

**FORMULATION AND EVALUATION OF RECIPES WITH
STANDARDIZED HIGH FIBER MIX**

By

KOTARI RANI SYAMALA

(11PN09)

**A THESIS SUBMITTED TO THE
AVINASHILINGAM INSTITUTE FOR HOME SCIENCE AND HIGHER
EDUCATION FOR WOMEN, COIMBATORE - 641 043**

**IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE
IN
FOOD SCIENCE AND NUTRITION**

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CERTIFIED AS BONA FIDE RESEARCH WORK



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HEAD OF THE DEPARTMENT**



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GUIDE**

ACKNOWLEDGEMENT

The investigator expresses her deep sense of gratitude to **God Almighty** who graciously blessed her with good health, strength and wisdom to complete the study.

The investigator extends her profound gratitude to **Thiru. T.S.K. Meenakshi Sundaram, M.A.,M.Phil., Ph.D.** Chancellor, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, for providing an opportunity to expose herself to the world of knowledge.

The investigator would like to express her sincere gratitude to **Dr. (Tmt) Sheela Ramachandran, M.Sc., P.G. Dip., Ph.D.**, Vice chancellor, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, for giving the project in the first instance and providing the infrastructural facilities for the student.

The investigator records her special thanks to **Dr (Tmt) Gowri Ramakrishnan, M.Sc., M.Phil., Ph.D.** Registrar, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, for providing all the administrative support and help required to carry out the project.

The researcher conveys her deepest sense of gratitude to **Dr (Tmt) K.Thangamani, M.Sc., Dip.Ed., M.Phil., Ph.D.**, Dean, Faculty of Home Science, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, for her valuable support and motivation.

The investigator owes her heartfelt thanks and gratitude to **Dr.(Mrs.) U.K.Lakshmi. M.Sc., and Dip Ed., M. Phil., Ph.D.** Professor and Head, Department Food Science and Nutrition, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, for her inspiration, encouragement and support.

With glowing sense of gratitude and honesty, the researcher places her sincere and grateful thanks to her most honored guide **Dr.(Mrs.) C.A KALPANA, M.Sc. (Madras), B.Ed. (Annamalai), M.Phil. (Mother Theresa), Ph.D. (Avinashilingam)**, Associate Professor, Department of Food Science and Nutrition, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, for her dynamic guidance, constant encouragement, valuable suggestions, supportive wisdom, perfectionism, untiring enthusiasm and gentle caring rendering through the successful completion of the study.

The investigator expresses her heartfelt thanks to her **beloved parents, family members, friends and sisters** for their motivation, care, concern and support which cannot be expressed in words.

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INTRODUCTION

In a world of highly refined carbohydrates and blood sugar highs and lows, fiber is the healthy standout in the carbohydrate category. It is an indigestible complex carbohydrate found in plants and is considered to have no calories because the body cannot absorb it. According to the National Institute of Nutrition (NIN), only a small amount of fiber is metabolized in the stomach and intestine, while the rest is passed through the gastrointestinal tract and eventually excreted (Cherbut et al., 2007).

Dietary fiber is the component in food not broken down by native enzymes and secretions of the gastrointestinal tract but which may be metabolized by the bacteria in the lower gut (Johnson, 2009).

Dietary fibers are long chain carbohydrates (polysaccharides) that are indigestible by the human digestive tract. Dietary fiber comes from thick cell wall of plants (Singh, 2001).

Dietary fiber are found in plants. While all plants contain some fiber, plants with high fiber concentrations are generally the most practical source. For example, plums have thick skin covering a juicy pulp. The plum's skin is an insoluble fiber source whereas soluble fiber is found inside in the pulp (Spiller, 2004).

Dietary fiber, also known as roughage or bulk, includes all parts of plant foods that our body can't digest or absorb. Unlike other food component such as fats, proteins or carbohydrate which our body breaks down and absorb, fiber is not digested by our body. Therefore, it passes relatively intact through stomach, small intestine and colon and out of our body. It might seem like fiber does not do much, but it has several important role in maintaining health (Susan et al., 2001).

Fiber acts by changing the nature of the contents of the gastrointestinal tract and by changing how other nutrients and chemicals are absorbed. Soluble fiber absorbs water to become a gelatinous, viscous substance and is fermented by bacteria in digestive tract. Insoluble fiber has bulking action and is not fermented, although a

major dietary insoluble source, lignin, may alter the fate and metabolism of soluble fiber (Derkamp et al., 2010).

Advantages of consuming fiber are the production of salubrious compounds during the fermentation of soluble fiber, and insoluble fiber's ability via its passive hydrophilic properties to increase bulk, soften stool and shorten transit time through the intestinal tract (Salovaara et al., 2007).

Fiber rich plants can be eaten directly or alternatively and they can be used to make supplements and fiber rich processed foods. The American Dietetic Association (ADA) recommends a 2000 calorie diet which includes 25 gm of fiber/day. For children over age 2, the recommended intake is the child's age + 5 grams. Both types of fiber are crucial for regular bowel function as it increases stool weight, and improves transit time, as well as decreases absorption of other carbohydrates and fats (Southgate et al., 2003).

A large increase in fiber over a short period of time may result in bloating, diarrhea, gas and general discomfort. An overdose of soluble fiber can cause diarrhea and worsen irritable bowel syndrome. Negative effects of dietary fiber include a reduced absorption of vitamins, minerals, proteins, and calories from the gut. Some insoluble fiber can bind to certain minerals such as calcium, magnesium, phosphorus and iron. Bran, an insoluble fiber, reduces absorption of liquids, may cause it to swell and, in extreme cases, cause choking (Michael et al., 2006).

People who have gastro intestinal tract infections should not take fiber supplements. In the market fiber supplements are a few example forms of fiber that have been sold as supplements or food additives. These may be marketed to consumers for nutritional purposes, treatment of various gastro intestinal disorders, and for such possible health benefits as lowering cholesterol levels, reducing risk of colon cancer, and losing weight (Sareen et al., 2005).

Consumption of high fiber starchy foods, mainly whole wheat flour and brown rice has gone down considerably and has been replaced by low fiber refined wheat

flour and polished rice. Depletion of fiber in our present day diet has resulted in emergence of several disease including diabetes, obesity, cardiovascular disease, gastrointestinal diseases, appendicitis, cancer of colon and constipation (Coulston and Boushy, 2008).

High-fiber diets provide bulk or more satiating and have been linked to lower body weight. Solubility of fiber was thought to determine physiological effect. More recent studies suggested other properties of fiber, perhaps ferment ability or viscosity are important parameters (Salovaara et al.,2007).

Dietary fiber is the part of a plant that cannot be digested by the body, just as there are many types of plants, there are also many types of fibers. Some fibers, such as oat bran, are from a gelatinous bulk that can lower cholesterol. Other fibers, such as wheat bran, are insoluble and add bulk to the stool (Gupta, 2005).

Kodo millet is nutritionally comparable with other common cereals and even superior to rice and wheat in some aspects like minerals and fiber (Bhawna et al., 2008).

Many types of green leaves such as palak, amaranth, curry leaves, fenugreek leaves, drumstick leaves, mint etc., are consumed all over the country as vegetables and most of them are rich sources of calcium, iron, carotene, vitamin-C, riboflavin and folic acid. These vegetables are therefore inexpensive sources of many nutrients which are essential for growth and maintenance of normal health (Frances and Ellie, 2011).

