics (n=100)**

<b>Variables</b>	<b>Category</b>	<b>Score</b>	<b>Number</b>	<b>Percentage</b>
Age of the respondents	Young ( $\leq 35$ years)	1	30	30
	Middle (36-55 years)	2	70	70
	Old ( $> 55$ years)	3	0	0
Religion of the respondents	Hindu	1	80	80
	Muslim	2	6	6
	Christian	3	14	14
Caste of the respondents	Forward caste	3	46	46
	OBC	2	44	44
	SC/ST	1	10	10
Educational status	Upper primary	1	2	2
	High school	2	20	20
	Pre- degree	3	63	63
	Degree /Diploma	4	15	15
	PG and above	5	0	0
Family type	Nuclear family	1	80	80
	Joint family	2	20	20

#### **4.2.1 Employment Status of the Respondents**

Tables 4, revealed that majority of the respondents were unemployed (62 per cent). Twenty three per cent were having private jobs, 8 per cent were in the government sector and 7 per cent were casual laborers while 5 per cent were farmers.

#### **4.2.2 Monthly Family Income of the Respondents**

Table 4, revealed that fifty five per cent of the respondents had a monthly income within the range of Rs 9788-19574; twenty two per cent had an income ranging from Rs. 7323- 9787; thirteen per cent of the respondents had an income ranging from Rs. 4894-7322 and only ten per cent belonged to high income group.

#### **4.2.3 Possession of Livestock**

Seventy two per cent of the respondents were not engaged in any livestock rearing. Fifteen per cent were engaged in animal rearing and thirteen per cent were engaged in poultry rearing.

#### **4.2.4 Type of House**

Majority of the respondents (seventy three per cent) lived in their own house and twenty one per cent respondents lived in rented houses and six per cent in leased buildings.

### **4.3 FOOD CONSUMPTION PATTERN WITH SPECIAL REFERENCE TO FINGER MILLET**

Diet survey was conducted as a primary step to determine the dietary profile of the respondents. The diet survey revealed information regarding food habits, food frequency, frequency use and frequency of finger millet based food preparations.

**Table 4: Distribution of Respondents Based on their Socio Economic Characteristics (n=100)**

<b>Variables</b>	<b>Category</b>	<b>Score</b>	<b>Number</b>	<b>Percentage</b>
Employment status	Unemployed	0	62	62
	Government sector	1	8	8
	Private sector	2	23	23
	Casual laborer	3	7	7
Monthly income	980-2935	1	0	0
	2936-4893	2	0	0
	4894-7322	3	13	13
	7323-9787	4	22	22
	9788-19574	5	55	55
	≥19575	6	10	10
Livestock possessed	Nil	0	72	72
	Animal rearing	1	15	15
	Poultry rearing	2	13	13
Type of house	Own	1	73	73
	Rented	2	21	21
	Leased	3	6	6

### **4.3.1 Food Habits of the Respondents**

Table 5 shows the dietary habits of the respondents. It was found that majority of respondents were non- vegetarians i.e. about 90 per cent and vegetarians constituted only about ten per cent.

### **4.3.2 Frequency Use of Food Commodities**

From the Table 6 we can see that majority of the respondents were using cereals daily (100 per cent). With regard to millets only twelve per cent were using finger millet daily. Forty one per cent were using pulses daily. Majority of the respondents used vegetables daily (90 per cent). Only fifteen per cent were using leafy vegetables daily. Thirty seven per cent were using meat once a week. Sixty five per cent of respondents consumed fish daily. Thirty five per cent consumed eggs on alternative days. Only 45 per cent used fruits daily. Seventy one per cent respondents used milk and milk products daily. Coffee or tea was consumed daily by 82 per cent of the respondents. Snacks were consumed twice a week by 29 per cent of the respondents. Thirty per cent of the respondents consumed juices or drinks on alternative days.

### **4.3.3 Food Frequency Score Obtained for Various Food Items**

Frequency scores of different food commodities were calculated by using 'Reaburn scale'. Table 7 shows the food frequency of various food items. Frequency score was calculated by means of Reaburn Scale. It was found that cereals (5), pulses (4.16), vegetables (4.9), fish (4.46), milk and milk products (4.48) and coffee /tea (4.5) obtained the highest frequency score among all the food items while millets especially finger millet (1.66) and leafy vegetables (2.45) obtained the lowest scores. Frequency scores obtained for meat, egg, fruits, juice/drinks, snacks were found to be 3, 3.68, 3.83, 3.36 and 3.02 respectively. On the basis of the frequency scores the percentage was also calculated.

**Table 5: Distribution of respondents based on their dietary habit (n=100)**

<b>Dietary habit of respondents</b>	<b>Distribution of respondents</b>	
	<b>Number</b>	<b>Percentage</b>
Vegetarians	10	10
Non -vegetarians	90	90
Total	100	100

**Table 6: Frequency use of different food commodities**

<b>Food items</b>	<b>Daily (%)</b>	<b>Alternative days (%)</b>	<b>Twice a week (%)</b>	<b>Once a week (%)</b>	<b>Once in 3 months (%)</b>	<b>Never (%)</b>	<b>Total n=100</b>
Cereals	100	0	0	0	0	0	100
Milletts (ragi)	12	0	0	0	12	76	100
Pulses	41	41	11	7	0	0	100
Vegetables	90	10	0	0	0	0	100
Leafy vegetables	15	13	13	20	39	0	100
Meat	17	19	19	37	8	0	100
Fish	65	22	7	6	0	0	100
Egg	28	35	20	11	6	0	100
Fruits	45	8	35	9	3	0	100
Milk and Milk products	71	19	0	7	3	0	100
Coffee /Tea	82	2	5	6	5	0	100
Juice/ Drinks	22	30	20	18	10	0	100
Snacks	13	23	29	23	12	0	100

**Table 7: Food frequency score obtained for various food items**

<b>Food items</b>	<b>Food frequency scores</b>	<b>Per cent of total scores</b>
Cereals	5	100
Millets (ragi)	1.66	33.2
Pulses	4.16	83.2
Vegetables	4.9	98
Leafy vegetables	2.45	49
Meat	3	60
Fish	4.46	89.2
Egg	3.68	73.6
Fruit	3.83	76.6
Milk & milk products	4.48	89.6
Coffee /Tea	4.5	90
Juice / Drinks	3.36	67.2
Snacks	3.02	60.4



#### **4.3.4 Classification of Foods Based on Frequency Scores**

Based on the percentage food frequency scores the foods included in the daily diet of the respondents were classified as most frequently used (percentage scores above 80), frequently used (percentage scores between 50 to 80), less frequently used (percentage scores between 30 to 50) and least frequently used items (percentage scores below 30).

The Table 8 shows the frequency of use of foods by the respondents. The table revealed that cereals, pulses, vegetables, fish, milk and milk products and coffee/tea were most frequently used. Fruits, meat, egg, snacks, juices were frequently used and leafy vegetables were less frequently used while millet especially finger millet was least frequently used by the respondents.

#### **4.3.5 Percentage of Respondents Consuming Finger Millet at Different Stages of Life Cycle**

Consumption pattern of respondents were assessed by means of questionnaires and also by interviewing the respondents. Table 9 reveals that only 7 per cent of the respondents used finger millet for feeding children up to 2 years. Five per cent used finger millet daily and 2 per cent used it twice a week for feeding children up to 10 years. Among adolescents only 3 per cent used finger millet once a week, two per cent used finger millet once in 6 months and one per cent used it twice a week. Two per cent of the adults consumed finger millet once in 6 months. In physiological conditions like pregnancy and lactation it was found that none of the respondents consumed finger millet. One percent of the elderly group was consuming finger millet once a month and one per cent consumed it once in 6 months. Table 10, indicates that 21 per cent of the respondents used finger millet in the form of porridge and 5 per cent used finger millet in the preparation of puttu. The Table also indicates that no other food preparations were made with finger millet.

**Table 8: Classification of Foods Based on Frequency Scores**

<b>Most frequently used</b>	<b>Frequently used</b>	<b>Less frequently used</b>	<b>Least frequently used</b>
Cereals Pulses Vegetables Fish Milk & milk products Coffee/ Tea	Fruit Meat Egg Snacks Juice/ Drinks	Leafy vegetables	Millet (Finger millet)

**Table 9: Percentage of Respondents Consuming Finger Millet at Different Stages of Life Cycle (n=100)**

<b>Consumption pattern of finger millet</b>	<b>Daily (%)</b>	<b>Twice a week (%)</b>	<b>Once a week (%)</b>	<b>Once a month (%)</b>	<b>Once in 6 months (%)</b>	<b>Never (%)</b>
Children (0-2 yrs)	7	0	0	0	0	93
Children (3-10yrs)	5	2	0	0	0	88
Adolescent ( girl/boy)	0	1	3	0	2	94
Adults (men/women)	0	0	0	0	2	98
Pregnant women	0	0	0	0	0	100
Lactating mother	0	0	0	0	0	100
Elderly	0	0	0	1	1	98

**Table 10: Method of Consumption of Finger Millet by Respondents (n=100)**

<b>Method of preparation</b>	<b>Number</b>	<b>Percentage</b>
Porridge	21	21
Puttu	5	5
Laddu	0	0
Dosa	0	0
Idli	0	0
Idiyappam	0	0

#### 4.4 NUTRITIONAL STATUS ASSESSMENT OF THE RESPONDENTS

##### 4.4.1 BMI of the Respondents

Anthropometric measurements like height and weight of the respondents were assessed. On the basis of the measurements their BMI were calculated and the respondents were classified in to different categories like ‘chronic energy deficit’ (CED), ‘normal’ and ‘obese’. From Table 11 it can be seen that among the one hundred respondents, 37 per cent were in obese grade I category and 30 per cent were in obese grade II category. Twenty eight percent were in the normal category while two per cent of the respondents came in the category of low weight to normal. One per cent was having mild chronic energy deficiency and 2 per cent of the respondents were having severe chronic energy deficiency.

##### 4.4.2 Haemoglobin Level of the Respondents

The biochemical assessment of the respondents was conducted by estimating the haemoglobin level. Table 12 shows the distribution of respondents based on their haemoglobin level. Table 13 indicated that 29 per cent of the respondents were non anaemic. Twenty one per cent of the respondents were in the marginally anaemic category. Thirty per cent of the respondents were mildly anaemic while 17 per cent were moderately anaemic and 3 per cent were severely anaemic.

#### 4.5 PREVALENCE OF LIFE STYLE DISEASES

The disease history of the respondents was assessed by means of questionnaire. Table 13 reveals the disease history of the respondents. It can be seen that 18 per cent of the respondents were suffering from diabetes, 10 per cent were having hyper tension and 13 per cent were having hypercholestermia. About 59 per cent of the respondents were free from these life style diseases.

**Table 11: Distribution of Respondents Based on their BMI**

BMI of the respondents	Category	Distribution of respondents	
		Number	Percentage
CED grade III (severe)	<16	2	2
CED grade II (moderate)	16 - 17	0	0
CED grade I (mild)	17- 18.5	1	1
Low weight- normal	18.5- 20	2	2
Normal range	20-25	28	28
Obese (grade I)	25-30	37	37
Obese (grade II)	≥30	30	30

**Table 12: Distribution of Respondents Based on their Haemoglobin Level**

Hb level of the respondents (gm/dl)	Category	Distribution of respondents	
		Number	Percentage
<7.9	Severe	3	3
8-9.9	Moderate	17	17
10-10.9	Mild	30	30
11-11.9	Marginal	21	21
>12	Non anaemic	29	29

**Table 13: Prevalence of Life Style Diseases among the Respondents**

<b>Disease history of the respondents</b>	<b>Distribution of the respondents</b>	
	<b>Number</b>	<b>Percentage</b>
Diabetes	18	18
Hypertension	10	10
Cholesterol	13	13
Heart diseases	0	0
Nil	59	59
Total	100	100

#### 4.6 ACCEPTABILITY STUDIES ON FINGER MILLET RECIPES

Ten ragi based recipes which are already developed by institutions like NIN, CFTRI, Food and Nutrition Board were collected, prepared and subjected to acceptability tests among a panel of judges, for finding out the suitability of selecting of these recipes. The Table 14 revealed that ragi laddu, pakoda, chocolate milk shake and halwa obtained the highest acceptability scores among the ten ragi based recipes. The scores obtained were ragi laddu (4.7), ragi halwa (4.1), ragi pakoda (4.1) and ragi chocolate milk shake (4). These highly accepted four recipes were again subjected for consumer preference tests.

#### 4.7 CONSUMER PREFERENCE TEST

Consumer preference tests were conducted to find the highly preferred dishes for taking up these on a commercial basis. As revealed in the Table 15 laddu was liked extremely by majority (55 per cent) of the respondents, whereas pakoda was liked extremely by 40 per cent of the respondents. Halwa was liked very much by 40 per cent while milk shake was liked moderately by 40 per cent of the respondents.

#### 4.8 IMPACT ASSESSMENT OF THE AWARENESS PROGRAMME

Impact assessment of the programme was conducted by assessing change in knowledge, attitude and consumption practices of the respondents after the programme. Table 16 shows the mean scores obtained by the respondents with regard to knowledge, attitude and consumption practices before and also after the awareness programme. The mean knowledge score of the respondents before the awareness programme was 11.48 out of a maximum of 20. After the awareness programme the mean knowledge score was increased to 18.57 showing the effectiveness of the awareness programme. The mean attitude score of the respondents before the awareness programme was 64.7 out of a maximum of 110. After the awareness programme the mean knowledge score was increased to 84.52. The mean score obtained for the consumption practices of finger millet

**Table 14: Acceptability of Finger Millet Based Recipes**

<b>Recipes</b>	<b>Appearance</b>	<b>Colour</b>	<b>Flavour</b>	<b>Texture</b>	<b>Taste</b>	<b>Overall acceptability (5 point scale)</b>
Ragi roti	2.1	2.06	1.7	1.9	2.1	1.9
Ragi laddu	4.6	4.8	4.6	4.6	4.9	4.7
Ragi pudding	1.6	2.8	3.1	2.7	3.1	2.6
Ragi pakoda	4.1	4.2	4.1	3.7	4.6	4.1
Ragi cake	3.4	3.6	2.9	3	3.2	3.2
Ragi health drink	3	2.8	3	2.8	2.6	2.8
Ragi cutlet	2.9	2.5	2.2	3	2.8	2.6
Ragi chocolate milk shake	4.2	4.1	4	3.5	4.5	4
Ragi halwa	4.1	4	4.3	4	4.1	4.1
Ragi dosa	2	1.8	2	2	1.5	1.8



**Table 15: Distribution of Respondents Based on their Preference of Finger Millet Recipes**

<b>Products</b>	<b>Like extremely</b>	<b>Like very much</b>	<b>Like moderately</b>	<b>Like slightly</b>	<b>Neither like nor dislike</b>
Laddu	55	33	5	5	2
Pakoda	40	30	22	5	3
Halwa	30	40	20	5	5
Milk shake	10	25	40	15	10

**Table 16: Impact of Awareness Programme on KAP of Respondents**

<b>Variables</b>	<b>Mean score</b>		<b>t-value</b>
	<b>Pre -test</b>	<b>Post -test</b>	
Knowledge	11.480	18.570	40.054**
Attitude	64.700	84.520	29.500**
Consumption practices	0.170	12.770	43.464**

\* \*\*Significant at 1 per cent level

was 0.17 before the awareness programme and afterwards the mean score was increased to 12.77 out of a maximum of 28. It can be seen that there was significant difference between the pre and post test scores.

#### **4.8.1 Impact of Awareness Programme on Knowledge Gain**

Knowledge gain of respondents was assessed by using a set of closed ended questions on use of finger millet before and after the awareness programme. Each question was given a unit score of one for correct answer and zero for wrong answer. The difference between pre and post test score was taken as knowledge gain of an individual. On the basis of mean score and standard deviation of knowledge, the respondents were classified into three categories such as low, medium and high.