Good health is not only an indicator of socio-economic status and standard of living in the country, but it reflects the values and beliefs of the society (Bella, 2006).

A large shift from consumption of coarse grains and millets to more refined cereals like polished rice and wheat is seen especially among the urban population and higher income groups. These changes could result in a significant decrease in the overall fiber content of the diet and associated with increasing prevalence of over weight/obesity and several chronic degenerative diseases such as diabetes mellitus, cardiovascular diseases and cancer (Popkin et al.,2007).

Although millets are nutritionally superior to cereals their utilization in the country is not widespread. They are mostly used in preparation of traditional dishes (www.agriculture.millets.com).

Millets are small seeded annual cereal grains and are particularly low in phytic acid and rich in dietary fiber, iron, calcium and B vitamins. In the present era of food scarcity, there exists a need of diversity to use millets by developing millet products (Karuppasamy et al., 2011).

The minor millets comprises of kodo millet or varagu (*Paspalumscrobiculatum*), little millet or samai (*Panicumilliare*), proso millet or panivaragu (*Panicummillaceum*). These millets contains high energy and are nutritious compared to other cereals which are consumed by the poor. They guard the people against nutritional deficiency disorders and provides nutritional security (www.agriculture.millets.com).

Traditionally, kodo millets are grown by tribals in certain parts of india. Kodomillet, is nutritionally comparable with other common cereals and even superior to rice and wheat in some aspects like minerals and fiber (Shirsat et al., 2008).

The botanical name of kodomillet is *Paspalamscrobiculatum* and it is commonly known as varagu in tamil. The nutritive value of varagu consists of 308kcal if energy,8 gram of protein, 9 gram of fiber, 1.4 of fat (Bhawna et al., 2008).

In India, different kinds of traditional foods are made from kodomilet which forms a staple diet for many rural and urban households (Vidyavathi,et al.,2004).

According to Harvard school of Public Health, fiber is one of the most nutritional ingredients for human diet. Deficiency of fiber is the major cause of obesity in U.S. citizen and it also increases the risk of diabetes and heart stroke (www.lifestylehealthinfoarticles.com).

The American Dietetic Association recommended the consumption of 25-35 grams of fiber each day. As varagu contains a dietary fiber content of 9g/100gm, it helps in protecting against obesity, hyperglycemia, hypercholesterolemia, heart disease and cancer.

Kodomillet acts as a digestive, appetizer and diuretic. Celiac patients can replace certain cereal grains in their diets by consuming such millets in various forms including breakfast cereals (www.agrisoures.com).

Whole Bengal gram are known as chickpeas or Garbanzo beans. Whole Bengal gram provides an excellent source of molybdenum. They are also a very good source of protein, folic acid and fiber (Yadhav et al.,2007).

Whole Bengal gram contains phytochemicals called saponins, which can acts as antioxidants. It could lower the risk of breast cancer, protect against osteoporosis and minimize hot flushes in post menopausal women (Brink et al., 2006).

In South Asia the whole Bengal gram is most of the developed world. Bengal gram is a major pulse crop in India, widely grown for centuries and accounts for nearly 40 percent of the total pulse production (Yadhav et al.,2007).

Whole Bengal gram is widely appreciated as health food. It is an protein rich supplement to cereal based diets, especially to the poor in developing countries, where people are vegetarians or cannot afford animal protein (Dulling 2008).

Whole Bengal gram offers the most practical means of eradicating protein malnutrition among vegetarian children and nursing mothers. It has a very important role in human diet in our country (Williams, 2007).

Whole Bengal gram contains both soluble and insoluble dietary fiber, which help to remove cholesterol containing bile from the body, and also prevent digestive disorders like irritable bowel syndrome and diverticulitis (Rulliere, 2003).

Whole Bengal gram can help in improving blood sugar levels. It is a cofactor in a variety of enzymes that help with the body's energy production. It is good source of minerals like iron copper and zinc (Dulling 2008).

Whole Bengal gram the world third most important food legume is currently grown on about 10 million hectare worldwide with 95% calculation in the developing countries. India is the major producer as well as consumer of channa in the world (Braun et al 2004).

Whole Bengal gram consumption is also a common practice in rural areas and farming community. Cooking of seeds by traditional method and also the nutritional quality adversely (Malleshi and Desikachar, 2011)

The leaves of drumstick tree have no parallel in the plant kingdom. The moringa tree is the most nutritious in the world, with most of its benefits stored in the small green leaves of this unassuming plant (Retka, 2008).

Moringa is known as the tree of life, it contains more than 90 nutrients including 40 powerful antioxidants. In fact, practically every part of the plant contains important minerals and are a good source of protein, vitamins, beta carotene, amino acids, and various phenolics (www.moringasource.com).

Moringa leaves are small, thick, and tear drop shaped and grow rapidly as plant matures. The leaves are strong and firm and can be easily picked from the tree's branches (www.moringaleaves.net).

Drumstick leaves powder contains all eight essential amino acids required for proper protein synthesis. It is rich in flavonoids, including Quercetin, Kaempferol, Beta-sitosterol, Caffeoylquinic acid and Zeatin. Stacked full of nutrients, antioxidants, and vital proteins, it is quite possibly the most amazing botanical ever studied (Schwarz et al., 2008).

Drumstick leaves increases the body's immune system, and provides nourishment to the brain and body, promotes energy, decreases anxiety, depression, and sleep related disorders, promotes cell structure of the body (Janick et al., 2008).

For centuries, people in many countries have used moringa leaves as traditional medicine for common ailments. Clinical studies have begun to suggest that at least some of these claims are valid. With such great medicinal value being suggested by traditional medicine, further clinical testing is very much needed at this time. If studies conclude that even some of the claims are correct, these could become an invaluable resource for people in areas where other forms of treatment (Robert et al., 2008).

In India drumstick leaves are traditional medicine used for cure anemia, anxiety, asthma, blackheads, blood impurities, bronchitis ,scurvy, headaches, pain in joints, etc (Baker et al., 2007).

In this view, the present study was carried out with the following objectives

To

- Identify and selection of fiber rich millet, pulse and green leafy vegetables.
- Develop a standardized mix with the selected foods.
- Formulate recipes with the developed and standardized mix.
- Analysis the nutrient content of the developed high fiber mix.
- Find out the acceptability of the formulated recipes.

REVIEW OF LITERATURE

The literature pertaining to the study titled “**Formulation and Evaluation of Recipes with Standardized High Fiber Mix**” is reviewed under the following headings.

- A. Introduction to dietary fiber.
- B. Health benefits of dietary fiber.
- C. Nutritive value of dietary fiber-kodomillet, bengalgram, drumstick leaves.
- D. Nutritional benefits of dietary fiber-kodomillet, bengalgram, drumstick leaves.

A. INTRODUCTION TO DIETARY FIBER

Dietary fiber, also known as roughage or bulk, includes all parts of plant foods that your body can't digest or absorb. Unlike other food components, such as fats, proteins or carbohydrates which your body breaks down and absorbs fiber isn't digested by your body. Instead, it passes relatively intact through your stomach, small intestine, colon and out of your body (Susan et al., 2001).

Fiber is commonly classified as soluble or insoluble Soluble fiber dissolves in water. It is readily fermented in the colon into gases and physiologically active byproducts, and can be prebiotic and/or viscous. Soluble fibers tend to slow the movement of food through the system (Derkamp et al.,2010).