From Table 17 it can be seen that among the one hundred respondents surveyed, majority (72 per cent ) had a medium level of knowledge , low level of knowledge was seen among 12 per cent of the respondents and 16 per cent had a high level of knowledge about the finger millet before the awareness programme. After the awareness programme their knowledge level increased to a high level (51 per cent) and 47 per cent came in medium level of knowledge and only 2 per cent were in low level of knowledge regarding importance of finger millet consumption.

#### **4.8.2 Change in Attitude of the Respondents**

Change in attitude was measured using a check list of twenty two statements before and after the awareness programme. On the basis of mean score and standard deviation of the attitude, the respondents were classified into three categories such as those having low, medium and high, attitude towards consumption of finger millet. Table 18 depicted that prior to the awareness programme, 63 per cent of the respondents had a medium level of attitude while 20 per cent had a low attitude and only 17 per cent had high attitude towards finger millet consumption before the awareness programme. After the awareness

**Table 17: Classification of Respondents Based on their Knowledge Scores**

Category	Percentage	
	Pre test	Post test
Low (mean+ SD)	12	2
Medium (mean+/- SD)	72	47
High (mean+ SD)	16	51
Total	100	100

**Table 18: Classification of Respondents Based on their Attitude Scores**

Category	Percentage	
	Pre test	Post test
Low (mean+ SD)	20	12
Medium (mean+/- SD)	63	57
High (mean+ SD)	17	31
Total	100	100

programme their attitude had slightly increased to a high level (31 per cent) , 57 percent were remaining in the medium levels and only 12 per cent were having a low attitude towards the finger millet consumption.

#### **4.8.3 Consumption Practices of Finger Millet after the Awareness Programme**

Change in the consumption practices of finger millet was assessed by interviewing the respondents. On the basis of mean and standard deviation of the consumption practices, the respondents were classified into three categories such as those having low, medium and high consumption practices of finger millet.

From Table 19 it can be seen that all the respondents had low consumption practices of finger millet (100 per cent) before the awareness programme. After the awareness programme their consumption practices increased to a high level (80 per cent) and low consumption practices was seen only among 20 per cent of the respondents.

**Table 19: Classification of respondents based on their consumption practices of finger millet**

Category	Percentage	
	Before	After
Low (mean+ SD)	100	20
Medium (mean+/- SD)	0	0
High (mean+ SD)	0	80
Total	100	100

# *Discussion*

## 5. DISCUSSION

The findings of the study entitled “Capacity Building of Rural Women on Enhancement of Family Nutrition and Livelihood Security through Consumption and Value Addition of Finger Millet” were statistically analyzed and presented in the previous chapter. These findings with relevant research support are discussed in this chapter under the following headings.

- 5.1 Personal characteristics of the respondents
- 5.2 Socio-economic characteristics of the respondents
- 5.3 Food consumption pattern with special reference to finger millet
- 5.4 Nutritional status assessment of the respondents
- 5.5 Prevalence of life style diseases
- 5.6 Acceptability studies on finger millet recipes
- 5.7 Consumer preference tests
- 5.8 Impact assessment of the awareness programme

### 5.1 PERSONAL CHARACTERISTICS OF THE RESPONDENTS

The personal characteristics of the respondents studied comprised of age, religion, caste, educational status and family type of the respondents. The above mentioned information were collected through direct interview with the subjects using an interview schedule and were statistically analyzed in detail. The result revealed that majority of the respondents (70 per cent) belonged to the middle age group between 36-55 years. The study is supported by Park (1997) who opined that the demographic profile of India is fast changing and is characterized by adult population forming 60 per cent.

As per the data from GOK State Planning Board (2013) [Hindus](#) comprise 65 per cent of the population, Christians are about 20 per cent of the population, and Muslims are about 15 per cent. The present study revealed that eighty per cent of the respondents were Hindus. Six per cent of the respondents were Muslims and fourteen per cent constituted Christians.

Caste is the oldest institution of the Indian society and has a great influence on the attitude and behavior of an individual. Arora (1991) reported that caste is a unique institution of the Indian society. Hence caste system of hundred families were analyzed and it was observed that majority of the families (forty six per cent) belonged to forward communities and forty four per cent were from other backward communities while ten per cent respondents belonged to Scheduled Caste groups.

According to the GOK State Planning Board (2013), Kerala is the most literate state in India with a literacy rate of 91 percent for the population age 7 and above. By contrast, the corresponding literacy rate for India as a whole is only 65 percent. In this study the educational status of the respondents revealed that sixty three per cent had studied up to pre-degree and 20 per cent had studied up to high school. Fifteen per cent had studied up to degree level and only two per cent had studied up to upper primary level. None had done post graduation and none of them were illiterate.

Sheethal (2011) has reported that family is a complex and dynamic institution in India. Joint family is now slowly giving way to nuclear families the mean size of joint families is almost twice the mean size of the nuclear families throughout India. Examining the changes that have taken place in the composition of the family since 1981, it was observed that the percentage of nuclear families has increased consistently. The findings of the study are in line with the above. Majority of the respondents (eighty per cent) belonged to nuclear family and twenty per cent belonged to joint family. Nuclear family has become a prevalent norm in Kerala as reported by Buliyya *et al.* (2002), and Gupta and Tripathi (2006). Studies conducted by NFHS 3 Survey (2006), in Kerala found that majority of all households are of nuclear type.

## 5.2 SOCIO ECONOMIC CHARACTERISTICS OF THE RESPONDENTS

Ramankutty (2010) reported that better socioeconomic status of women is reflected in better literacy, better work participation and greater independence



within and outside the family. Hence the personal and socio-economic characteristics of the respondents were ascertained.

The National Population Policy adopted by the Government of India in 2000 (MOHFW, 2000) explicitly recognizes the importance of women's paid employment in achieving the goal of population stabilization in India and also specifies measures to encourage paid employment and self-employment of women. The present study also revealed that majority of the respondents was unemployed (62 per cent). Twenty three per cent were having private jobs, 8 per cent were in the government sector and 7 per cent were casual laborers while 5 per cent were farmers. Unemployment is a major problem in India which affects the work performance of the country's population. This might be due to lack of job opportunities and the fact that majority of them were housewives. This finding is also similar with the findings of Cicil (2000).

Arora (1991) suggested that household income should be taken in to consideration because it is the family income which really determines the family's status and socio-economic strata of the society to which they belong. The present study indicated that 55 per cent of the respondents had family income in the range of Rs. 9788 to 19574 and belonged to middle income group.

The present study indicated that seventy two per cent of the respondents were not engaged in any livestock rearing. Fifteen per cent were engaged in animal rearing and thirteen per cent were engaged in poultry rearing.

Details about the housing of the respondents were collected. It was found that majority of the respondents (73 per cent) were having own houses and 21 per cent of the respondents lived in rented houses and 6 per cent in leased buildings.

### 5.3 FOOD CONSUMPTION PATTERN WITH SPECIAL REFERENCE TO FINGER MILLET

In order to find out the frequency of use of different foods especially finger millet in the diet, the details regarding the food consumption practices of the respondents were studied through diet survey. The diet survey revealed the information regarding food habits, food use frequency, frequency use and preparations of finger millet.

#### 5.3.1 Food Habits

Robinson *et al.* (2009) opined that the dietary habit of an individual in general has influence on his or her nutritional status.

The results of the present study revealed that majority of respondents were non-vegetarians (90 per cent). Consumption pattern of Keralites as reported by Kerala Statistical Institute (2001) also revealed that 98 per cent of the Keralites are habituated to non-vegetarian foods. Similar results were observed by Beatrice (1999), Krishnaroop (2003), Reshmi (2007), Unnithan (2008), and Sheethal (2011) in their studies undertaken in Thiruvananthapuram district. Now a day's most of the people are interested in the novel foods. Hence fast foods have an important place in the daily diets. This could be the reason for the non vegetarian habit being more prevalent in Kerala.

#### 5.3.2 Frequency of Use of Food Commodities

The consumption of a wide variety of nutritious foods is important for good health. Adequate amounts of protein, fat, carbohydrates, vitamins, and minerals are required for a well-balanced diet (Gopalan *et al.*, 2004).

On assessing the frequency in use of food commodities by the respondents it was found that majority of the respondents were using cereals daily (100 per cent) because rice is the staple food for Keralites. With regard to millets, only

twelve per cent used finger millet daily. Thirty seven per cent of them were using meat once a week. Sixty five per cent consumed fish daily. A similar observation was reported by Karuna (2000). Nirmala *et al.* (2000) also reported that in Kerala consumption of fish was high. Thirty five per cent consumed eggs on alternative days. Only 45 per cent of them were using fruits daily. Seventy one per cent respondents were using milk and milk products daily. Coffee or tea was consumed daily by 82 per cent of the respondents. Juna (2005) also reported that all the surveyed respondents were found to be consuming coffee/tea daily in their diets.

### **5.3.3 Food Frequency Score Obtained For Various Food Items**

Food frequency score was calculated by means of Reaburn Scale. Food frequency scores of the different food commodities revealed that cereals, pulses, vegetables, fish, milk and milk products and coffee/tea obtained the highest frequency scores. On the basis of the frequency scores, the percentage was also calculated.

Based on the percentage of food frequency scores the foods included in the daily dietaries by the respondents were classified as most frequently used (percentage scores above 80), frequently used (percentage scores between 50 to 80), less frequently used (percentage scores between 30 to 50) and least frequently used items (percentage scores below 30). It was found that cereals, pulses, vegetables, fish, milk and milk products and coffee/tea were most frequently used. Leafy vegetables were less frequently used while millet especially finger millet was least frequently used by the respondents.

### **5.3.4 Percentage of Respondents Consuming Finger Millet at Different Stages of Life Cycle**

Finger millet is much more nutritious than cereals like rice, sorghum, wheat and is available at a cheaper price. Finger millet can be used to handle harsh situations like famine and large number of poor people suffering from malnutrition (Watt and Brandwijk, 1992). Despite finger millet's rich nutrient

profile, recent studies indicated lower consumption of millets in both rural and urban Indians (Shobhana *et al.*, 2013).

In this study, the consumption pattern of finger millet at different stages of life cycle revealed that only 12 per cent respondents using finger millet daily for feeding their children up to ten years. In physiological conditions like pregnancy and lactation they were not consuming finger millet at all. It was also found that some of the respondents used finger millet for feeding their family members but were not consuming it themselves. The method of consumption of finger millet revealed that 21 per cent consumed finger millet in the form of porridge while 5 per cent consumed it in the form of 'puttu'. It was also found by interviewing the respondents that they were not much familiar with different finger millet based recipes, and so they were not using finger millet for any other preparations.

#### 5.4 NUTRITIONAL STATUS ASSESSMENT OF THE RESPONDENTS

According to Park and Park (1991) anthropometric measurements are valuable indicators of nutritional status. In the present study height and weight of the respondents were taken and on the basis of their height and weight their BMI was calculated to assess their nutritional status.

##### 5.4.1 BMI of the Respondents

BMI is an indicator of body's energy stores as reported by Choudary and Solanki (2005). Experts from NIN are of opinion that BMI values between 18.5 and 25 can be considered as compatible with health for both men and women.

In the present study 28 per cent of the respondents were found to fall in the normal range of BMI implicating that their current nutritional status was satisfactory. However thirty seven per cent of the respondents surveyed had BMI above 25 and belonged to obese grade I category and thirty per cent had BMI above 30 and belonged to grade II category. According to Mammi *et al.* (1991) the nutrition of Keralites is now that of over nutrition in terms of significant

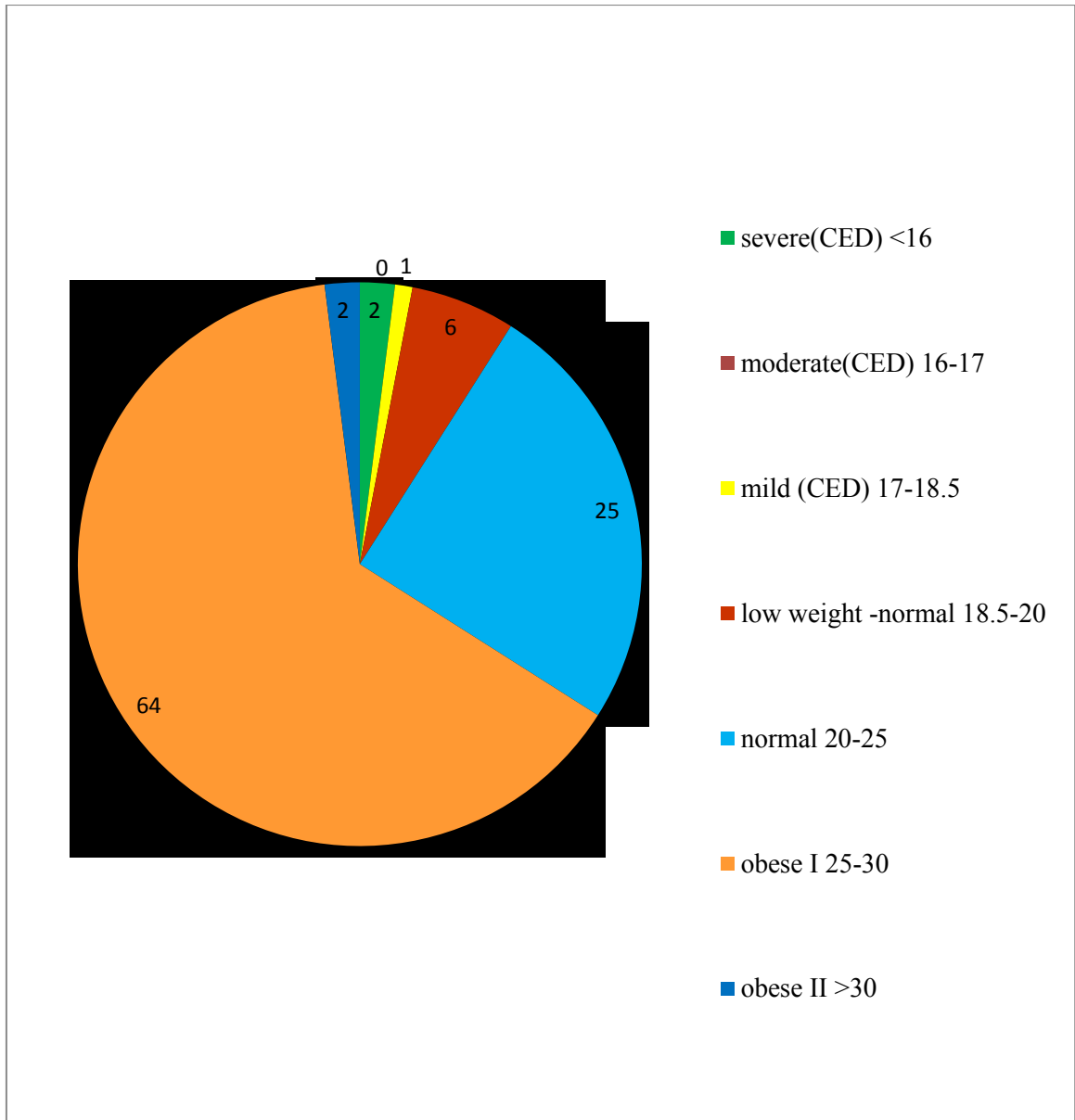
positive energy balance. Inactivity of Keralite women has transformed them into obese metabolically abnormal individuals, who have lost the protection offered by the female sex hormones. Low levels of physical activity, watching television, and consuming junk foods are associated with a higher prevalence of overweight. There is an urgent need to educate the urban community on the aspects of healthy food habits and desired lifestyles to prevent overweight/obesity and its associated ill effects (Unnikrishnan *et al.*, 2012). Two per cent were having severe chronic energy deficiency and 1 per cent of the respondents were having mild chronic energy deficiency. Figure 1 shows the BMI levels of the respondents.