Insoluble fiber does not dissolve in water. It can be metabolically inert and provide bulking or prebiotic, metabolically fermenting in the large intestine. Bulking fibers absorb water as they move through the digestive system, easing defecation Fermentable insoluble fibers mildly promote stool regularity, although not to the extent that bulking fibers do, but they can be readily fermented in the colon into gases and physiologically active byproducts. Insoluble fibers tend to accelerate the movement of food through the system (Barry et al.,2001).

Dietary fibers can act by changing the nature of the contents of the gastrointestinal tract and by changing how other nutrients and chemicals are absorbed. Some types of soluble fiber absorb water to become a gelatinous, viscous substance and is fermented by bacteria in the digestive tract (Birch et al, 2010).

Some types of insoluble fiber have bulking action and are not fermented. A major dietary insoluble fiber source may alter the rate and metabolism of soluble fibers. Other types of insoluble fiber, notably resistant starch, are fully fermented (Baily, 2003).

Chemically, dietary fiber consists of non-starch polysaccharides such as arabinoxylans, cellulose, and many other plant components such as resistant starch, resistant dextrans, inulin, lignin, waxes, chitins, pectins, beta-glucans, and oligosaccharides (Sareen et al., 2005).

A novel position has been adopted by the US Department of Agriculture to include *functional fibers* as isolated fiber sources that may be included in the diet. The term "fiber" is something of a misnomer, since many types of so called dietary fiber are not actually fibrous (Don Ross, 2007).

Disadvantages of a diet high in fiber is the potential for significant intestinal gas production and bloating. Constipation can occur if insufficient fluid is consumed with a high-fiber diet (Premnath, et al 2010).

Originally, fiber was defined to be the components of plants that resist human digestive enzymes, a definition that includes lignin and polysaccharides. The definition was later changed to also include resistant starches, along with inulin and other oligosaccharides (Jhonson, 2009).

Some plants contain significant amounts of soluble and insoluble fiber. For example, plums and prunes have a thick skin covering a juicy pulp. The skin is a source of insoluble fiber, whereas soluble fiber is in the pulp. The root of the konjac plant, or glucomannan, produces results similar to fiber and may also be used to relieve constipation (Banerjee, 2010).

Some fruits and fruit juices (including prune juice, plums, berries, ripe bananas, and the insides of apples and pears) certain vegetables such as broccoli, carrots, and Jerusalem artichokes root tubers and root vegetables such as sweet potatoes and onions (Spiller, 2004).

Psyllium seed husk (a mucilage soluble fiber) and flax seeds nuts, with almonds being the highest in dietary fiber. Sources of insoluble fiber include: whole grain foods, wheat and corn bran, legumes such as beans and peas, nuts and seed as potato skins. Vegetables such as green beans, cauliflower, zucchini, celery, and nopal some fruits including avocado, and unripe bananas the skins of some fruits, including kiwifruit and tomatoes are sources of insoluble fibers (Freeman, 2009)

Dietary fiber has many functions in diet, one of which may be to aid in energy intake control and reduced risk for development of obesity. The role of dietary fiber in energy intake regulation and obesity development is related to its unique physical and chemical properties that aid in early signals of satiation and enhanced or prolonged signals of satiety (Gardner, 2006).

Glucomannan is sold in various forms, and while safe in some forms, it can be unsafe in others, possibly leading to throat or intestinal blockage. Soluble fiber is found in varying quantities in all plant foods, including legumes (peas, soybeans, lupines and other beans)oats, and barley (Zilli *et al.*,. 2002).

B. HEALTH BENEFITS OF DIETARY FIBER

A high-fiber diet has many benefits, which include Normalize bowel movements. Dietary fiber increases the weight and size of your stool and softens it. A bulky stool is easier to pass, decreasing your chance of constipation. If you have loose, watery stools, fiber may also help to solidify the stool because it absorbs water and adds bulk to stool (Evans, 2006).

Helps maintain bowel health. A high-fiber diet may lower your risk of developing hemorrhoids and small pouches in your colon (diverticular disease). Some fiber is fermented in the colon. Helps control blood sugar levels. In people with

diabetes, fiber particularly soluble fiber can slow the absorption of sugar and help improve blood sugar levels. A healthy diet that includes insoluble fiber may also reduce the risk of developing type 2 diabetes (Burton, 2007).

Another benefit attributed to dietary fiber is prevention of colorectal cancer. However, the evidence that fiber reduces colorectal cancer is mixed.

TABLE I
DIFFERENT FIBERS AND THEIR CONTRIBUTION IN VARIOUS
PHYSIOLOGICAL FUNCTIONS

Type of fiber	Sources	Physiological functions
Insoluble fiber	Wheat bran, corn bran, fruit skins.	May contribute to maintenance of a healthy digestive tract may reduce the risk of some types of cancer.
Soluble fiber	Psyllium seed husk, pears, beans, apples, citrus fruit.	May reduce risk of CHD and some types of cancer.

(Mehta and Kaur, 2005).

C. NUTRITIVE VALUE OF DIETARY FIBER, KODOMILLET, WHOLE BENGALGRAM, DRUMSTICK LEAVES

TABLE-II
THE AMOUNT OF FIBER PRESENT IN THE FOOD

Food group	Quantity	Per 100 grams
Fruit.	0.5 cup	1.1gm
Dark green vegetables.	0.5 cup	6.4gm
Orange vegetables.	0.5 cup	2.1gm
Cooked dry beans.	0.5 cup	8.0gm
Starchy vegetables.	0.5 cup	1.7gm
Other vegetables.	0.5 cup	1.1gm

(Parisi, 2008).

TABLE-III
NUTRITIVE VALUE OF VARAGU

Nutrients	Per 100grams
Energy (Kcal)	309
Carbohydrate (g)	65.9
Protein (g)	8.3
Fat (g)	1.4
crude fiber (g)	9.0
Calcium (mg)	27
Iron (mg)	0.5
Moisture (%)	12.8

(Gopalan, 2006).

TABLE-IV
NUTRITIVE VALUE OF WHOLE BENGAL GRAM

Nutrients	Per 100grams
Energy (Kcal)	360
Carbohydrate (g)	60.9
Protein (g)	17.1
Fat (g)	5.3
Crude fiber (g)	3.9
Calcium (mg)	202
Iron (mg)	4.6
Moisture (%)	9.8
Vitamin –c (mg)	0.9

(Gopalan, 2006)

Bengal gram are a source of zinc, folate and protein. Bengal gram are low in fat and most of this is polyunsaturated. Nutrient profile of desi chana (the smaller variety) is different, especially the fiber content which is much higher than the light coloured variety (Devraj, 2007).

One hundred grams of mature boiled contains Bengal gram 164 calories, 2.6 grams of fat (of which only 0.27 grams is saturated), 7.6 grams of dietary fiber and 8.9 grams of protein. Bengal gram also provides dietary phosphorus (168 mg/100 g), which is higher than the amount found in a 100-gram serving of whole milk. (Maria, 2000).

TABLE-V
NUTRITIVE VALUE OF DRUM STICK LEAVES

Nutrients	Per 100grams
Energy (Kcal)	92
Carbohydrate (g)	12.5
Protein (g)	6.7
Fat (g)	1.7
Crude fiber (g)	0.9
Calcium (mg)	440
Iron (mg)	0.85
Moisture (%)	75.9
Vitamin –c (mg)	22

(Gopalan, 2006).

Much of the plant is edible by humans or by farm animals. The leaves are rich in protein, vitamin A, vitamin B, vitamin C and minerals. One hundred grams of fresh Moringa leaves have 2 times the protein of 100 g yogurt (Moringa 8.3 g, yogurt 3.8 g) 4 times the calcium of 100 g milk (Moringa 434 mg, whole cow milk 120 mg) the same potassium as 100 g banana (Moringa 404 mg, banana 376 mg) the same vitamin A as 100 gm carrot (Moringa 738 µg, carrot 713 µg) 3 times the vitamin C of 100 g orange (Moringa 164 mg, orange 46.9 mg (www.morigaleaves.net)).

D. NUTRITIONAL BENEFITS OF DIETARY FIBER- KODOMILLET, BENGALGRAM, DRUMSTICK LEAVES

Most people have not even heard of millet, much less understand the benefits of millet nutrition. And yet, millet is one of the best-kept secrets of our ancient

ancestors. Traced back to its origin, millet has been used throughout the ages and across many countries.

For centuries millet has been a prized crop in China, India, Greece, Egypt and Africa, used in everything from bread to couscous, and as cereal grain. Millets are even mentioned as a treasured crop in the Bible (Franke, 2005).

This tiny "grain" is gluten-free and packed with vitamins and minerals. In fact, while it's often called a grain because of its grain-like consistency, *millet is actually a seed*. It's often used in birdseed mixture, but if you think it's just for the birds, you're missing out on important benefits of millet nutrition (Kharkar 2007).

Millet is one of the four gluten-free grain-like seeds on the Body Ecology program. Some of the key reasons millet is part of your healthy Body Ecology diet is because it: Highly nutritious – ideal for children.

High amounts of fiber Rich in phytochemicals including phytic acid, which is believed to lower cholesterol, and phytate, which is associated with reducing cancer risks. All Millet varieties show high antioxidant activity. Millet helps to control Blood sugar and Cholesterol Digests easily. Millet Consumption decreases Triglycerides and C-Reactive Protein (justeat.in/articles).

Many studies have been done on millet nutrition to identify its benefits for your health. Here are some of the findings Magnesium in millet can help reduce the affects of migraines and heart attacks.

Niacin (vitamin B3) in millet can help lower cholesterol. Phosphorus in millet helps with fat metabolism, body tissue repair and creating energy (phosphorus is an essential component of *adenosine triphosphate* or ATP, a precursor to energy in your body).Millet can help lower risk of type 2 diabetes. Fiber from whole grains has been shown to protect against breast cancer. Whole grains have been shown to protect against childhood asthma (www.miletexports.com).

Bengal gram is called Chickpea or Gram (*Ciceraritinum L.*) in South Asia and Garbanzo bean in most of the developed world. Bengal gram is a major pulse crop in India, widely grown for centuries and accounts for nearly 40 percent of the total pulse production. India is the major growing country of the world, accounting for 61.6 per cent of the total world area under Bengal gram and 68.1 per cent of the total world production (Prakash et al., 2005).

Bengal gram is widely appreciated as health food. It is a protein-rich supplement to cereal-based diets, especially to the poor in developing countries, where people are vegetarians or cannot afford animal protein. It offers the most practical means of eradicating protein malnutrition among vegetarian children and nursing mothers. It has a very important role in human diet in our country (David, 2003).

Recent studies have also shown that they can assist in lowering of cholesterol in the bloodstream. Sprouted Bengal gram is reported to possess higher antioxidant potential along with inhibitory potential against carbohydrate digestive enzymes relevant to type-2 diabetes (alpha-amylase and alpha-glycosidase) (Robert, 2008).

Bengal gram or chick pea (Channa) is regarded as to generally be the greatest significant pulses inside India. Literally it is ingested within the type of dried out seeds or dal, which well prepared by splitting of the seed-stock towards two halves by separating it from the husk (Khatarpaul, 2004).

Bengal gram broadly grown within the fields of Burma, India, Egypt, Ethiopia, South America, Australia and also Mediterranean international locations. It may be consumed within cooked, boiled or perhaps sprouts style. Their flour is widely applied within Indian confectionery for making snacks for example Chile, pakoras (David, 2003).

Bengal gram got a lot of medicinal properties. It really is a trusted tonic towards the physique any time ingested immersed on water for whole night and also later chewed within the morning having honey. Sprouted Bengal gram is noticed to be ripe through Vitamin C plus B-complex (Higgins, 2004).

Drumstick leaves (*Moringaoleifera*), with a total carotene of 40,000 g/100 g fresh weight and beta-carotene 19,000 g/100 g fresh weight can be a suitable protocol for dietary diversification/improvement strategy. These Green leafy vegetables with their storehouse of polyphenols as well as calcium, iron, folic acid, riboflavin, vitamin C and beta-carotene, should be used in abundance in order to maintain the body against oxidative damage caused by everyday pollutants (Hemangini and Gandhi, 2006).

Drumstick is also preserved and exported worldwide. Tender drumstick leaves, finely chopped, make an excellent garnish for any vegetable dishes, dals, sambers, salads, etc (Nambiar et al, 2005).

Drumstick leaves are also rich sources of flavonols such as kaempferol and 3'-OMe quercetin. A flavone, acacetin and a glycoflavone 4-OMe Vitexin was also identified. The phenolic acids identified included melilotic acid, p-coumaric acid, and vanillic acid (Nambiar et al, 2005).

Diabetes mellitus is a metabolic disorder of multiple etiology characterized by chronic hyperglycemia with disturbance of carbohydrate, fat and protein metabolism resulting from in insulin secretion, insulin action on both (WHO) (Biliaderis and Marta, 2007).

Pomace is the residue that remained after juice extraction from fruits. It is source of dietary fiber with 50% soluble dietary fiber in total dietary fiber (Anjali and Ronate, 2005).

Dietary fiber plays an important role in human health. Dietary fiber is not only desirable to nutritional properties, but also for their functional and technological properties and because of that they can be used to upgrade agricultural products and by products for use as a food ingredient. This is used in various food preparations like biscuits etc (Kannan and Susheela, 2006).

Plant fibers can moderate postprandial glucose and insulin concentrations in non-insulin dependent diabetic if administrated with meals (Brigenti, 2004).

Fiber nutrition has been an area of increasing interest for study by nutritionist of the world over for the past 25 years. Dietary fiber, unavailable carbohydrate or roughage are the different terms used to define that part of the plant food which is not digested by the endogenous secretions of the human digestive system.

According to researchers in the department of pharmacology, *paspalumscobiculatum* shows antidiabetic potential and used in traditional medicine systems to treat diabetes (www.livestrong.com).

Kulkarni and Naik (2009) reported that kodo millet decreased cholesterol levels and helped to maintain healthy body weight.

Kodomillet served as a nutraceutical and functional food in health promotion and disease risk reduction and can be included in therapeutic diets (Chandrasekhara and Shalidi, 2011).

Jain et al., (2010) revealed that every single millet is a solution for malnutrition that affects a vast majority of the Indian population.

Kodomillet contains dietary fiber and it has a role in weight control, obesity, cardiovascular disease and gut-health (Jain, 2008).