#### **5.4.2 Haemoglobin Level of the Respondents**

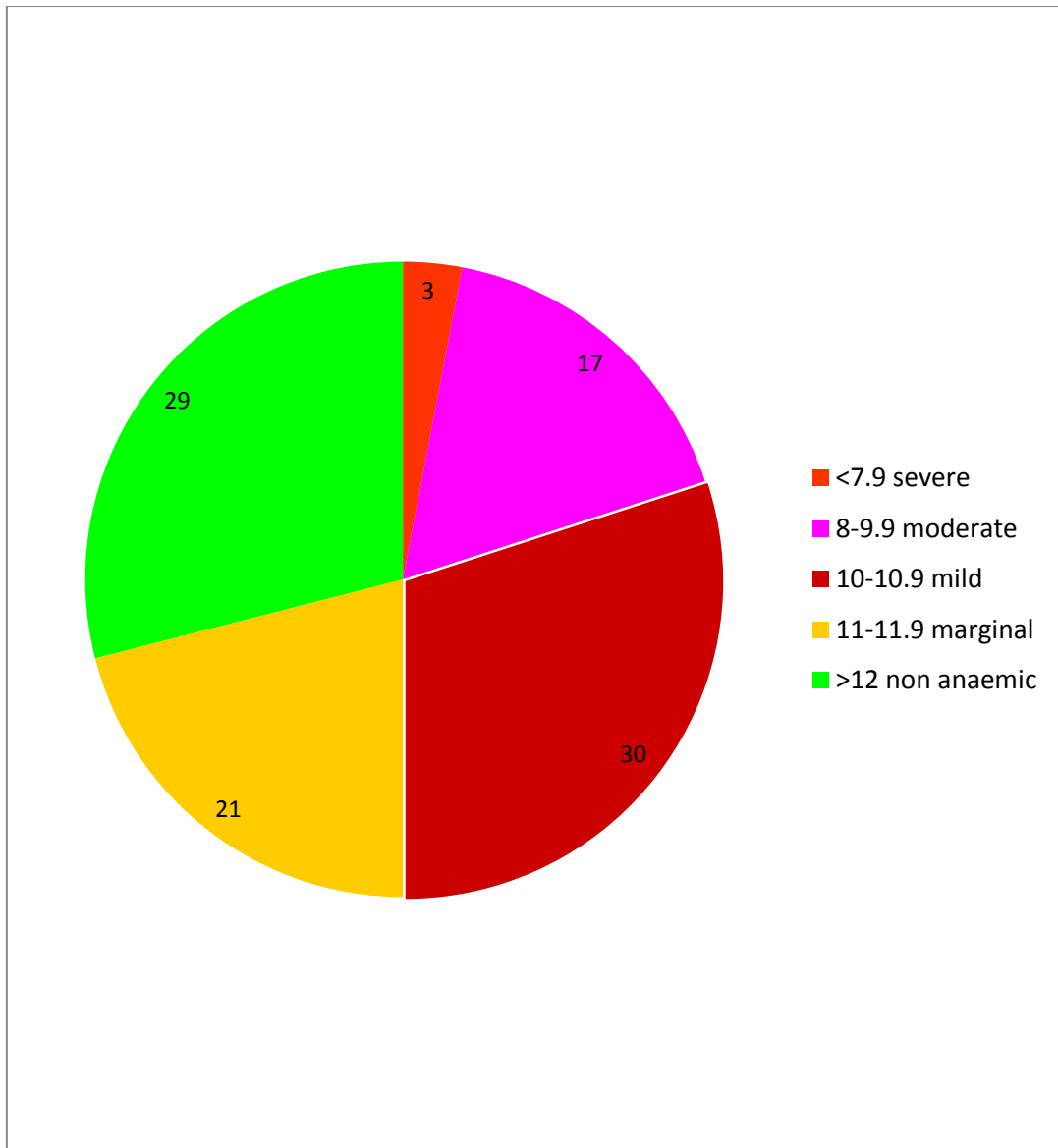
Anaemia is characterized by a low level of haemoglobin in the blood. Iron deficiency is the most widespread form of malnutrition in the world, affecting more than two billion people (Stolzfus *et al.*, 2003). In India, anaemia affects an estimated 50 percent of the population (Seshadri and Subadra, 2010).

Anemia is a nutrition problem worldwide and its prevalence is higher in developing countries when compared to the developed countries. Anemia prevalence among children of school-going age is 37.70 per cent, among non-pregnant women 35 per cent and among adult males 18 per cent. There are few data concerning anemia in adolescents and in elderly people which precludes any precise estimates for these two groups but it is thought that the prevalence rate for adolescents is close to that for adult females and the rate for the elderly is slightly higher than that for adult males (Sudhagandhi *et al.*, 2011).

In the present study haemoglobin estimation of the respondents revealed twenty one per cent of the respondents were marginally anaemic thirty per cent of the respondents were mildly anaemic while 17 per cent were moderately anaemic and 3 per cent were severely anaemic. Figure 2 shows the haemoglobin level of the respondents.



**Fig. 1: Distribution of Respondents Based on their BMI**



**Fig. 2: Distribution of Respondents Based on their Haemoglobin Level (g/dl)**

## 5.5 PREVALENCE OF LIFE STYLE DISEASES

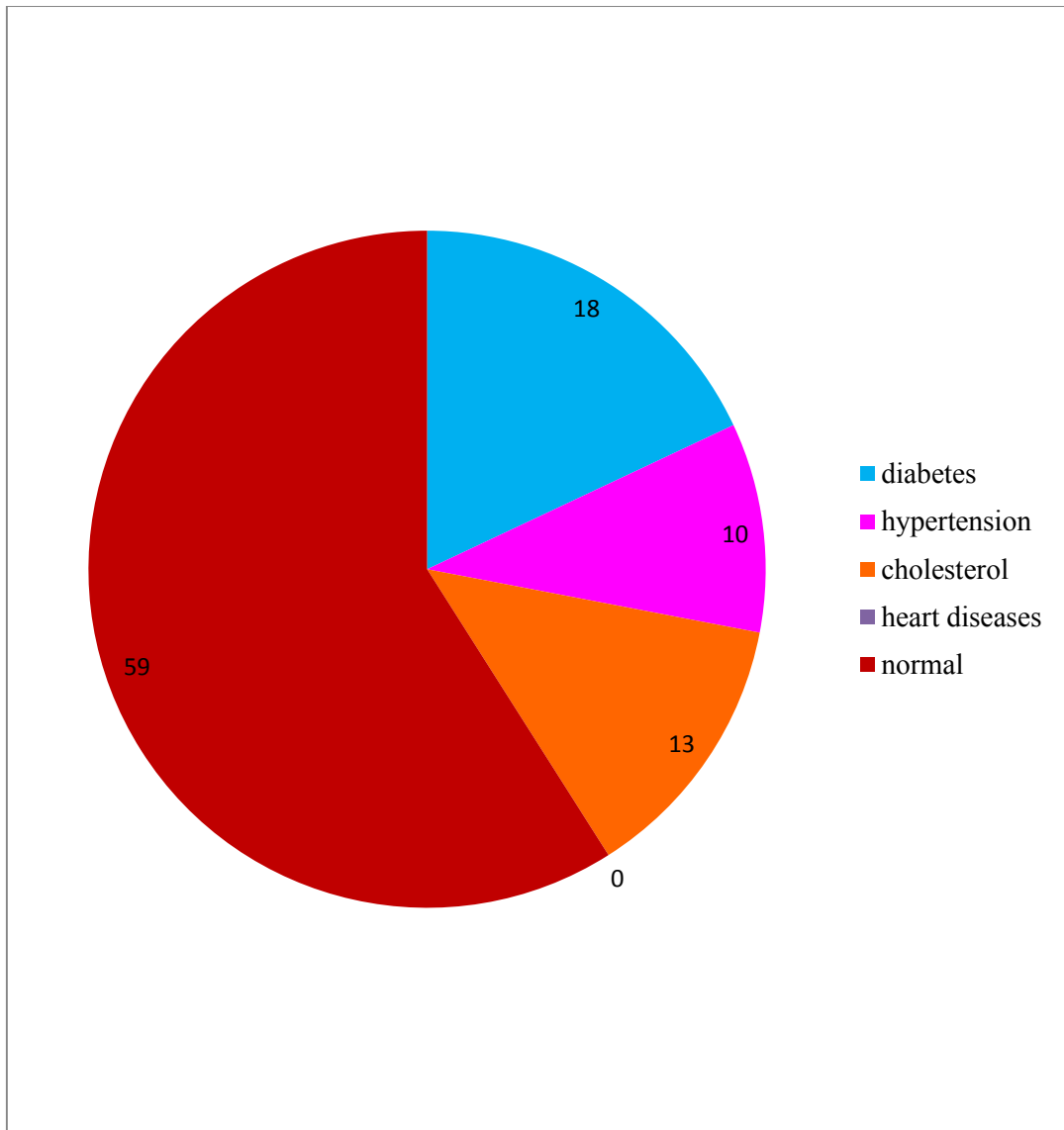
Diseases linked to our way of life are growing, in every country of the world, lack of proper knowledge, inadequate time, faulty eating habits, lack of exercise, smoking are all to blame for lifestyle diseases particularly for household women who are neglected the most (Hiremath *et al.*, 2014).

The disease history of the respondents was assessed by means of questionnaire and it was found that about 59 per cent of the respondents were free from life style diseases. Eighteen per cent were suffering from diabetes, 10 per cent were having hyper tension and 13 per cent were having hypercholestermia. A study conducted by Bindhu *et al.* (2014) in Thiruvananthapuram district revealed that the prevalence of hypertension and pre-hypertension is high in the rural area. It was also found by interviewing them that in such conditions they were not using finger millet, which may help to reduce the incidence of such diseases. Figure 3 shows the disease profiles of the respondents.

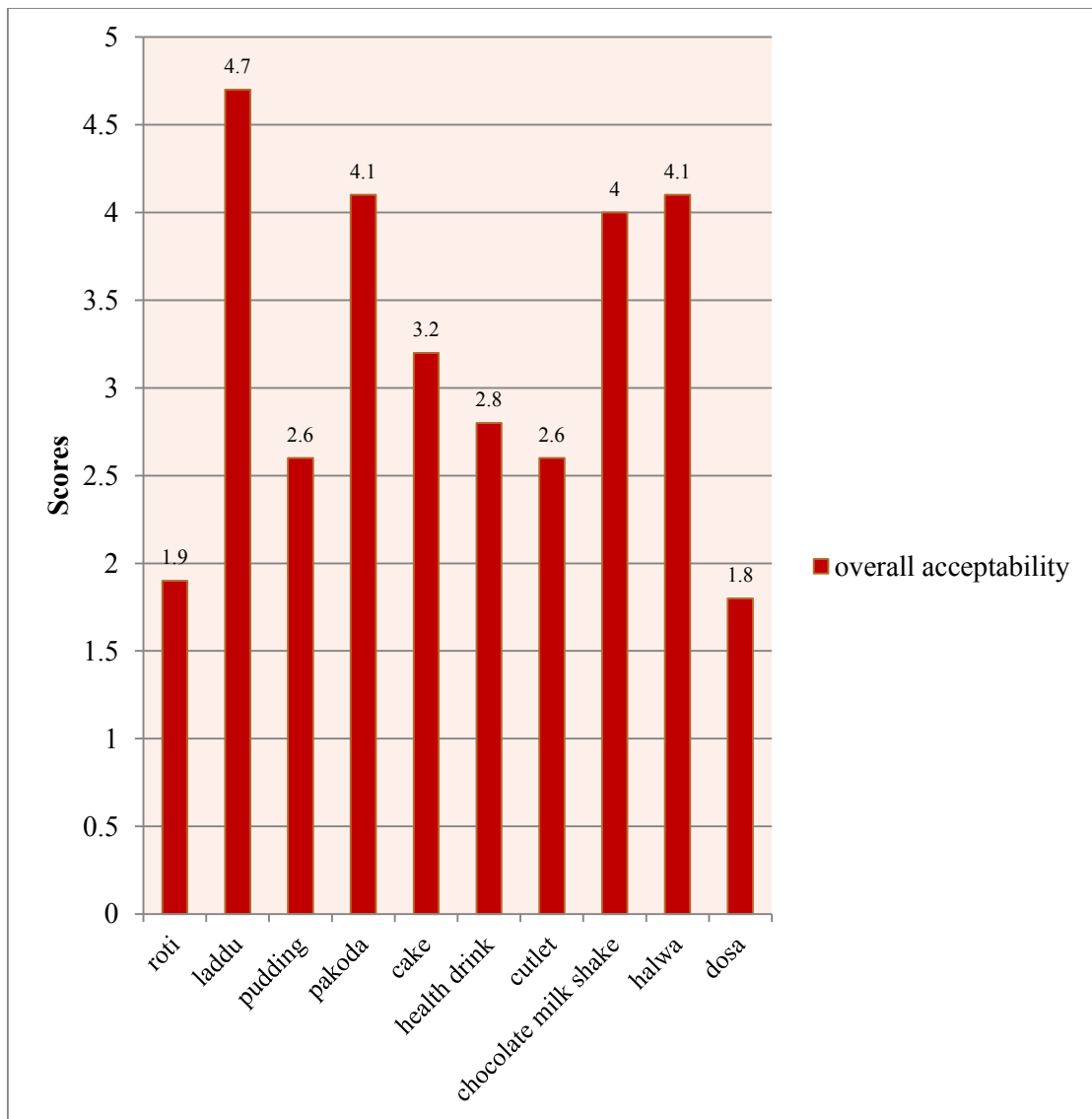
## 5.6 ACCEPTABILITY STUDIES ON FINGER MILLET RECIPES

Acceptability of finger millet recipes was assessed in terms of organoleptic qualities like appearance, flavour, colour, taste and texture. Organoleptic quality plays an important role in evaluating the quality of food products. For an average consumer, the concept of food quality consists in those related to the sensory characteristics which may be classified in accordance with human senses of perception as appearance, texture, odour and taste (Setty, 2009). Appearance is a composite of all information about the product and its environment which reaches the eye (Birch *et al.*, 2002). Flavour is an important factor which enriches the consumer's preference to a particular food (Ranganna, 2006). Clydesdale (2008) reported that colour affected the perception of other sensory characteristics such as taste and flavour. According to Rolls *et al.* (2011), in the quality attribute tests, the first preference goes to taste followed by appearance, texture and colour.