The nutritive value of millets are comparable to other cereals with slightly higher content of proteins and minerals (Ugare, 2008).

Legumes, which are used as pulse, the most important pulse crop in India are Bengal gram or channa, belongs to leguminosae family, and is also known as garbanzo beans (Banga and Mogra, 2008).

Bengal gram or channa the world third most important food legume is currently grown on about 10 million hectare worldwide, with 95% calculation in the developing countries (Devrai and Sharma, 2007).

Bengal gram seeds are eaten fresh as green vegetables, parched, fried, roasted, boiled, in snack food and condiments and their flour (made by grinding channa) can

be used as soup, dhal. Both whole legumes and split are used for making curries and consumed along with the rice, chapattis and poories (Singh, 2002).

Whole legumes take much longer time for cooking than splits and washed dhal reduction in cooking time of pulses by a simple process is a consumer requirement (Khatarpaul, 2004).

The desi types the main variety of India has a smaller seed is Indian origin. Desi channa accounts for about 85% of world production. While Kabuli channa for 15% production (Sodhi, 2005).

The Moringa or Drumstick tree (aka Munaga, Muruggai, Muranka) is perennial, erect, slender, medium-sized with many arching branches. It has drumstick-like fruits, small white flowers and small and tear- drop shaped round leaves, which are cooked and eaten as vegetable (Tanna ,2001).

In the developing countries like India, sources of vitamin-A such as drumstick leaves are valuable in overcoming the problem of vitamin A deficiency. These findings also accentuate the importance of carotene on the vitamin A status, and underscore its equivalence to synthetic vitamin A when fed in the right amount (Nambiar and Seshadri 2001).

Bioavailability trials using fresh as well as blanched and sulphited shade dehydrated drumstick leaves were conducted on vitamin A deficient rats. Male *Charlesfoster* strain of rats were fed on a synthetic vitamin A deficient diet for 4 weeks and there after replete with 4000 IU vitamin A/kg diet from either fresh or dehydrated drumstick leaves (Nambiar, 2001).

Varagu was domesticated in India almost 3000 years ago. It is found across the old world in humid habitats of tropics and subtropics. It is a minor grain crop in India and an important crop in the Deccan plateau. The fiber content of the whole grain is very high (Dykes and Rooney,2007).

Varagu has around 11% protein, and the nutritional value of the protein has been found to be slightly better than that of Thinai but comparable to that of other small millets (Sudharshana et al.,2006).

As with other food grains, the nutritive value of Varagu protein could be improved by supplementation with legume protein. It has high source of Protein, Calcium, fiber and Minerals. It can reduce body weight. Varagu increases liver functionality and good for lymphatic disorder (Marlette ,2010).

People who are diabetic and fasting prefer varagu as a major cereal for the day (Lupien, 2005).

Varagu has been used as a human food since ancient times. It can adapt itself and thrive in soils of variable salt concentration and degree of rain fall (Mahdi and Abdal, 2008).

Kodo millet has 37-38 percent of dietary fiber which is highest among cereals, the fat content ranging from 1.1 to 3.4g which has higher poly unsaturated fatty acid(PUFA). The mineral content (4.9%) is also higher than rice and wheat (Hedge and Chandra, 2005).

Bengal gram has many medicinal properties. Soaked in water overnight and chewed in the morning with honey, the whole gram seed acts as a general tonic. The liquid, obtained by soaking the seeds and then macerating them, also serves as tonic. Sprouted Bengal gram supply plenty of B-complex and vitamins (Siddiq, et al.,2008).

Cooked germinated gram is a wholesome food for children and invalids. However excessive use of Bengal gram causes indigestion and may precipitate urinary calcium due to high concentration of oxalic acid and form urinary stone of calculi (Brink et al., 2006).

Diabetic patients who are on a prescribed diet which does not severely restrict the intake of carbohydrates. but includes liberal amounts of Bengal gram extract, have shown considerable improvement in their fasting blood sugar levels, glucose

tolerance, urinary excretion of sugar and general condition (Malleshi, Desikchar, 2011).

Fresh juice of Bengal gram leaves is a very rich source of iron. It is therefore, highly beneficial in the treatment of iron deficiency anemia. A table spoonful of fresh juice mixed with honey should be taken in this condition. An acid liquid is obtained by collecting the dew drops from the leaves by spreading a thin white cloth over the crop at night or by any other means. This acid liquid contains about 94 per cent malic acid and 6 per cent oxalic acid and is used medicinally. It is a valuable astringent for use in dyspepsia, vomiting, indigestion, costiveness, diarrhea and dysentery (Zohary, 2007).

Flour of the unroasted Bengal gram is a very effective cleansing agent and its regular use as a cosmetic bleaches the skin. In allergic skin diseases like eczema, contact dermatitis, scabies, washing the skin with this flour will be highly beneficial. The Bengal gram flour can be beneficially used in the treatment of pimples. The flour should be mixed with curd to make a paste (Daniel, 2007).

Bengal gram is one of the most important pulses in India. Whole dried seeds or splitted seeds are the forms in which they are usually used. This 'dal' is a rich source of proteins, carbohydrates, B group vitamins and certain minerals and thus the food and nutritive value of such food are excellent (Shirley, 2008).

In addition to their excellent nutritive properties, Bengal gram (Whole and dhal) exhibit good curative properties. Bengal gram has many natural therapeutic benefits (Daniel, 2007).

The soaked seeds taken along with honey early morning serves as an excellent general tonic. Isoflavones like Biochanin A and formononetin that have been isolated from Bengal gram have shown hypolipidemic activity. Experiments have also shown that the intake of water extract of Bengal gram enhances the utilization of glucose both in diabetic and normal individuals (Siddiq et al.,2008).

Another important value of this product is its use in the infant feed formulae. Studies have shown that food products prepared by combining rice chicken pea (Bengal gram presoaked) and milk in the proportion (58:30:18) have excellent nutritive properties, rationalizing its use as an infant food. Leaves of Bengal gram are a very rich source of iron and experiments have successfully isolated a haemo protein from them and thus claiming highly beneficial effect in the treatment of iron deficiency anemias. Proteins isolated from Bengal gram have good digestibility and also the protein energy utilization from them is optimum. Processing the chicken pea by cooking increases its net protein utilization and rendering it more nutritive (www.aayurvedatips.blogspot.com).

Thus, Chana Dal that forms a staple part of our diet can be rated as having good nutritive and curative properties (www.aayurvedatips.blogspot.com).

Drumstick leaves as a source of vitamin A These leaves could retain 50% of their B-carotene on shade dehydration and the dehydrated leaves could be easily rehydrated and incorporated into traditional Western Indian recipes without altering their acceptability characteristics (www.moringasource.com).

Fresh leaves gram for gram fresh leaves contain about:4 times the vitamin A of carrots, 7 times the vitamin C of oranges, 4 times the calcium of milk, 3 times the potassium of bananas, $\frac{3}{4}$ the iron of spinach, 2 times the protein of yogurt. Dried leaves gram for gram dried leaves contain about 10 times the vitamin A of carrots, $\frac{1}{2}$ times the vitamin C of oranges, 17 times the calcium of milk, 15 times the potassium of bananas, 25 times the iron of spinach, 9 times the protein of yogurt (www.moringaleaves.net).

Drumstick leaves as a source of vitamin A These leaves could retain 50% of their B-carotene on shade dehydration and the dehydrated leaves could be easily rehydrated and incorporated into traditional Western Indian recipes without altering their acceptability characteristics (www.moringasource.com).

Drumstick sag is beneficial in asthma, bronchitis, arthritis, diabetes, and low blood pressure. It shows positive effects in amenorrhea and reduction of weight. Being warm in potency, it is very effective against digestive disorders such as anorexia and flatulence. The rejuvenating effect of drumstick on the nervous system makes this is useful in nervous debility and paralysis. This drumstick sag increases lactation. The leaves are highly nutritious, being a significant source of beta carotene, vitamin-c, protein, iron, and potassium (Kosambia, 2004).

METHODOLOGY

The methodology pertaining to the study titled “**Formulation and Evaluation of Recipes with Standardized High Fiber Mix**” is presented under the following headings:

- A. Identification and selection of fiber rich millet, pulse and green leafy vegetable.
- B. Development of mix with the selected foods-Varagu, whole Bengal gram and drumstick leaves.
- C. Formulation of recipes with the developed mix.
- D. Acceptability of the formulated recipes using the fiber rich mix.
- E. Nutrient analysis of the mix.

A. IDENTIFICATION AND SELECTION OF FIBER RICH MILLET, PULSE, AND GREEN LEAFY VEGETABLE

Dietary fiber is neither inert nor innocuous and does play an important role in relation to human nutrition (Chopra 2012).

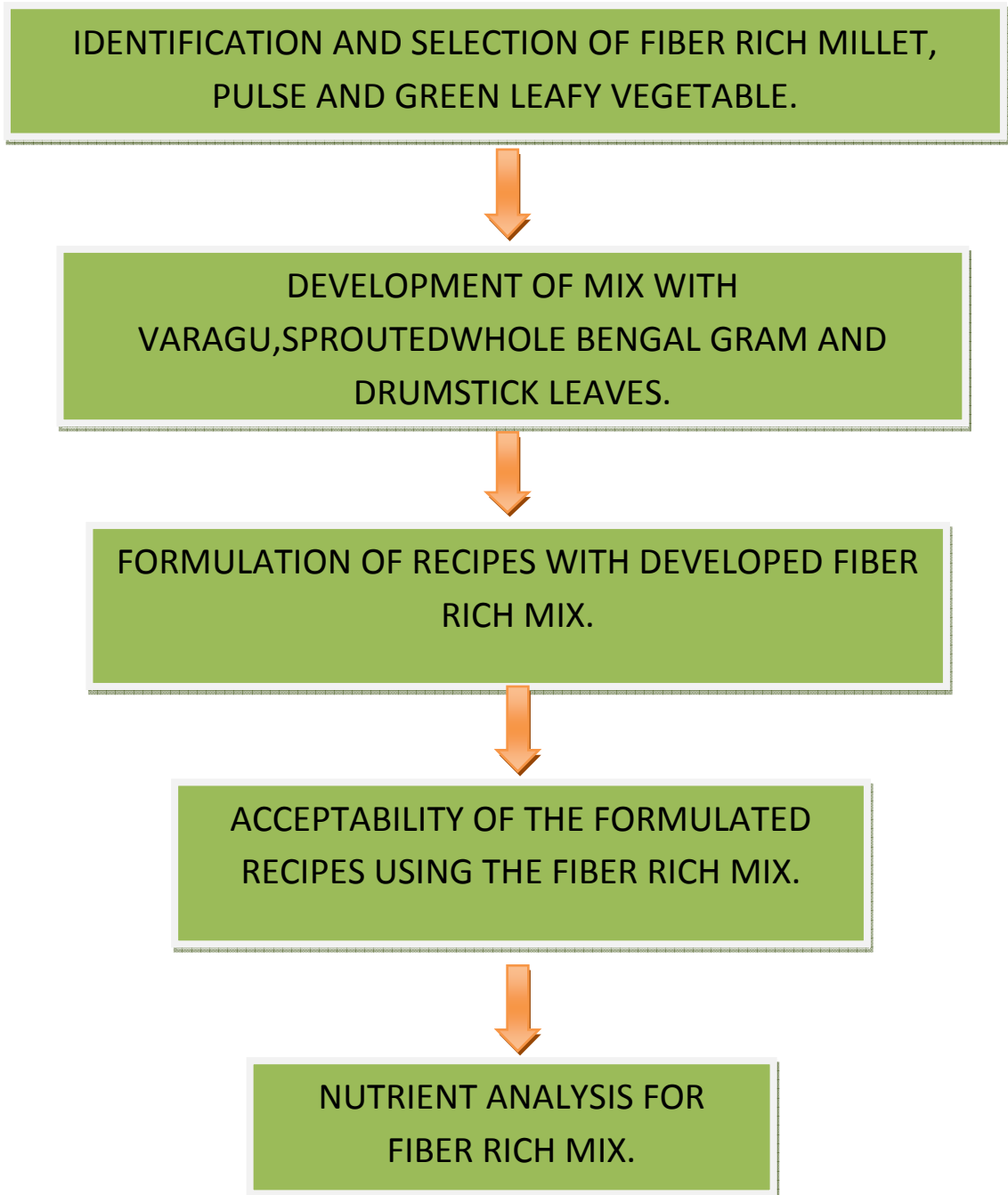
Varagu (kodomillet) has around 11 percent protein. It has high source of protein, calcium, fiber and minerals. Varagu increases liver functionality and good for lymphatic disorders and reduce body weight (Marlette, 2010)

Bengal gram is a good source of protein and fiber. Bengal gram is low in fat and most of this is poly unsaturated. The fiber content is much higher than light coloured variety of the gram.

Sprouted Bengal gram is reported to possess higher antioxidant potential along with inhibitory potential against carbohydrate digestive enzyme, relevant to type-II diabetes. (Malleshi and Desikachar, 2011).

Drumstick leaves are good sources of beta carotene, fiber and also rich source flavonols such as kaempferol. A flavonacacetin and a glycoflavon 4-ome viteexin is also present (Prynne, 2001).

Hence the investigator selected varagu, whole Bengal gram and drumstick leaves for the study. The research design is presented in Figure I



RESEACH DESIGN

FIGURE 1

B. DEVELOPMENT OF MIX WITH THE SELECTED FOODS-VARAGU, WHOLE BENGAL GRAM, DRUMSTICK LEAVES

1. Preparation of mix

Varagu was purchased from departmental store and cleaned thoroughly and then roasted in a pan for 5-7 mins and then cooled at room temperature and powdered very finely.

Bengal gram was purchased and cleaned, and then it was soaked in a bowl of water and tied in a wet cotton cloth and sprouted. The sprouted Bengal gram was dried under the shade and powdered.

Drumstick leaves were cleaned, and dried under the shade and made in to powder.

2. Preparation of powder mix at three different ratios

The three variations was done with the mixture of varagu, sprouted Bengal gram and drumstick leaves powder. The variations are presented in the following tables

TABLE VI
VARIATIONS OF VARAGU FLOUR

VARAGU FLOUR	QUANTITY (g)
Variation I	70
Variation II	60
Variation III	50

TABLE VII
VARIATIONS OF WHOLE BENGAL GRAM FLOUR

WHOLE BENGAL GRAM FLOUR	QUANTITY (g)
Variation I	25
Variation III	30
Variation III	35

TABLE VIII
VARIATIONS OF DRUMSTICK LEAVES POWDER

DRUM STICK LEAVES POWDER	QUANTITY(g)
Variation I	5grams
Variation II	10 grams
Variation III	15 grams

C. FORMULATION RECIPES WITH FIBER RICH MIX

Five recipes namely dosa, kozhukatai, porridge, puttu, upma. Were selected. These recipes were prepared with the developed fiber rich mix. Three variations of each recipe were prepared with the ratios mentioned in the tables.