**Fig. 3: Prevalence of Life Style Diseases among the Respondents**



**Fig. 4: Overall Acceptability of the Finger Millet Recipes**

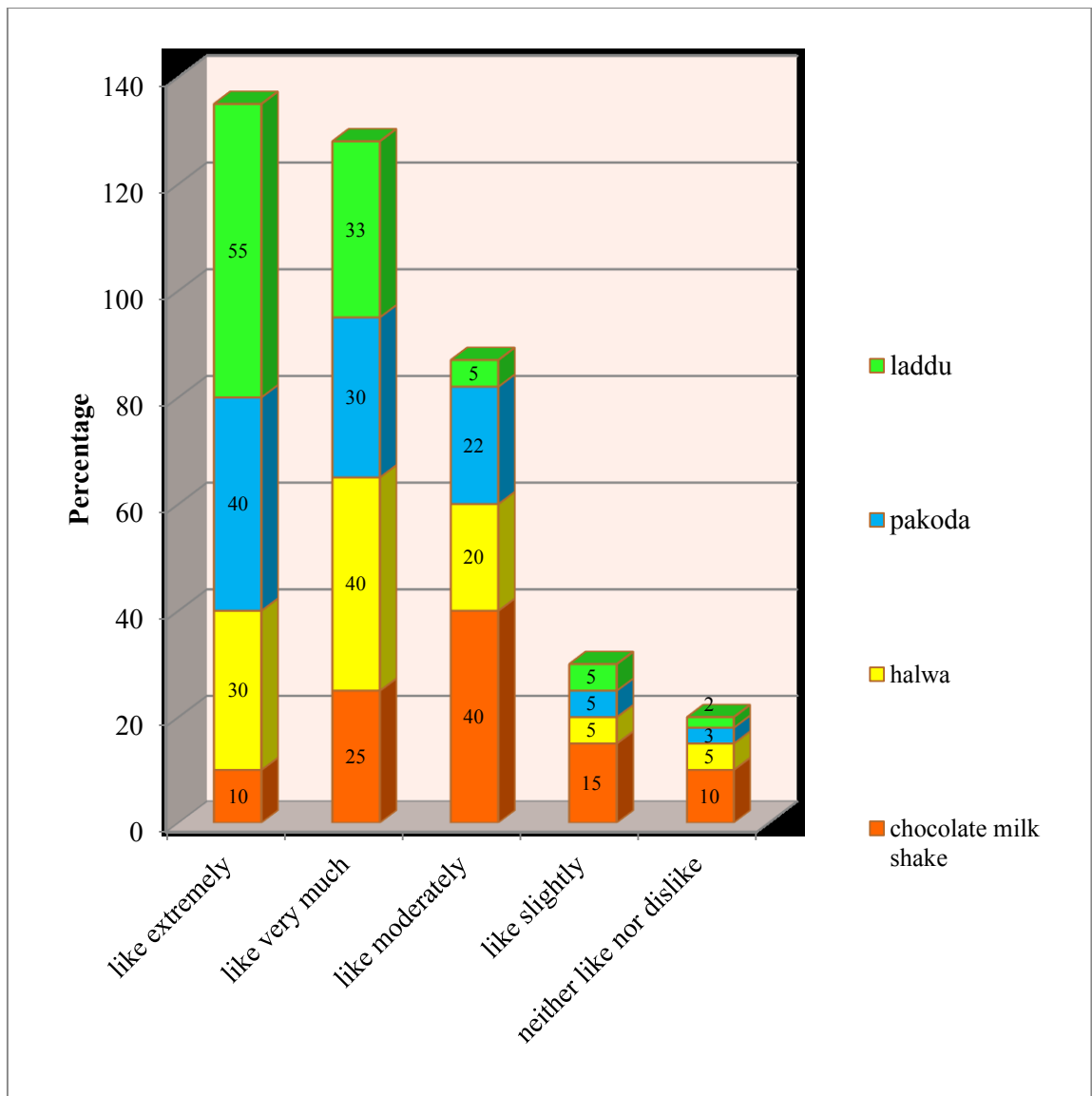
Texture is a percentage resulting from interaction between food and consumer (Jack *et al.*, 2005).

In the present study the overall acceptability depends on the concentration or amount of the particular components, nutritional and other hidden attributes of a food and its palatability or sensory quality. Indian Food Industry (2008) reported that the quality is the main criteria on which the acceptability of any product depends. Here, the overall acceptability scores were determined by pooling up the scores obtained for different quality attributes (appearance, flavour, colour, taste and texture) of each finger millet recipe. It was observed that laddu, pakoda, chocolate milk shake and halwa obtained the highest acceptability scores among the ten finger millet based recipes. These highly accepted four recipes were again subjected to consumer preference tests to find the highly preferred ones for taking up these on a commercial basis. The selected recipes were also utilized for recipe demonstration during the awareness programme. Figure 4 shows the overall acceptability of the finger millet products.

#### 5.7 CONSUMER PREFERENCE TEST

One of the objectives of this study was to popularize value added finger millet products so that they would be taken up by the respondents as an income generating activity in addition to increasing consumption of finger millet in their families. So, consumer preference tests were conducted among consumers. Preference studies are designed to determine consumer's subjective reactions to external phenomena and their reasons for having them. According to Watt (1999), most consumers have fairly fixed ideas and know what to expect in terms of sensory quality of a given processed food. Consumer's reactions towards new products are of great importance.

The consumer preference tests revealed that laddu was liked extremely by majority (55 per cent) of the consumers, whereas pakoda was liked extremely by 40 per cent of the consumers. Halwa was liked very much by 40 per cent while



**Fig. 5: Distribution of Respondents Based on their Preference of Finger Millet Recipes**

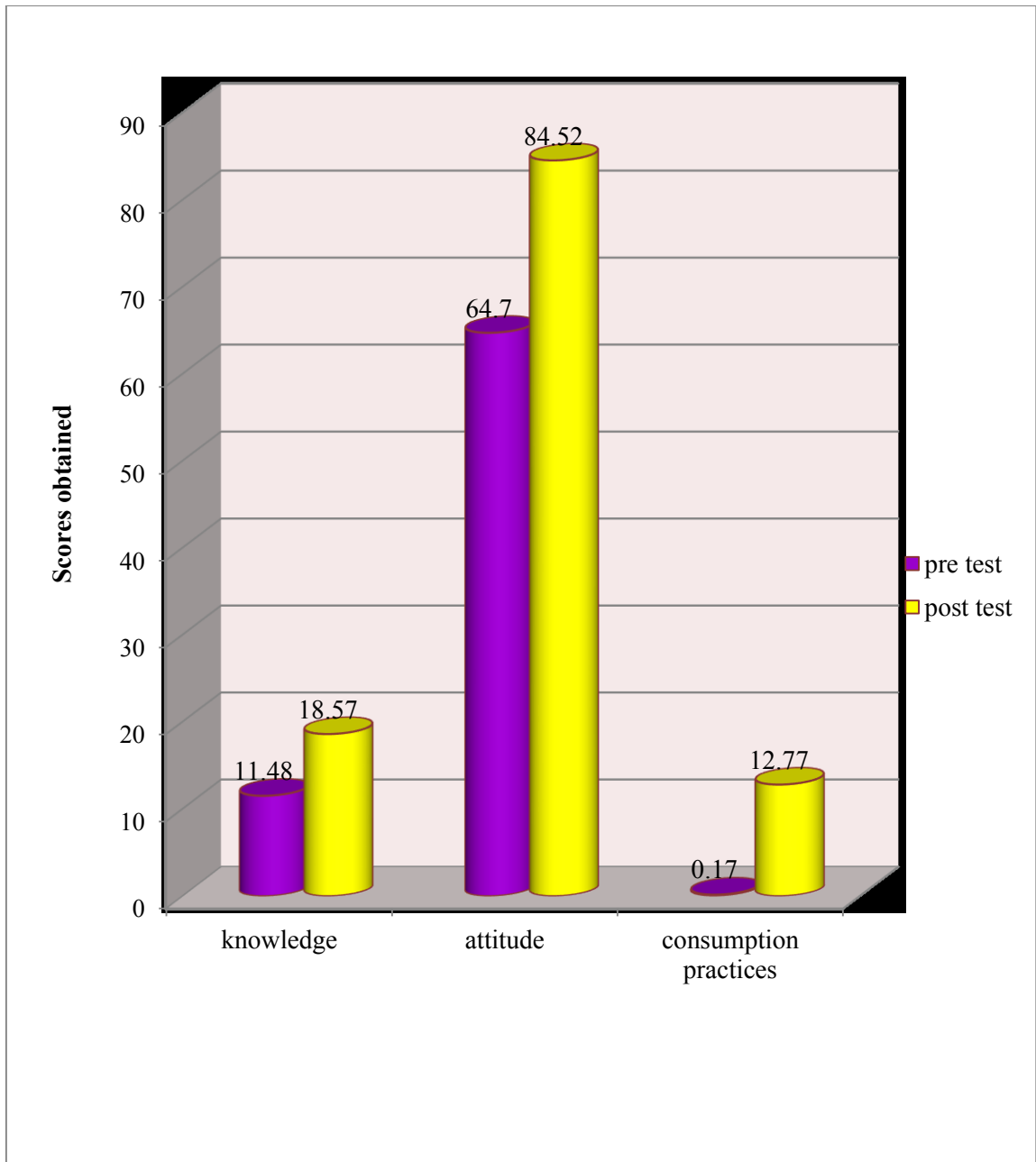
chocolate milk shake was liked moderately by 40 per cent of the consumers. Figure 5 shows the percentage of preference obtained for the finger millet products by the consumers.

## 5.8 IMPACT ASSESSMENT OF THE AWARENESS PROGRAMME

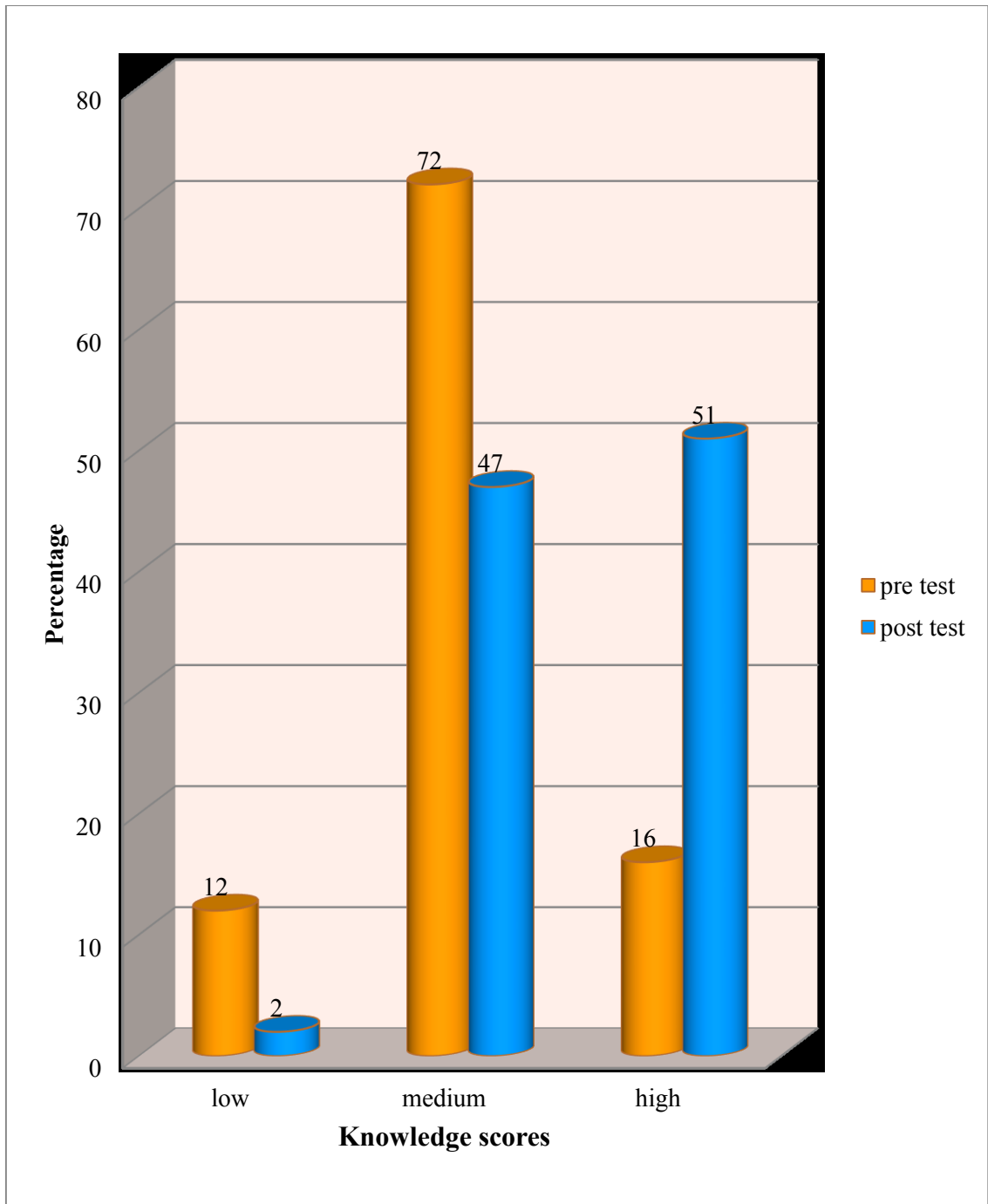
The present study revealed that majority of the selected respondents reported low consumption of finger millet prior to the conduct of the awareness programme. The awareness programme was conducted through a campaign approach with the objective of reinforcing the message of importance of finger millet consumption and consisted of nutrition education supplemented with charts, posters, folders and booklet, slide show, demonstration of selected recipes, discussion and exhibition of finger millet based products. The impact was assessed one month after the awareness programme in order to find out the change in knowledge, attitude and consumption of finger millet by the respondents. The mean scores obtained for knowledge (18.57), attitude (84.52) and consumption practices (12.77) were also seen to be increased after the conduct of the awareness programme. Figure 6 shows the impact of the awareness programme.

### 5.8.1 Impact of Awareness Programme on Knowledge Gain

A knowledge test was administered to the respondents before and after the awareness programme to measure if there was any increase in their knowledge about finger millet and its importance to human health. Among the one hundred respondents surveyed, majority (72 per cent) had a medium level of knowledge. After the awareness programme their knowledge level was increased to a high level (51 per cent) and 47 per cent came in the medium level of knowledge and only 2 per cent were in low level of knowledge regarding importance of finger millet consumption. This may be due to the effectiveness of the awareness programme conducted. The respondents were exposed to multimedia education programme like slide show, charts, folders and booklets which enabled them to



**Fig. 6: Impact of Awareness Programme on KAP of Respondents**



**Fig. 7: Classification of Respondents Based on their Knowledge Scores**

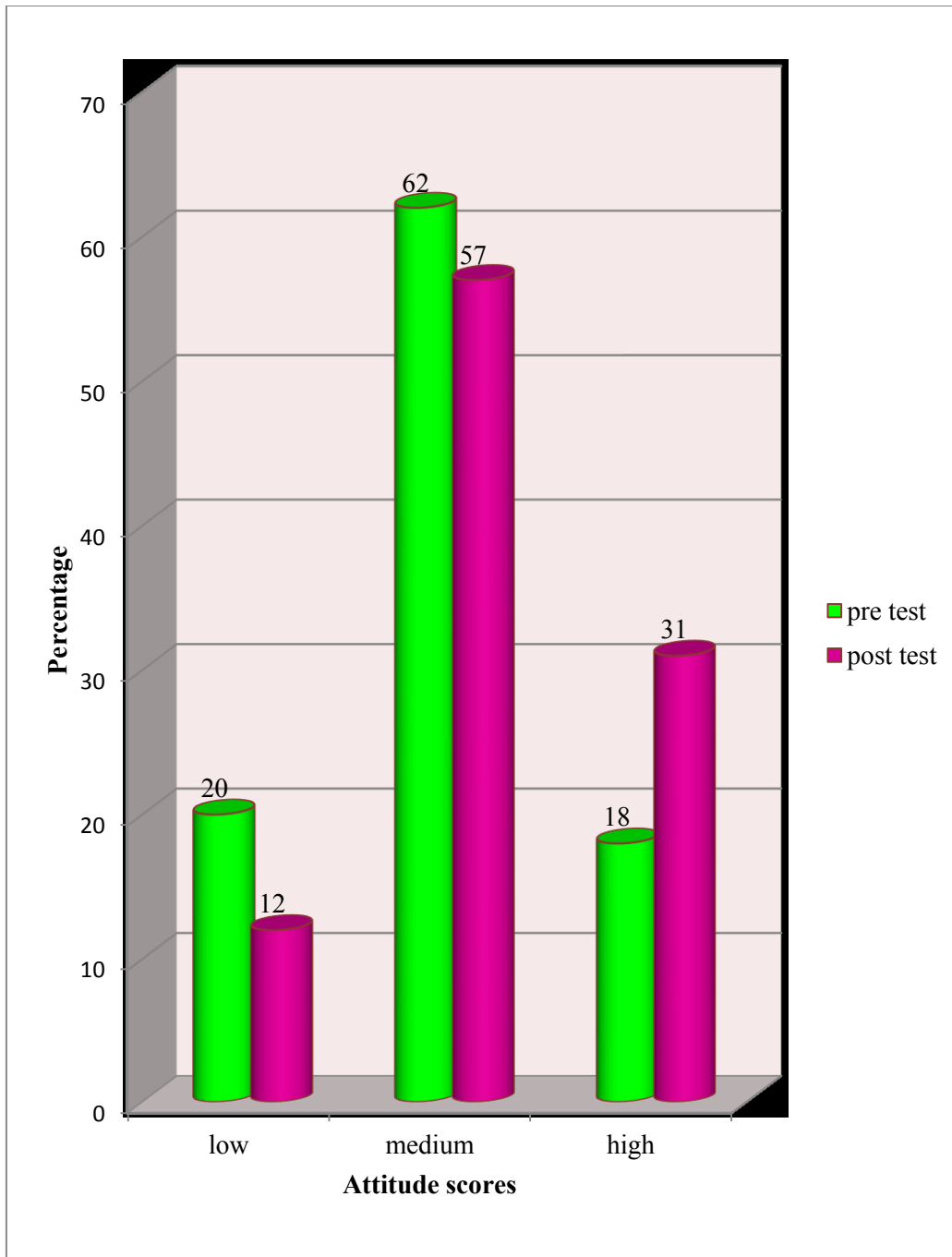
understand the importance of finger millet. Several studies have shown that nutrition education increases the nutritional knowledge of the respondents (Sajitha, 2000; Razeena, 2000; Sheela, 2004; Krishnendu, 2012). Figure 7 shows the classification of respondents based on their knowledge scores.

### **5.8.2 Change in Attitude of the Respondents**

An attitude test was administered to the respondents before and after the awareness programme to measure their attitude towards finger millet. It was found that prior to the awareness programme, the attitude of 63 per cent of the respondents towards finger millet consumption was medium and attitude of only 18 per cent of the respondents was high. After the awareness programme, it was found that 31 per cent of the respondents had high attitude. The attitude of 57 percent was medium and attitude of 12 per cent was low. Hence this finding points out the positive change in the attitude of the respondents due to the intervention programme. The findings of the study are supported by the observations of Jaimy (2001) in her study on effect of training on food safety measures to the anganwadi helpers of ICDS. A study conducted by Shiny (2004) on assessment of nutrition cognition of selected rural youth and the nutrition related practices of their families also pointed out the similar results.

Krishnendu (2012) in her study on promoting consumption of green leafy vegetables among rural women through participatory approach revealed that effective nutrition education programmes can change the attitude of the respondents. Based on the findings of the present study it may be concluded that changes in attitudes and levels of knowledge that may be obtained from acceptance of new ideas from effective nutrition education programme which ultimately leads to practice of what is being learnt. Figure 8 shows the classification of respondents based on their attitude scores.





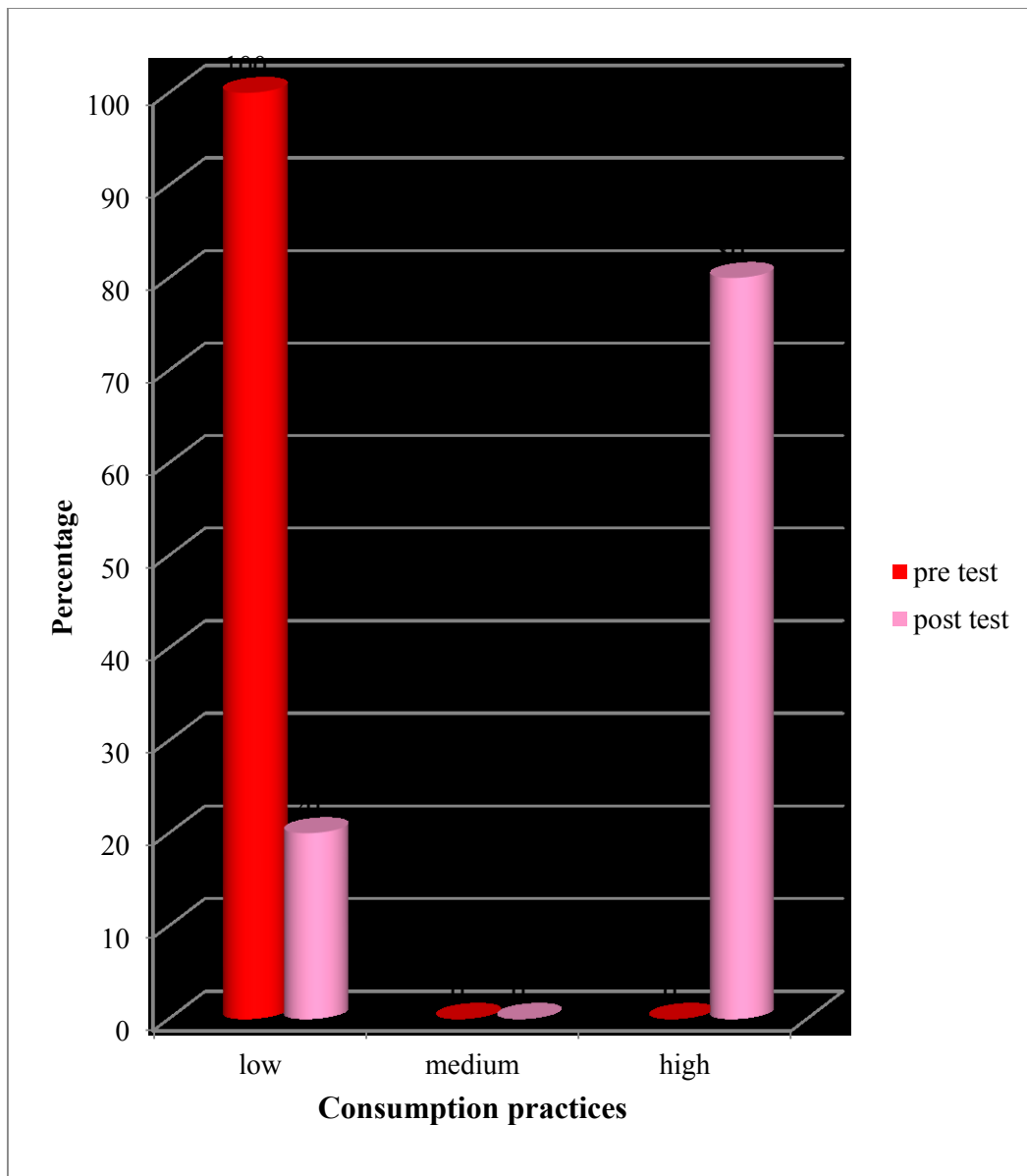
**Fig. 8: Classification of Respondents Based on their Attitude Scores**

### **5.8.3 Consumption Practices of Finger Millet after the Awareness Programme**

Nutritionally beneficial traditional practices are under threat of erosion from factors related to urbanization and modernization and need to be protected and supported by educational campaigns and communication strategies that aim to preserve such positive food practices (Snyder, 2007). In the present study all the respondents had low consumption practices of finger millet (100 per cent) before the awareness programme. After the awareness programme their consumption practices were increased to a high level (80 per cent) and low consumption practices was seen among only 20 per cent of the respondents. Saibaba *et al.* (2010) reported that an IEC intervention programme was conducted among adolescent girls in Hyderabad and Secunderabad, Andhra Pradesh. As a result of the intervention it was found that there was a marked increase in the intake of finger millet which is a very rich source of calcium and iron. Figure 9 shows the classification of respondents based on their consumption practices of finger millet.

### **5.8.4 Respondents Opinion about Finger Millet Products**

On basis of consumer preference value the acceptable recipes were demonstrated to the respondents and their views on the possibility of starting finger millet based processed foods following the above recipes were ascertained. All the respondents reported that they were able to prepare the demonstrated recipes at home. Forty per cent of the respondents showed their interest to start new enterprises based on finger millet product. The anganwadi workers who formed the panel for consumer preference study also expressed their interest in popularizing finger millet products among the mothers in their respective anganwadi centers.



**Fig. 9: Classification of Respondents Based on their Consumption Practices of Finger Millet**

*Summary*

## 6. SUMMARY

The present study entitled “Capacity Building of Rural Women on Enhancement of Family Nutrition and Livelihood Security through Consumption and Value Addition of Finger Millet (*Eleusine coracana(L.)Gaertn.*) was conducted with the objective of promoting consumption of finger millet among rural families to enhance their family nutrition and livelihood security through a campaign approach and to assess the impact of the awareness programme. Three ICDS centers at Keezhoor, Palappur and Punkulam were chosen at random from the ICDS centers of Kalliyoor panchayath which comes under Nemom ICDS block formed the study area. One hundred rural women beneficiaries of the ICDS programme selected from these three centers formed the respondents of the study.

The awareness programme was conducted through a campaign approach with the objective of reinforcing the message of importance of finger millet consumption and consisted of nutrition education supplemented with charts, posters, folders and booklet, slide show, demonstration, discussion and exhibition of finger millet based products. The study was conducted in four phases i.e. conceptualization phase, formulation phase, implementation phase and evaluation phase. Data regarding socio economic characteristics of the respondents, food consumption pattern with special reference to finger millet at different stages of life cycle, prevalence of life style diseases and their knowledge and attitude towards the finger millet consumption were collected from the respondents.

The findings of the socio-economic survey done revealed that majority of the respondents belonged to the age group between thirty six to fifty five years (70 per cent). Eighty per cent of the respondents were Hindu's. Majority of the respondents i.e. forty six per cent belonged to forward communities. Majority (63 per cent) of the respondents were educated up to pre-degree. Analysis of family structure revealed that majority of the respondents belonged to nuclear type of families.

Regarding the employment status it was found that most of the respondents were unemployed. Most of the families had monthly income between Rs.9788-19574 rupees per annum and belonged to middle income group. Most of the respondents were not engaged in any livestock rearing (72 per cent). About 73 per cent of the respondents lived in their own houses.

Dietary habits of the respondents indicated that 90 per cent of them were habitual non vegetarians. Food consumption pattern of the respondents revealed that cereals, pulses, vegetables, fish, milk and milk products and coffee/tea were most frequently used. Fruits, meat, egg, snacks, juices were frequently used while leafy vegetables were less frequently used and millet especially finger millet were least frequently used by the respondents. Consumption pattern of finger millet at different stages of life cycle revealed that 12 per cent respondents using finger millet daily only for feeding their children up to ten years. It was also found that some of the respondents used finger millet for serving their family members but were not consuming it themselves. The method of consumption of finger millet revealed that 21 per cent consumed finger millet in the form of porridge while 5 per cent were consumed in the form of puttu. It was also found by interviewing the respondents that they were not much familiar with different finger millet based recipes, and so they were not using finger millet for any other preparations.

Anthropometric assessment revealed that thirty per cent of the respondents surveyed had BMI above 25 and belonged to obese grade I and 37 per cent were in the grade II categories having BMI above 30. Two per cent having severe chronic energy deficiency and 1 per cent of the respondents were having mild chronic energy deficiency. Haemoglobin estimation of the respondents revealed that 29 per cent were non anaemic. Twenty one per cent of the respondents were marginally anaemic. Thirty per cent of the respondents were mildly anaemic while 17 per cent were moderately anaemic and 3 per cent were severely anaemic. Disease history of the respondents shows that 18 per cent were suffering from diabetes, 10 per cent were having hyper tension and 13 per cent were having hypercholestermia.

Prior to the conduct of awareness programme ten finger millet based recipes which are already developed by institutions like CFTRI, NIN and Food and Nutrition Board were collected, prepared and subjected to a panel of judges for finding out the suitability of selecting these recipes demonstration of finger millet products among the respondents. It was observed that among ten finger millet recipes four were obtained the highest scores they were ragi laddu (4.7), ragi halwa (4.1), ragi pakoda (4.1) and ragi chocolate milk shake (4). These highly accepted four recipes were again subjected for consumer preference tests to find the highly preferred ones for taking up these on a commercial basis. The consumer preference tests revealed that laddu was liked extremely by majority (55 per cent) of the respondents.

Assessment of knowledge, attitude and consumption practices of finger millet conducted before the awareness programme showed that majority of respondents had poor level of knowledge and their attitude and consumption practices were also very low. The awareness programme was conducted with the help of nutrition education classes and discussion, charts, slide show, a folder on importance of finger millet consumption and booklet containing finger millet based recipes. A demonstration on preparation of finger millet products and an exhibition were also included in the awareness programme.

The impact of the awareness programme assessed after one month showed that there was significant gain in knowledge, change in their attitude and also a significant change in the consumption of finger millet by the respondents pointing out the positive impact of the programme. The mean scores obtained for knowledge (18.57), attitude (84.52) and consumption practices (12.77) were also seen to be increased after the conduct of the awareness programme. After the awareness programme their knowledge level increased to a high level (51 per cent) and 47 per cent came in medium level of knowledge and only 2 per cent were in low level of knowledge regarding importance of finger millet consumption. Attitude had slightly increased to a high level (31 per cent), 57 per cent were remaining in the medium levels and only 12 per cent were having a

low attitude towards the finger millet consumption. Consumption practices increased to a high level (80 per cent) and low consumption practices was seen only among 20 per cent of the respondents. All the respondents reported that they were able to prepare the demonstrated recipes at home. Forty per cent of the respondents expressed their interest to start enterprises for preparation and marketing of value added products of finger millet.

The study proved that this programme can be successfully implemented in other parts of our state to promote consumption of finger millet and also as an avenue for marketing and income generation. Consumption of finger millet will help to reduce micronutrient deficiencies and other life style diseases prevalent especially among women and children and also ensure their nutritional and livelihood security. Promotion of consumption of finger millet can be effected throughout the state through the following steps.

- ❖ Taking steps to promote cultivation of finger millet in the state.
- ❖ Creating awareness programmes throughout the state for promoting consumption of finger millet for nutritional and livelihood security.
- ❖ Training women SHG's in the production of different value added products from finger millet.
- ❖ Including finger millets in the PDS.
- ❖ Serving finger millet based foods in ICDS, school meals and hostel programmes to ensure quality nutrition to children.



# *References*

## 7. REFERENCES

- Amadou, I., Gbadamosi, O. S. and Guowei, L. 2011. Millet based traditional processed foods and beverages. A review. *Cereal Food World*. 56(3):115–121.
- Amerine, M. A., Pangborn, R. M. and Roseller, E. B. 1965. *Principles of sensory evaluation of food*. New York, Academic Press, pp.104-110.
- Annison, G. and Topping, D. P. 1994. Nutritional role of resistant starch: chemical structure and physiological function. *Annu Rev Nutr*. 14:297–320.
- Antony, U. and Chandra, T. S. 1998. Antinutrient reduction and enhancement in protein, starch and mineral availability in fermented flour of finger millet (*Eleusine coracana*). *J. Agric. Food Chem*. 46 (7): 2578-2582.
- Antony, U., Sripriya, G. and Chandra, T. S. 1996. Effect of fermentation on the primary nutrients in finger millet (*Eleusine coracana*). *J. Agric. Food Chem*. 44: 2616-2618.
- Arora, A. 1991. *The Women Elite in India*. Sangana Book Limited, London, 42p.
- Bacher, K., Mansour, E., Haddad, M. and Abid, M. 2013. Fiber Content and Mineral Composition of the Finger Millet of the Oasis of Gabes Tunisia. *J. Agric. Sci*. 5(2) 219- 226.
- Balasubramanian, S. C. 2009. Finger millet tops in antioxidant activity among common Indian foods. *Indian J. Biochem. Biophys*. 46(1):112-125.
- Basappa, S. C., Somashekar, D., Agarwal, R., Suma, K. and Bharthi, K. 1997. Nutritional composition of fermented ragi (chhang) by phab and defined starter cultures as compared to unfermented ragi (*Eleusine coracana* G.). *Int. J. Food Sci. Nutr*. 48 (5): 313-319.