1. PREPARATION OF RECIPES

a. Standard recipes- Dosa, kozhukatai, upma, puttu, porridge were prepared using standard method and proportions using their respective ingredients.

b. Variations using mix

Dosa

The fiber rich mix was taken in a bowl with the selected variation. And then added water. Mixed with salt. Made it in to a dosa batter

consistency. Taken required amount of batter then made dosa in the pan. Fried it both sides without oil and served it on a clean plate.

Kozhukatai

Water was boiled for 5mins. Added hot water in to the mix and then added salt. For taste added onions and other vegetables also. Mixed it and made it into kozhukatai shapes. Steamed these kozhukatais in a idly steamer, and served it on a clean plate.

Porridge

Water is taken, in a bowl and boiled .Added the mix, stir it continuously to prevent lumps. Cooked it for 5 mins. Added little bit of salt and pepper. Served it on a clean bowl.

Puttu

The mix was taken, added little amount of water. Mixed it once and added salt. As this is Karaputtu, there is no addition of sugar and coconut. Added little spices for taste. Steamed it in a steamer for 10 mins. Served it on a bowl.

Upma

Took a pan and added half spoon of oil for seasoning. Heated the oil and added seasoning material. Fried it for 2mins. Added vegetables like carrot, tomato, potato etc. Fried it for 2mins and then added one cup of water boil it. After boiling added the mix stir it. Cooked it for 5mins. Served it in a clean plate.

All the recipes were developed in the Foods Laboratory, Department of Food science and Nutrition, Avinashilingam Institute for Home science and Higher Education for Women, Coimbatore, as it was convenient for the investigator to conduct the research work.

During the preparation accurate weight, equal measurement of ingredients, maintenance of temperature and time controls were followed for all recipes.

Vessels used for the preparation of recipes were cleaned and standardized in shape and size.

D. SENSORY EVALUATION OF SELECTED RECIPES

Sensory evaluation is a scientific tool that uses the human senses. Smell, sight, taste, texture and hearing to examine the properties which influence the quality of product.(Dermoth and Murray,2007).

Sensory evaluation have to be done because from the evaluation the invistigator have to select standard ratio from three variations.

Hence, the following steps:

- 1.Selection of venue.
- 2.Selection of panel members.
- 3.Formulation of score card.
- 4.Conduct of palatability.

1. Selection of venue

The selection of evaluation room is an essential requisite to sensory evaluation. The Foods laboratory in the Department of Food Science and Nutrition, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore was selected as the venue for sensory evaluation .During evaluation, each panel member was allowed to take their own time to assess the product presented to them. The recipes were arranged neatly, placed on a plate with a spoon or fork as required. The panel members were provided with an evaluation form and pen. A clear glass of water was placed to enable the evaluator to rinse the mouth between tasting.

2. Selection of panel members

Panel members are a group of assessors chosen to participate in a sensory test. A taste panel consisted of people who are requested to assess food quality of samples presented for evaluation and may vary in number depending up on the testing technique used.

Thirty semi-trained panel members were selected based on their health, co-operation, willingness and knowledge of quality characteristics and sensory analysis of foods. A similar study has been conducted using twenty semi trained panel members to find out the acceptability of value addition in biscuits using whey protein concentrate (Uthira and Lakshmi, 2009).

3. Formulation of score card:

Score card is a tool which helps in evaluation through direction and degree of judgment using suitable defined scores. Scoring is form of rating of the prepared food items using a numerical scale where the numbers form an internal or ratio scale (Manay and Shadaksharaswamy, 2007).

A five point scale was formulated for studying the acceptable of the recipes in terms of appearance, colour, flavour, texture, taste and a score card was formulated (Appendix I.)

4. Conduct of palatability:

All the five recipes and its variations made out of developed mix were presented to the panel members for sensory evaluation at different points of time. To prevent any changes in their quality due to storage, temperature changes and reheating, recipes were evaluated immediately after preparation. The portion sizes for all the recipes were kept consistent and uniform.

An evaluation sheet with allotted codes and details of the attributes and number of samples to be evaluated were prepared and given to each panel member. The scores obtained through sensory evaluation of the products by the panel members were

recorded and the mean scores were calculated for each recipe. From the sensory evaluation the ratio of the mix containing 70 percent varagu flour, 25 percent sprouted whole bengal gram flour and 5 percent drumstick leaves powder was considered to be acceptable. The standard and all the variations are presented in plates I, Ia, Ib and II

E. NUTRIENT ANALYSIS OF THE MIX:

The best acceptable ratio with fiber rich mix was analyzed for selected nutrients. Moisture, ash, dietary fiber was carried out by using the methods given by the Association of Analytical Chemists International (2006). Carbohydrate estimation was done by anthrone method. The amount of protein present was estimated by macro kjeldhal's method. The iron content was estimated using colorimetric method and calcium by using titrimetric method. Fat was estimated by sox let extraction method. The total energy was calculated by multiplying the total amount of carbohydrates, fat and protein by their calorific value.(AOAC, 2006).The estimation procedure for nutrient content of the developed mix are given in Appendix II.

Dosa



Standard



Variation

Upma



Standard



Variation

PLATE I

RECIPES PREPARED WITH HIGH FIBER MIX

Kozhukatai



Standard



Variation

Porridge



Standard



Variation

PLATE Ia

RECIPES PREPARED WITH HIGH FIBER MIX

Puttu



Standard



Variation

PLATE Ib

RECIPES PREPARED WITH HIGH FIBER MIX



PLATE II
EVALUATION OF RECIPES

RESULTS AND DISCUSSION

The results of the study on the topic “**Formulation and Evaluation of Recipes with Standardized High**” Fiber Mix discussed under the following headings

- A. Variations of the mix
- B. Sensory evaluation of dosa
- C. Sensory evaluation of kozhukatai
- D. Sensory evaluation of puttu
- E. Sensory evaluation of upma
- F. Sensory evaluation of porridge
- G. Nutrient analysis of fiber rich mix

A. VARIATIONS OF THE MIX

1. Three variations were selected for making the mix and are presented in Table IX

TABLE IX
SELECTED VARIATIONS FOR THE MIX

Varagu flour (g)	Whole Bengal gram flour (g)	Drumstick leaves powder (g)
70	25	5
60	30	10
50	35	15

In the first variation, 70gm of varagu flour, 25gm of whole Bengal gram flour and 5gm of drum stick leaves powder were used. Second variation consisted of 60gm of varagu flour, 30gm of whole Bengal gram flour and 10gm of drum stick leaves powder were used. 50gm varagu flour, 35gm of whole Bengal gram flour and 15gm of drum stick leaves powder were used for the third variation.

These variations are selected for making recipes like dosa, kozhukatai, puttu, upma, porridge and evaluated for their attributes of appearance, colour, flavour, texture, and taste,

B. SENSORY EVALUATION OF DOSA

Dosa is commonly used tiffin item. Dosa was selected for making more nutritious food by using developed mix. Dosa was prepared with developed mix in three variations.