- Beatrice, P. J. 1999. Nutritional adequacy of diets in selected hostel messes. M.Sc (HSc) thesis, Kerala Agricultural University, Thrissur, 40-89pp.
- Begum, J. M. 2007. Refined processing and Products for commercial use and health benefits from finger millet. In: K. T. Krishne Gowda and A. Seetharam (eds.), *Food Uses of Small Millets and Avenues for Further Processing and Value Addition* (2003). Project Coordination Cell, All India Coordinated Small Millets Improvement Project, ICAR, UAS, GKVK, Bangalore, India. 193p.
- Bhatt, A., Singh, V., Shrotria, P. K. and Baskheti, D. C. 2003. Coarse Grains of Uttaranchal: Ensuring sustainable Food and Nutritional Security. *Indian Farmer's Digest*, pp. 34-38.
- Bindhu, A. S., Beevi, N., Thankam, K., Girija, V. and Haran, J. C. 2014. Prevalence and determinants of hypertension among adults in a rural area in Thiruvananthapuram. A cross sectional study. *Np. J. Epidemiol.* 4(2)180-196.
- Birch, G., Lee, C. K. and Ray, A. 2002. *The chemical basis of bitterness in sugar derivatives. Sensory properties of foods.* Applied Science Publishers, London, pp.175-198.
- Bravo, L. 1998. Polyphenols: chemistry, dietary sources, metabolism and nutritional significance. *Nutr. Rev.* 56:317-333.
- Bulliyya, G., Mohapattiya, S. S., Kerkelta, A. S. and Das, P. K. 2002. Status of anaemia in elderly tribal population of sundargragh district, Orrissa. *Indian J. Nutr. Dietet.* 39: 182-190.
- Cade, J. E., Berley, V. J. and Greenwood, D. C. 2007. Dietary fibre and risk of breast cancer in the UK womens's Cohort study. *Int. J. Epidemiol.* 36:431-438.

- Chandrasekara, A. and Shahidi, F. 2010. Content of insoluble bound phenolics in millets and their contribution to antioxidant capacity. *J. Agric. Food Chem.* 58:6706–6714.
- Chandrashekhar, A. 2010. Finger millet: Eleusine coracana. *Adv. Food Nutr. Res.* 59:215-262.
- Chaturvedi, R. and Srivastava, S. 2008. Genotype variations in physical, nutritional and sensory quality of popped grains of amber and dark genotypes of finger millet. *J. Food Sci. Tech.* 45(5):443-446.
- Choudary, M. and Solanki, H. 2005. Body Mass Index (BMI) an indicator of energy stores and body proportions in female laborers. *J. Dairy Food. Home Sci.* 18 (2): 109-112.
- Cicil, M. J. 2000. Impact on nutrition education on mushroom consumption. M.Sc (HSc) thesis, Kerala Agricultural University, Thrissur, 32-49pp.
- Clydesdale, F. M. 2008. Influence of colour on sensory perception and food choice in developments in food colours. *Walford. J. Newyork.* 213-219.
- Desai, A. D., Kulkarni, S. S., Sahu, A. K., Ranveer, R. C. and Dandge, P. B. 2010. Effect of supplementation of malted ragi flour on the nutritional and sensorial quality characteristics of cake. *Adv. J. Food Sci. Tech.* 2(1):67-71.
- Devi, S. P. 2004. Differential preference of work by agricultural laborers and their employment and wage pattern in Thiruvananthapuram District. M.Sc (Ag) thesis, Kerala Agricultural University, Thrissur, 246p.
- Eagly, A. and Chaiken, S. 1998. *Attitude structure and Function.* Handbook of Social Psychology, Gowan Publishers, Lindsey, New York, 413–432pp.

- Edem, D. O., Ayatse, J. O. and Itam, E. H. 2001. Effect of soy protein supplementation on the nutritive value of “starch” (farina) from *Manihot coculenta*. *J. Agric. Food Chem.* 75:57-62.
- Edwards, A. L. 1957. *Techniques of Attitude Scale Construction*. Vakils, Feffer and Simons Private Ltd, Mumbai, 1-40pp.
- Elizabeth, K. E. 2005. *Nutrition and child development*. Paras Medical Publishers, Hyderabad, India, 1: 29-39pp.
- Englyst, H. N., Kingman, S. M. and Cummings, J. H. 1992. Classification and measurement of nutritionally important starch fractions. *Eur. J. Clin. Nutr.* 46:S33–S50.
- Ferguson, L. R. 2001. Role of plant polyphenols in genomic stability. *Mutat. Res.* 475:89–11.
- Gahlawat, P. and Sehgal, S. 1994. Protein and starch digestibility and iron availability in developed weaning foods as affected by roasting. *J. Hum. Nutr. Dietet.* 7(2): 121-126.
- Gee, J. M., Johnson, I. T. and Lind, L. 1992. Physiological properties of resistant starch. *Eur. J. Clin. Nutr.* 46:S125–S131.
- Geetha, C. and Parvathi, E. 1990. Hypoglycemic effect of millet incorporated breakfast items on selected non-insulin dependent diabetic patients. *Indian J. Nutr. Dietetics.* 27: 316-320.
- Geervani, P., Vimala, V., Umapradeep, K., Rama, S. and Devi, M. 1996. Effect of processing on protein digestibility biological value, and net protein utilization of millet and legume based infant mixes and biscuits. *J. Plant Foods Hum. Nutr.* 49: 221-227.

- Goel, A. K., Kumar, R. and Mann, S. S. 2007. *Post harvest management and value addition*. Daya Publishing House, Trinagar, New Delhi, 1: 272 – 292.
- Gopalan, C., Ramshashtri, B. V. and Balasubramanian, S.C. 2004. *Nutritive value of Indian foods*. Hyderabad, NIN, p.156.
- GOK [Government of Kerala]. 2011. *Census Report 2011*,[on-line]. Available: [http://censusindia.gov.in/2011-Documents/House listing % 20 english.pdf](http://censusindia.gov.in/2011-Documents/House%20listing%20english.pdf) [03 July 2011].
- GOK [Government of Kerala]. 2013. *Economic Review 2013*,[on-line]. Available: <http://spb.kerala.gov.in/images/pdf/er13/Chapter4/chapter04.html>[08 August 2013].
- Guptha, M. and Tripathi, H. 2006. Communication intervention for Technical Empowerment of Resources, Poor Rural Women in Dairy farming. *J. Commun. Sci.* 2: 89-93.
- Hiremath, R. N., Ghodke, S., Kumar, R., Chopra, M., Sinha, S. and Bhalla, S. 2014. A comprehensive lifestyle diseases survey among women of Ranchi, Jharkhand, *Np. J. Epidemiol.* 4(2) 152-179.
- Hulse, J. H., Laing, E. M. and Pearson, O. E. 1980. *Sorghum and the millets: their composition and nutritive value*. Academic Press, London, p. 997.
- ICAR(Indian Council of Agricultural Research). 2010. *ICAR News- A Science and Technology News Letter*. Indian Council of Agricultural Research, Goa, 76p.
- ICRISAT [International Centre for Agricultural Research in the Semi Arid Tropics]. 1997. *Annual Report*. 1997-1998. International Centre for Agricultural Research in the Semi Arid Tropics, Hyderabad, 101p.

- IFI (Indian Food Industry). 2008. *Technology, Quality and scope of fruit wines especially apple beverage*. CSIR, CFTRI campus, Indian Food Industry, Mysore, 14p.
- Jack, F. R., Peterson, A. and Piggot, J. R. 2005. Perceived texture- Direct and indirect method for use in product development. *Int. J. Food Sci. Tech.* 1-12pp.
- Jaimy, S. 2001. Effect of training of food safety measures to the anganwadi helpers of ICDS. M.Sc (HSc) thesis, Kerala Agricultural University, Thrissur, 98p.
- Jayalekshmi, G. 2001. Empowerment of rural women through self help group and action reserah. Phd (Ag) thesis, Kerala Agricultural University, Thrissur, 246p.
- Jessy, P. 1987. To develop a indigenous weaning food based on ragi flour. Msc (HSc) thesis, Kerala Agricultural University, Thrissur, 35-38pp.
- Juna, L. P. 2005. Nutritional profile of pregnant women with reference to iron. M.Sc (HSc) thesis, Kerala Agricultural University, Thrissur, 23-105p.
- Kamini, S. and Sarita, S. 2011. Quality characteristics of finger millet based baby food preparation as affected by its varieties and processing techniques. *J. Funct. Environ. Bot.*1: 77-84.
- Karuna, M. S. 2000. Nutritional status of women engaged in fish vending in Thiruvananthapuram district. Ph.D thesis KAU, Thrissur, 140-147pp.
- Kathy, M., John, S. and Estherlydia, D. 2013. Effect of ragi (*Eleusine coracana*) vermicelli supplementation on anemic school children. *Int. J. Curr. Res.* 2:48-53.

- KSI (Kerala Statistical Institute). 2001. *Socio economic changes in Kerala- A study based on selected localities*, Kerala Statistical Institute, Thiruvananthapuram, 30p.
- Khader, V. and Maheswari, K. U. 2012. Effect of feeding malted foods on the nutritional status of pregnant women, lactating women and preschool children in Lepakshi Mandal of Ananthapur district, Andhra Pradesh, India, *Int. J. Biotechnol. Mol. Biol. Res.* 4(4)35-46.
- Khodr, B. and Khalil, Z. 2001. Modulation of inflammation by reactive oxygen species: implications for aging and tissue repair. *J. Free. Radical. Biol. Med.* 30:1-8.
- King, L. 2001. *Impaired wound healing in patients with diabetes*. Nurs. Stand. Hyderabad, 15(38):39-45.
- Krishnaroopu, G. 2003. Determinants of dietary profile of higher secondary children. M.Sc (HSc) thesis, Kerala Agricultural University, Thrissur, pp. 32-49.
- Krishnendu, J. R. 2012. Promoting consumption of green leafy vegetables among rural women through participatory approach. M.Sc (HSc) thesis, Kerala Agricultural University, Thrissur, pp. 75-82.
- Kumar, S. 2000. An experimental study on the relative effectiveness of selected visual aids in teaching neoliterate. M.Sc (Ag) thesis, Kerala Agricultural University, Thrissur, 198p.
- Kuppuswamy, B. 1981. *Manual of Socio economic status (Urban)*, Manasayan, Delhi, 22p.



- Lakshmi, K. P. and S. Sumathi. 2002. Effect of consumption of finger millet on hyperglycemia in non-insulin dependent diabetes mellitus (NIDDM) subjects. *Indian J. Nutr. Dietet.* 23(3):241-245.
- Lawes, J. C., Dhirawani, M. K. and Dharne, R. D. 2004. Ragi in the management of diabetes mellitus. *Indian J. Med. Sci.* 22:28–29.
- Lupien, J. R. 1990. *Sorghum and millets in human nutrition*. FAO, ICRISAT. Available: <http://www.fao.org>. p.86.
- Mallesh, N. G. 2003. *Decorticated finger millet (Eleusine coracana)*. US Patent No:2003/0185951. Available: <http://www.freepatentsonline.com/0185951.html>. p.86.
- Mallesh, N. G. 2007. Nutritional and technological features of ragi (finger millet) and processing for value addition. In: K. T. Krishne Gowda and A. Seetharam (Eds.), *Food Uses of Small Millets and Avenues for Further Processing and Value Addition*, Project Coordination Cell, All India Coordinated Small Millets Improvement Project, ICAR, UAS, GKVK, Bangalore, India, pp.9-19.
- Mallesh, N. G. and Hadimani, N. A. 1993. Nutritional and technological characteristics of small millets and preparation of value added products from them. *J. Food Chem.* 69:120-156.
- Mammi, M. V. I., Pavithran, P., Rahman, A., Pisharody, R. and Sugathan, K. 1991. Acute myocardial infraction in north Kerala- A 20 year hospital based study. *Indian Heart. J.* 43: 93-96.
- Martinez, F. H. E., Chang, Y. K., Bustos, F. M. and Sinencio, F.S. 1999. Extrusion cooking of cassava starch with different fiber sources: effect of fibers on expansion and physicochemical properties. *Adv Extrusions. J. Food Chem.* pp. 271–278.

- Mbithi, M. S., Ooghe, W., Van Camp, J., Nagundi, D. and Huyghebaer, A. 2000. Amino acid profile after sprouting, Autoclaving and lactic acid fermentation of finger millet (*Elusine coracana*) and kidney beans (*Phaseolus vulgaris* L.) *J. Agric. Food Chem.* 48 (8): 3081-3085.
- MNI (Millet Network of India). 2012. *Millets in your meals*. Millet Network of India, Hyderabad, Andhra Pradesh, 2-24pp.
- MOHFW (Ministry of Health and Family Welfare). 2000. *National Population Policy*, 2000. Department of Family Welfare, Ministry of Health and Family Welfare, New Delhi, 312p.
- Mittal, M. 2002. *Development of finger millet and barnyard millet based convenience mixes for food products and their evaluation for nutritional quality, storage stability and acceptability*. Thesis. Ph.D. G.B. Pant Univ. of Agric and Technol. Pantnagar, p. 260.
- Nagammal, K. 1989. The impact of ragi based food supplement on the nutritional status of selected preschool children. Msc thesis submitted by KAU, Thrissur, pp. 51-54.
- NFHS-2(National Family Health Survey) 1999. International Institute for Population Sciences, National Family Health Survey, Mumbai, 315p.
- NFHS-3(National Family Health Survey) 2006. International Institute for Population Sciences, *National Family Health Survey*, Mumbai, 288p.
- NIN (National Institute of Nutrition)1986. *A manual of Laboratory Techniques*. National Institute of Nutrition. Indian Council of Medical Research, Hyderabad, pp. 135-136.

- Nirmala, M., Rao, M. V. S. S. T. S. and Murlikrishna, G. 2000. Carbohydrates and their degrading enzymes from native and malted finger millet (Ragi, *Eleusine coracana*, Indaf- 15). *J. Food Chem.* 69:175-180.
- NSS (National Sample Survey Organization). 2006. *Level and Pattern of Consumer Expenditure*, National Sample Survey Organization, New Delhi, 98p.
- Park, J. E. and Park, K. 1991. *Text book of preventive and social medicine* (13<sup>th</sup> Ed), Banaras Bhanot Publishers, Jabalpur, 278p.
- Park, K. 1997. *Health education*. Text book of preventive and social medicine, Banaras Bhanot Publishers, Jabalpur, 233p.
- Patil, Y. R. and Sawant, R. S. 2012. A role of starch of *Eleusin coracana Gaertn.* (ragi satwa) in management of malnutrition. *Int. Res. J. pharm.* 3(2):287-290.
- Pawar, P. A. and Dhanvijay, V. P. 2007. Weaning foods: An overview. *J. Beverage Food World.* 34(11):27-33.
- Pradhan, A., Nag, S. K. and Patil, S. K. 2010. Dietary management of finger millet controls diabetes. *Curr. Sci.* 98(6):763-765.
- Rajasekaran, N. S., Nithya, M., Rose, C. and Chandra, T. S. 2004. The effect of finger millet feeding on the early responses during the process of wound healing in diabetic rats. *Biochem Biophys Acta*, 1689:190– 201.
- Ramankutty, V. 2010. Women's education and its influence on attitudes to aspects of child care in a village community. *Kerala Social Sci. Med.* 29:11.
- Ranganna, S. 2006. *Manual of fruit and vegetable products*. Tata Mc Graw-Hill Publishing Company, New Delhi, 298p.

- Rangaswamy, P. 1989. *Tools for collecting data interview*. A hand book of methodology of research. Narosa Publishing House, New Delhi, 100-110pp.
- Rao, M. V. S. S. T. S. and Muralikrishna, G. 2001. Nonstarch polysaccharides and bound phenolic acids from native and malted finger millet (Ragi, Eleusine coracana, Indaf-15). *J.Food Chem.* 72:187-192.
- Rao, M. V. S. S. T. S. and Muralikrishna, G .2002. Evaluation of the antioxidant properties of free and bound phenolic acids from native and malted finger millet (ragi, Eleusine coracana Indaf-15). *J. Agric Food Chem.*50:889–892.
- Razeena, K. A. 2000. Impact of educational programmes on the health and dietary practices of the workers of sewage farm in Thiruvananthapuram. M.Sc (HSc) thesis, Kerala Agricultural University, Thrissur, 17-79pp.
- Reaburn, J. A., Krondle, M., and Lau, D. 1979. Social determinants in food selection. *Am. J. Dietetics.* 74: 637-642.
- Reshmi, R. 2007. Age of menarch and nutritional status of urban school girls. M.Sc (HSc) thesis, Kerala Agricultural University, Thrissur, 94-128.
- Reshmi, R. 2013. *Ragi and its health benefits*. The Times of India, Jan 6, 2013, p.14.
- Robinson, K., Arhert, K., Refsum, H., Brattstrom, L. and Graham, I. 2009. Low circulating folate and vitamin B6 concentrations: Risk factors for stroke and coronary disease. *J. Circ,* 97: 437-444.
- Rolls, B. J., Rowe, E. A. and Rolls, E. T. 2011. *Variety enhances food intake in man*. A text book of physiological behavior. Oasis Publishers, Moscow, 2-31pp.

- Saibaba, A., Mohanram, M., Rao, G. V. R., Devi, U. and Syamala, T. S. 2010. Nutritional status of adolescent girls of urban slums and the impact of IEC on their nutritional knowledge and practices. *Indian J. Community Med.* 27:4.
- Sajitha, K. S. 2000. Anaemia and work performance of pre adolescent girls engaged in sports activities. M.Sc (HSc) thesis, Kerala Agricultural University, Thrissur, 74-102pp.
- Sen, S. and Dutta, K. S. 2012. Evaluation of Anti-cancer Potential of Ragi Bifunctional Inhibitor (RBI) from *Eleusine coracana* on Human Chronic Myeloid Leukemia cells. *Eur. J. Plant Sci. Biotechnol.* 1: 103-108.
- Seshadri, C. L. and Subadra, M. 2010. *A Data Base on Iron Deficiency Anemia (IDA) in India: Prevalence, Causes, Consequences and Strategies for Prevention.* Vadodara: The Maharaja Sayajirao University, Baroda, pp. 21-36.
- Setty, L. 2009. *Colour as criterion of quality.* CFTRI, Imprint Publishers, Mysore, 624p.
- Shanthi, P., Johnkennedy, Z., Parvathy, K., Malathi, D., Thangavel, and Raghavan, G. S. V. 2005. Effect of incorporation of finger millet in pasta products. *Indian J. Nutr. Dietet.* 42: 503-508.
- Shashi, B. K., Sharan, S., Hittalamani, A. G., Shankar, T. K. and Nagarathna, S. 2007. Micronutrient composition, antimicronutrient factors and bioaccessibility of iron in different finger millet (*Eleusine coracana*) genotype. *Karnataka J. Agric. Sci.* 20(3):583-585.
- Sheela, K. V. 2004. Effectiveness on IEC materials on health and nutritional practices of adolescent girls. M.Sc (HSc) thesis, Kerala Agricultural University, Thrissur, 69-100pp.

- Sheth, M., Gurudasani, R., Mistry, V. and Malhotra, S. 2006. Food Safety education as an effective strategy to reduce diarrhoeal morbidity in children less than two years of age. *Indian J. Nutr. Dietet.* 43(1): 22-32.
- Sheethal, K. C. 2011. Promoting fruit and vegetable consumption among school children through nutrition intervention programme. M.Sc (HSc) thesis, Kerala Agricultural University, Thrissur, 69-146pp.
- Shiny, R. L. 2004. Assessment of nutritional cognition of selected rural youth and the nutrition related practices of their families. M.Sc (HSc) thesis, Kerala Agricultural University, Thrissur, 94-128pp.
- Shobana, S., Harsha, M. R., Platel, K., Srinivasan, K. and Malleshi, N. G. 2010. Amelioration of hyperglycaemia and its associated complications by finger millet (*Eleusine coracana* L.) seed coat matter in streptozotocin-induced diabetic rats. *Br. J. Nutr.* 104(12):1787–1795.
- Shobana, S., Krishnaswamy, K., Sudha, V., Malleshi, N. G., Anjana, R. M., Palaniappan, L. and Mohan, V. 2013. Finger millet (*Ragi*, *Eleusine coracana* L.): a review of its nutritional properties, processing, and plausible health benefits. *Adv. Food Nutr. Res.* 69:1-39.
- Shobana, S., Kumari, U. S. R., Malleshi, N. G. and Ali, S. Z. 2007. Glycemic response of rice, wheat and finger millet based diabetic food formulations in normoglycemic subjects. *Int. J. Food Sci. Nutr.* 58 (5):363–372.
- Shobana, S. and Malleshi, N. G. 2007. Preparation and functional properties of decorticated finger millet (*Eleusine coracana*). *J. Food Eng.* 79:529–538.
- Sindhu, K. S. 1984. *Methodology of research in education*. Sterling Publishers, New Delhi. 145-158pp.

- Singh, P. and Raghuvanshi, R. S. 2012. Finger millet for food and nutritional security. *Afr. J. Food Sci.* 6(4):77-84.
- Singh, P. and Srivastava, S. 2006. Nutritional composition of sixteen new varieties of finger millet. *J. Community Mobilization Sustainable Dev.* 1(2): 81-84.
- Singh, P. and Srivastava, S. 2007. Development and quality evaluation of Iron Rich Biscuit Mixes Using Finger Millet. *J. Community Mobilization Sustainable Dev.* 2(1): 89-94.
- Srilakshmi, B. 2002. *Nutrition Science*. New Age International (P) Ltd, New Delhi, 383p.
- Sripriya, G., Chandrasekharan, K., Murty, V.S. and Chandra, T. S. 1996. ESR spectroscopic studies on free radical quenching action of finger millet (*Eleusine coracana*). *J. Food Chem.* 57(4):537-540.
- Stolzfus, R. J. and Michele L. D. 2003. *Guidelines for the Use of Iron Supplements to Prevent and Treat Iron Deficiency Anemia*. International Nutritional Anemia Consultative Group. International Life Sciences Institute Press, Washington, 30(3): 585-618.
- Sudhagandhi, B., Sundaresan, S., William, W. E. and Prema, A. 2011. Prevalence of anemia in the school children of Kattankulathur, Tamil Nadu, India, *Int. J. Nutr. Pharmacol. Neurol. Dis.* 1: 184-8.
- Snyder, B. L. 2007. Health Communication Campaigns and Their Impact on Behavior. *J. Nutr Educ Behav.* 39: S32-S40.
- Swaminathan, M. S. 2010. *Report on the state of food insecurity* [online]. Available: <http://www.mssrf.org/fs/pub/report>.

- Tatala, S., Ndossi, G., Ash, D. and Mamiro, P. 2007. *Effect of germination of finger millet on nutritional value of foods and effect of food supplement on nutrition and anaemia status in Tanzanian children*. *Tanzan Health Res Bull.* 9(2) Morogoro, Tanzania, pp. 77-86.
- Thanuja, S. 2012. *They learnt how to add value to ragi products*. *The Hindu*, May17. 2012, p.16.
- Thompson, L. U. 1993. Potential health benefits and problems associated with anti-nutrients, Genetic variability and calcium contents in finger millet (*Eleusine coracana* L.Gaertn) in relation to grain colour. *J. Plant Foods Hum. Nutr.* 52 (4): 353-364.
- Toeller, M. 1994.  $\alpha$ -Glucosidase inhibitors in diabetes: efficacy in NIDDM subjects. *Eur. J. Clin. Invest.* 24:31–35.
- Unnikrishnan, A. G., Kalra, S. and Garg, M. K. 2012. Preventing obesity in India: Weighing the options. *Indian J. Endocrinol. Metab.* 16:4-6.
- Unnithan, A. G. 2008. Contributing factors and problems associated with overweight among rural and urban school children. Ph.D thesis KAU, Thrissur. 140-147pp.
- Vachanth, M. C., Subbu Rathinam, K. M., Preethi, R. and Loganathan, M. 2010. Controlled atmospheric storage techniques for safe storage of processed little millet. *Acad. J. Entomol.* 3(1):13-16.
- Varadaraj, M. C. and Horigane, A. 1998. Biochemical characteristics and microbial profile during sprouting process in grains of *Eleusine coracana* L. (finger millet). *J. Agric. Food Chem.* 46: 1719-1726.
- Verma, V. and Patel, S. 2013. Nutritional security and value added products from finger millets (ragi). *J. Applic. Chem.* 1 (4):485-489.



- Vijayakumari, J., Begum, M. J., Begum, S. and Gokavi, S. 2003. Sensory attributes of ethnic foods from finger millet (*Eleusine coracana*). Recent Trends in Millet Processing and utilization. In: *Proceeding of National Seminar on Processing and Utilization of Millet for Nutrition Security*, 7-8 October, 2003, RNPSI (NATP), CCSHAV, Hisar, pp. 7-12.
- Vijayalakshmi, D., Geetha, K., Gowda, J., Ravi, S. B. and Padulosi, S. 2010. Empowerment of Women Farmers through Value Addition on Minor Millets Genetic Resources: A Case Study in Karnataka. *Indian J. Plant Genet. Resour.* 23(1) 132-135.
- Viswanath, V., Urooj, A. and Malleshi, N. G. 2009. Evaluation of antioxidant and antimicrobial properties of finger millet polyphenols (*Eleusine coracana*). *J. Food Chem.* 114:340–346.
- Wadikar, D. D., Vasudish, C. R., Premavalli, K. S. and Bawa, A. S. 2006. Effect of variety and processing on antinutrients in finger millet. *J. Food Sci. Technol.* 43(4):370–373.
- Watt, B. M. 1999. Research: *Basic Sensory Methods for Food Evaluation* [Lecture notes]. International Development and Research Centre, IDRC, Ottawa, Canada, 270p.
- Watt, J. M. and Brandwijk, B. M. G. 1992. *The medical and poisonous plants of southern and eastern Africa* (2<sup>nd</sup> Ed). Livingstone Ltd, London, pp. 175-198.
- Wood, W. 2000. Attitude Change: Persuasion and Social Influence. *Annual Review of Psychology.* 51: 539–570.
- WHO (World Health Organization). 2005. Physico status. *The use and interpretation of anthropometry*. Report of a WHO Expert Committee. Technical Report. World Health Organization, Geneva, 78p.

Yenagi, N. B., Hadigol, J. A. and Ravi, S. 2010. Nutritional and technological advancement in the promotion of ethnic and novel foods using the genetic diversity of millets in India. *Indian J. Plant Genet. Resour.* 23(1) 82-86.

# *Appendices*

## APPENDIX- I

### Interview Schedule to Elicit Information on Personal and Socio Economic Characteristics of the Respondents

1. Name and address :
2. Age :
3. Religion : Hindu/ Christian/Muslim
4. Caste : General/ OBC/SC/ST
5. Educational status : Primary/Upper primary/High school/  
Pre degree/Graduate
6. Family type : Nuclear/Joint
7. Family composition :

Sl. No.	Sex	Age	Education	Employment	Monthly income

8. Details of livestock possessed : Animal/Poultry/Both
9. Type of house : Own/Rented/Leased

## APPENDIX- II

### Schedule to Collect Dietary Habits of the Respondents

1. Dietary habit of the respondent : Vegetarian/Non vegetarian
2. Frequency use of different food commodities:

<b>Food items</b>	<b>Daily</b>	<b>Alternative days</b>	<b>Twice a week</b>	<b>Once a week</b>	<b>Once in three months</b>
Cereals					
Millets ( ragi)					
Pulses					
Vegetables					
Meat					
Fish					
Egg					
Fruits					
Milk and milk products					
Coffee/ tea					
Juice/ drinks					
Snacks					

3. Consumption pattern of finger millet at different stages of life cycle :

<b>Consumption pattern of finger millet</b>	<b>Daily</b>	<b>Twice a week</b>	<b>Once a week</b>	<b>Once a month</b>	<b>Once in 6 months</b>	<b>Never</b>
Children (0-2 yrs)						
Children (3-10yrs)						
Adolescent ( girl/boy)						
Adults (men/women)						
Pregnant women						
Lactating mother						
Elderly						

4. Preparations from finger millet, whether you prepared or not?

<b>Method of preparation</b>	<b>yes</b>	<b>no</b>
Porridge		
Puttu		
Laddu		
Dosa		
Idli		
Idiyappam		

### APPENDIX- III

#### Interview Schedule to Elicit Information on Knowledge of the Respondents about Finger Millet

Name of the respondent:

Address:

Sl no.	Statements	True	False
1.	Ragi can be included in the diet of elderly since, it is easily digestible.		
2.	Finger millet is a rich source of vitamin A.		
3.	Finger millet is a rich source of calcium and iron.		
4.	A daily intake of finger millet is recommended for diabetic patients.		
5.	Frequent consumption of finger millet in infants leads to diarrhea.		
6.	Nutritional value of finger millet is increased by malting.		
7.	Consumption of finger millet is good for the development of healthy bones.		
8.	Consumption of finger millet is beneficial to patients with hypocholestrolema since, it has low fat and high fiber.		
9.	Finger millet consumption helps to prevent anemia since, it contains appreciable amounts of iron.		
10.	Finger millet is good for overweight and obese.		
11.	Vitamin D is made into the body by the consumption of finger millet.		
12.	Finger millet is rich in fiber which improves the process of digestion.		
13.	It is not recommended to the people after the age of 60 since, it is not easily digestible.		

14.	Finger millet along with jaggery ensures adequate supply of iron.		
15.	Finger millet is very cheap or cost less than other cereals.		
16.	Finger millet is generally used for feeding the infants.		
17.	Consumption of finger millet makes children more healthy.		
18.	It is not advised to the patients who having kidney stones.		
19.	Sprouting increases the nutritive value of finger millet.		
20.	It is good for asthma patients.		



### APPENDIX- IV

#### Interview Schedule to Elicit Information on Attitude of the Respondents towards Finger Millet

Name of the respondent:

Address:

SI no	Statements	Agree	Fully agree	No comments	Disagree	Fully disagree
1.	Finger millet is cheap in price compared to other cereals.					
2.	Finger millet will prevent the non communicable disease to some extent.					
3.	Finger millet is not a good food for elderly since it causes flatulence.					
4.	Finger millet is not cultivated in Kerala because it is not in much demand here.					
5.	Finger millet consumption causes irritation to the stomach; it is not consumed by all.					
6.	Finger millet is good weaning food for infants from older times.					
7.	Finger millet processing takes more time, so I don't take.					
8.	Calcium is not sufficiently present in finger millet.					
9.	Malting of finger millet improves the nutritional quality.					
10.	Finger millet has less shelf life and is easily get affected by insects and rodents on storage.					
11.	Variety of food products can be prepared from finger millet.					
12.	Finger millet products are not very tasty and the preschoolers dislike this.					
13.	Finger millet reduces the risk of gestational diabetes during pregnancy.					
14.	Finger millet is not rich in protein.					

15.	Finger millet is rich in vitamin A.					
16.	Finger millet acts as remedy various health conditions.					
17.	Finger millet lowers the blood cholesterol level.					
18.	Finger millet helps in bone development in children so it is essential.					
19.	Finger millet can be used for body weight reduction.					
20.	Finger millet lowers the blood pressure level.					
21.	Finger millet is an ideal food for people with diabetes.					
22.	Distributing finger millet through public distributing system is a good idea.					