1. The overall acceptability and the mean scores of standard dosa is given in Table X.

TABLE X
OVERALL ACCEPTABILITY AND MEAN SCORES OF
STANDARD DOSA

[Maximum Scores:25]

PARAMETERS	SCORES
Appearance	4.2
Colour	4.3
Flavour	4.2
Texture	4.0
Taste	4.6
Total	21.3
Mean	4.3

The above table shows overall acceptability and mean score of the standard dosa i.e. total value was 21.3 and the mean value is 4.3 and other scores are obtained were appearance 4.2, colour 4.3, flavour 4.2, texture 4.0, taste 4.6.

2. The overall acceptability and the mean scores of variation I dosa with developed mix is given in Table XI

TABLE XI

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION I
DOSA PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION I SCORES
Appearance	4.1
Colour	3.7
Flavour	4.0
Texture	3.8
Taste	4.2
Total	19.8
Mean	4.0

The table shows overall acceptability and mean value of the variation1 dosa i.e. total value was19.8 and the mean value 4.2 and other scores are appearance 4.1, colour 3.7, flavour 4.0,texture 3.8, taste 4.2.

3.The overall acceptability and the mean scores of variation II dosa with developed mix is given in Table XII

TABLE XII
OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION II
DOSA PREPARED WITH DEVELOPED MIX

PARAMETERS	VARIATION II SCORES
Appearance	3.8
Colour	3.3
Flavour	3.8
Texture	3.5
Taste	4.0
Total	18.4
Mean	3.7

Table shows overall acceptability and mean value of the variation II dosa i.e. total value is 18.4 and the mean value 3.7 and other scores are appearance 3.8, colour 3.3, flavour 3.8, texture 3.5, taste 4.0.

4. The overall acceptability and the mean scores of variation III dosa with developed mix is given in Table XIII

TABLE XIII
OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION III
DOSA PREPARED WITH DEVELOPED MIX

PARAMETERS	VARIATION III SCORES
Appearance	3.2
Colour	3.1
Flavour	3.7
Texture	2.8
Taste	3.4
Total	16.2
Mean	3.2

Table shows overall acceptability and mean value of the variation III dosa i.e. total value is 16.2 and the mean value is 3.2 and other values are appearance is 3.2, colour 3.1, flavour 3.7, texture is 2.8, taste is 3.4.

From the above tables, it is revealed that the overall acceptability scores for variation I was 19.8 out of 25 it obtained a mean score of 4.0 when compared variation II which had a overall acceptability of 18.5 with the mean score of 3.7. The third variation obtained total score 16.2 and the mean score is 3.2. The standard dosa scored 21.3 out of a maximum score of 25 the mean score of 4.3 as the highest score was obtained by variation I dosa with developed mix. When compared with the standard it can suggested that this preparation is most acceptable. Similar studies have been done by using millets and pulses based foods like biscuits etc.,(Banerjee, 2010).

B. SENSORY EVALUATION OF KOZHUKATAI

Kozhukatai has different varieties, kozhukatai is a steamed item, we can make sweet kozhukatai and also spicy kozhukatai. The investigator selected and prepared kozhukatai with the developed mix.

1. The overall acceptability and means scores of standard kozhukatai is depicted in Table XIV.

TABLE XIV
OVERALL ACCEPTABILITY AND MEAN SCORES OF
STANDARD KOZHUKATAI

[Maximum Scores:25]

PARAMETERS	STANDARD SCORES
Appearance	4.9
Colour	4.8
Flavour	4.8
Texture	4.8
Taste	4.9
Total	24.2
Mean	4.8

Table shows overall acceptability and mean value of the standard kozhukatai i.e. total value 24.2 and the mean value 4.8 and other scores are appearance 4.9, colour 4.8, flavour 4.8, texture 4.8 and taste 4.9.

2. The overall acceptability and means scores of variation I kozhukatai prepared with developed mix is depicted in Table XV.

TABLE XV

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION I
KOZHUKATAI PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION I SCORES
Appearance	4.7
Colour	4.5
Flavour	4.6
Texture	4.4
Taste	4.4
Total	22.6
Mean	4.5

Table shows overall acceptability and mean value of the variation kozhukatai i.e. total value 22.6 and the mean value 4.5 and other scores are appearance 4.7, colour 4.5, flavour 4.6, texture 4.4, taste 4.4.

3. The overall acceptability and means scores of variation II kozhukatai prepared with developed mix is given in Table XVI

TABLE XVI

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION II
KOZHUKATAI PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION II SCORES
Appearance	4.6
Colour	4.5
Flavour	4.4
Texture	4.2
Taste	4.2
Total	21.9
Mean	4.4

The table represents overall acceptability and mean value of the variation II kozhukatai i.e. total value 21.9 and the mean value 4.4 and other scores are appearance 4.6, colour 4.5, flavour 4.4, texture 4.2 and taste is 4.2.

4. The overall acceptability and mean scores of variation III kozhukatai prepared with developed mix is given in Table XVII

TABLE XVII

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION III
KOZHUKATAI PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION III SCORES
Appearance	3.0
Colour	2.9
Flavour	3.1
Texture	3.2
Taste	3.1
Total	15.3
Mean	3.1

The table represents overall acceptability and mean value of the variation III kozhukatai i.e. total value 15.3 and the mean value 3.1 and other scores are appearance 3.0, colour 2.9, flavour 3.1, texture 3.2, taste 3.1.

The overall acceptability scores for variation I kozhukatai is 22.6 out of 25 it obtained a mean score of 4.5 when compared in the variation II kozhukatai which had a total score of 21.9 with the mean score of 4.4. The third variation variation III obtained total score 15.3 and the mean score is 3.1 the standard kozhukatai scored 24.2 out of a maximum score of 25 the mean score of 4.8 as the highest score was obtained by kozhukatai with developed mix. This preparation was considered to be the most acceptable.

C. SENSORY EVALUATION OF PUTTU

Puttu is very famous food in Kerala. Generally the puttu is in sweet taste but the researcher prepared puttu with spicy taste.

1. The overall acceptability and mean scores of standard puttu is given in Table XVIII.

TABLE XVIII
OVERALL ACCEPTABILITY AND MEAN SCORES OF
STANDARD PUTTU

[Maximum Scores:25]

PARAMETERS	STANDARD SCORES
Appearance	4.3
Colour	4.2
Flavour	4.3
Texture	4.4
Taste	4.4
Total	21.6
Mean	4.3

Table shows overall acceptability and mean value of the standard puttu. The overall acceptability 21.6 and the mean value 4.3 and other values are appearance 4.3, colour 4.2, flavour 4.3, texture obtained 4.4, and taste 4.4.

2. The overall acceptability and means scores of variation I puttu prepared with developed mix is given in Table XIX

TABLE XIX

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION I
PUTTU PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION I SCORES
Appearance	4.2
Colour	4.1
Flavour	4.2
Texture	4.4
Taste	4.3
Total	21.2
Mean	4.5

Table shows overall acceptability and mean value of the variation I puttu total value 21.2 and the mean value 4.5. and other scores are appearance 4.2, colour 4.1, flavour 4.2, texture 4.4, and taste 4.3.

3. The overall acceptability and mean scores of variation II puttu prepared with developed mix is given in