## APPENDIX -V

### Score Card for Sensory Evaluation of Finger Millet Products

Name of the panel member:

Address:

Name of products: 1) roti, 2) laddu, 3) pudding, 4) pakoda, 5) health drink,  
6) cake, 7) cutlet, 8) chocolate milk shake, 9) halwa,  
10) dosa

Assign scores for each sample for various characteristics

Quality attributes	Maximum score	Code number of samples									
		1	2	3	4	5	6	7	8	9	10
Appearance											
Colour											
Flavour											
Texture											
Taste											

**Scores: Excellent (5), Very good (4), Good (3), Satisfactory (2), Poor (1)**

Signature

## APPENDIX -VI

### Hedonic Rating Scale for the Preference of Finger Millet Products

Name:

Address:

Name of products :1) laddu, 2) pakoda, 3) halwa, 4) chocolate milk shake

Assign scores for each sample

Rating	Score (Max-5)	Code number of samples			
		I	II	III	IV
Like extremely					
Like very much	5				
Like moderately	4				
Like slightly	3				
Neither like / nor dislike	2				
	1				

Signature

## APPENDIX -VII

## Body Mass Index of the Respondents

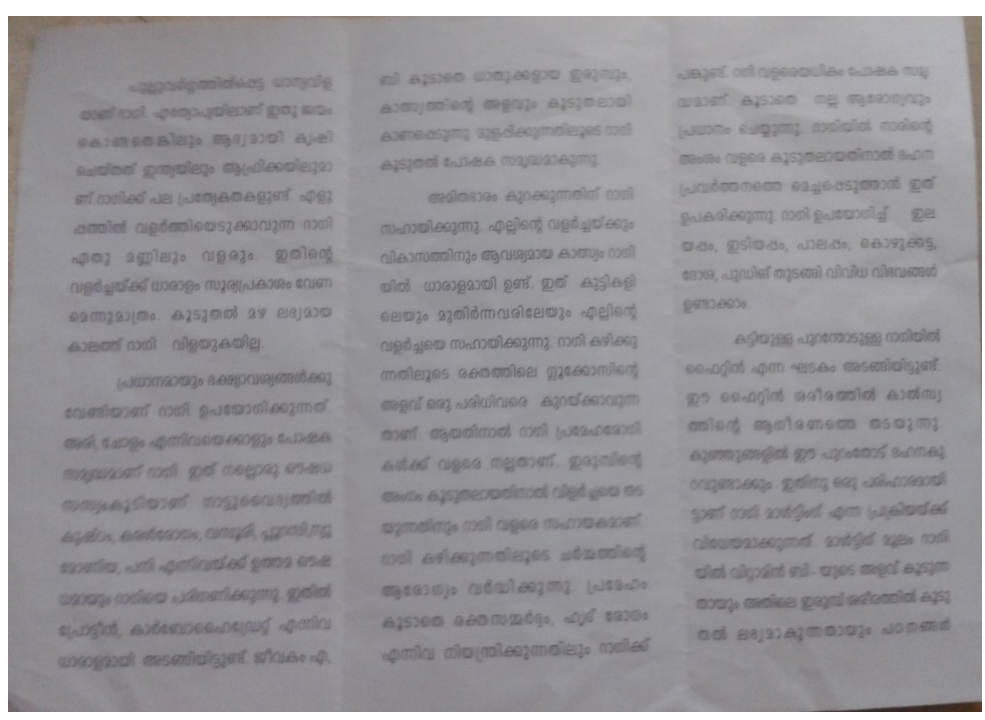
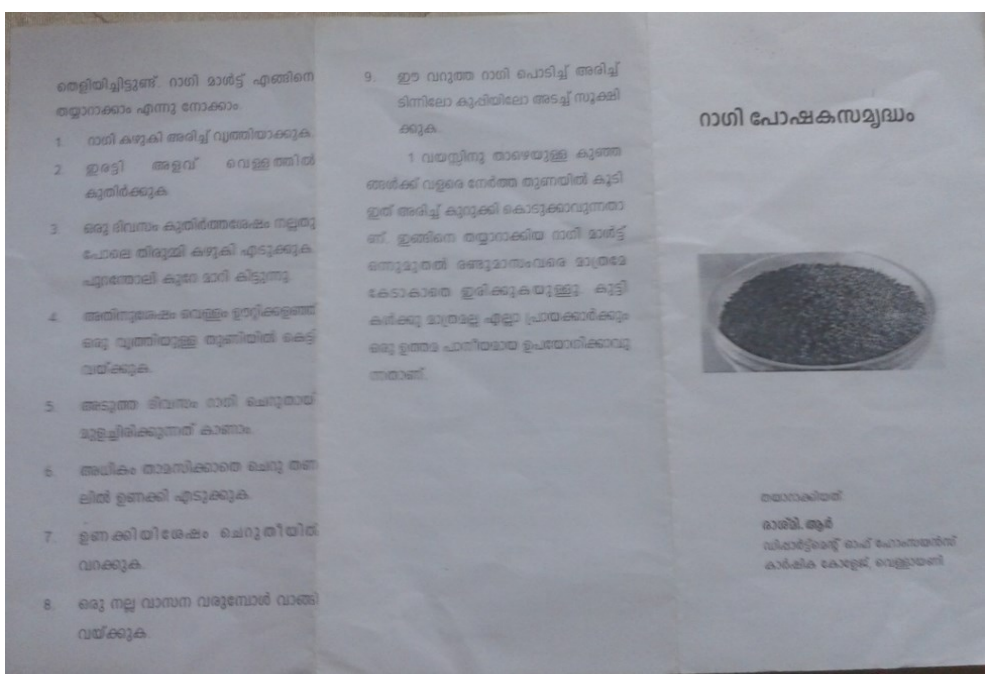
Sl no	Wt (kg)	Ht (cm)	BMI	Sl no	Wt (kg)	Ht (cm)	BMI	Sl no	Wt (kg)	Ht (cm)	BMI
1	59	159	23.4	35	71	157	30.7	69	53	142	26.3
2	78	164	29.1	36	58	150	23.5	70	55	150	27.3
3	53	154	22.3	37	53	157	23.5	71	60	150	26.6
4	57	159	22.6	38	50	153	20.3	72	56	144	24.8
5	78	164	29.1	39	79	160	33.7	73	44	152	21.2
6	54	145	25.7	40	72	153	28.1	74	71	163	30.7
7	83	152	35.9	41	42	147	17.9	75	63	159	23.7
8	58	167	20.8	42	83	148	38.4	76	71	149	28
9	67	155	27.9	43	63	149	28.7	77	75	156	33.7
10	82	163	30.9	44	58	151	26.1	78	74	150	30.4
11	65	158	26.1	45	51	147	22.3	79	60	153	26.6
12	55	157	22.3	46	48	163	22.2	80	66	143	28.2
13	68	156	27.9	47	68	162	25.6	81	72	164	35.2
14	70	160	27.3	48	88	150	33.5	82	59	154	22
15	75	158	30.1	49	78	148	34.6	83	78	159	32.9
16	36	162	13.7	50	50	162	22.8	84	53	164	20.9
17	70	157	28.4	51	86	158	32.8	85	57	145	21.2
18	64	164	23.8	52	72	147	28.9	86	78	152	37.1
19	60	162	22.9	53	79	147	37.6	87	54	157	23.3
20	55	155	22.9	54	40	157	19	88	83	155	33.7
21	77	162	29.3	55	68	153	27.6	89	58	163	24.1
22	77	148	35.1	56	72	160	30.7	90	67	161	25.2
23	85	155	36.7	57	56	146	21.8	91	82	158	31.6
24	76	160	31.6	58	53	157	24.8	92	70	153	28
25	88	157	34.3	59	89	149	36.1	93	60	156	25.6
26	68	162	27.6	60	58	160	26.1	94	68	160	27.9
27	73	166	27.8	61	63	155	24.6	95	70	162	27.3
28	76	162	27.6	62	64	153	26.6	96	38	157	14.5
29	82	163	31.2	63	60	153	25.6	97	70	162	28.4
30	80	146	30.1	64	45	148	19.2	98	62	155	23.6
31	71	162	33.3	65	63	151	28.7	99	55	155	22.9
32	75	148	28.6	66	72	159	31.5	100	77	148	35.15
33	59	156	26.9	67	58	164	22.9				
34	53	152	21.8	68	83	142	30.9				

**APPENDIX -VIII**  
**Haemoglobin of the Respondents**

SI no	Hb (gm/dL)	SI no	Hb (gm/dL)	SI no	Hb (gm/dL)
1	8.4	35	11.6	69	12
2	10	36	11	70	11
3	7.6	37	10.6	71	10.4
4	8	38	10.8	72	8
5	13	39	11	73	10.4
6	10.6	40	11.6	74	11
7	12.2	41	8	75	12
8	11	42	9	76	12.6
9	12	43	8	77	13.4
10	12.4	44	10.4	78	12.4
11	13	45	9	79	11
12	10	46	11	80	11
13	9.6	47	13	81	10.8
14	11.4	48	10.2	82	8.4
15	8.2	49	13	83	10
16	10.4	50	10.4	84	7.6
17	11.6	51	11	85	12
18	9	52	10	86	13
19	10	53	10.4	87	10.6
20	9.8	54	10.2	88	12.2
21	12	55	12	89	11
22	13	56	10.4	90	12
23	11.8	57	10.8	91	12.4
24	12	58	10	92	13
25	13	59	10.6	93	12
26	11.6	60	12	94	9.6
27	11	61	10.2	95	11.4
28	12.8	62	9.6	96	10.4
29	10	63	10.4	97	12.6
30	12.2	64	11	98	10
31	10	65	11.8	99	10.8
32	10	66	12.2	100	13
33	9	67	10.4		
34	8.8	68	11		

APPENDIX -IX a

Teaching Aid Used in Nutrition Education Programme (FOLDER)



APPENDIX -IX b

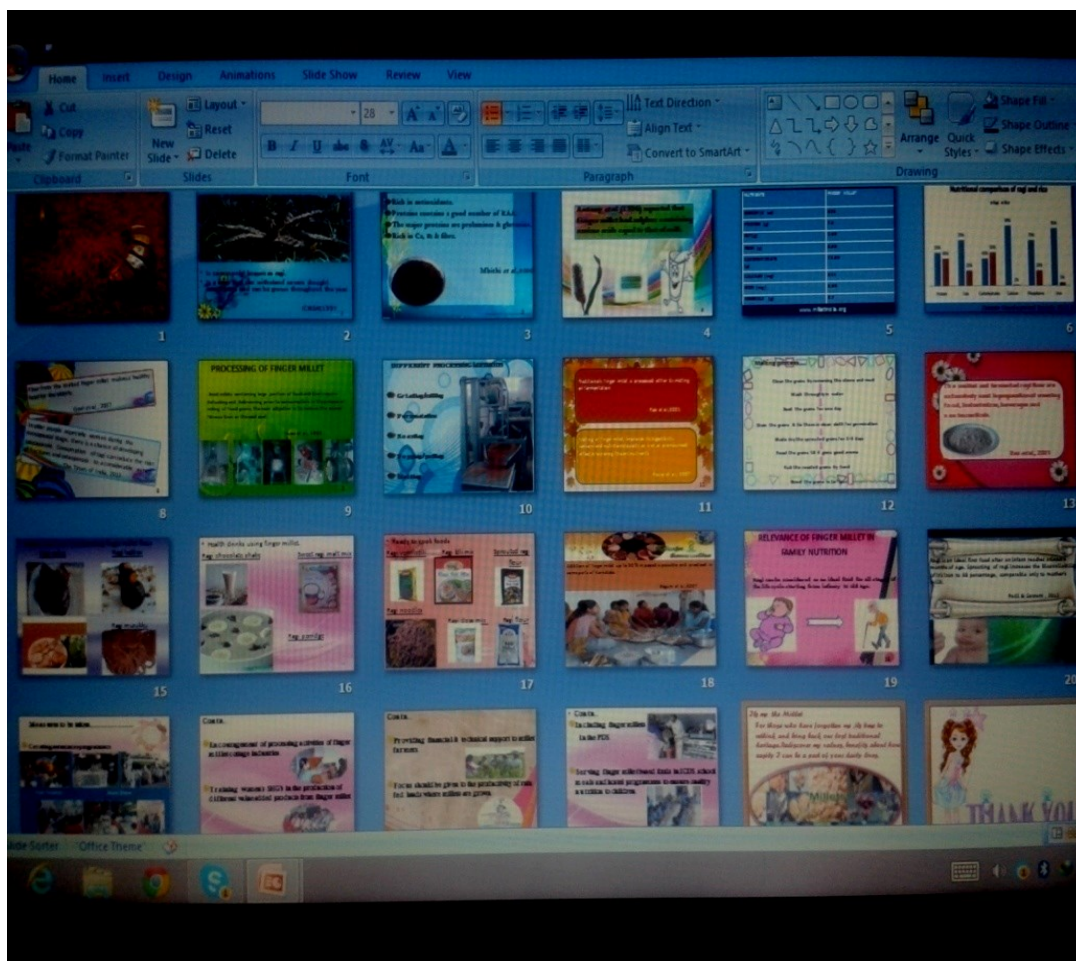
Teaching Aid Used in Nutrition Education Programme (BOOKLET)





## APPENDIX –IX c

## Teaching Aid Used in Nutrition Education Programme (SLIDE SHOW)



*Abstract*

**Capacity Building of Rural Women on Enhancement of Family  
Nutrition and Livelihood Security through Consumption and  
Value Addition of Finger Millet (*Eleusine coracana(L.)Gaertn.*)**

by

**RASHMI R.**

**(2012 -16 -104)**

**Abstract of the thesis**

**Submitted in partial fulfillment  
of the requirements for the degree of**

**MASTER OF SCIENCE IN HOME SCIENCE**

**(Food Science and Nutrition)**

**Faculty of Agriculture**

**Kerala Agricultural University**



**DEPARTMENT OF HOME SCIENCE**

**COLLEGE OF AGRICULTURE**

**VELLAYANI, THIRUVANANTHAPURAM -695522**

**KERALA, INDIA**

**2014**

## ABSTRACT

The study entitled “Capacity Building of Rural Women on Enhancement of Family Nutrition and Livelihood Security through Consumption and Value Addition of Finger Millet”. (*Eleusine coracana(L.)Gaertn.*) was carried out in the Department of Home Science, College of Agriculture, Vellayani, during the year 2012-2014 with the objective of capacity building of rural women to promote consumption of finger millet (*Eleusine coracana(L.)Gaertn.*) among rural families to enhance their family nutrition and livelihood security through a campaign approach and to assess its impact.

One hundred respondents were selected randomly from the beneficiaries of ICDS programme from Kalliyoor panchayath. The findings of the socio-economic survey done revealed that majority of the respondents belonged to the age group between thirty six to fifty five years (70 per cent). Majority (63 per cent) of the respondents were educated up to pre degree. Most of the families had monthly income between 9788-19574 rupees per annum and belonged to middle income group.

The food frequency scores revealed that millets were least frequently used. Consumption pattern of finger millet revealed that only 12 per cent were consuming finger millet for feeding their children.

Anthropometric assessment of the respondents revealed that 30 per cent of the respondents were in obese grade I category, 37 per cent of the respondents were in obese grade II category while 2 per cent were suffering from severe chronic energy deficiency. Haemoglobin estimation showed that 71 per cent of the respondents were anaemic with mild to severe anaemia. Disease history of the respondents showed that 41 per cent of them were suffering from various life style diseases like diabetes, hypercholesteremia and hypertension.

Prior to the conduct of awareness programme ten finger millet based recipes already standardized were collected, prepared and subjected to

acceptability tests among a selected panel of judges. The four most highly accepted recipes were later subjected to consumer preference test.

Assessment of knowledge, attitude and consumption practices of finger millet conducted before the awareness programme showed that majority of respondents had poor level of knowledge and their attitude and consumption practices were also very low.

The impact of the awareness programme assessed after one month showed that there was significant gain in knowledge, change in their attitude and also a significant change in the consumption of finger millet by the respondents pointing out the positive impact of the programme. The mean scores obtained for knowledge (18.57), attitude (84.52) and consumption practices (12.77) were also seen to be increased after the conduct of the awareness programme. Forty per cent of the respondents expressed their interest to start enterprises for preparation and marketing of value added products of finger millet. The study proved that this programme can be successfully implemented in other parts of our state to promote consumption of finger millet thus ensuring nutritional and livelihood security.

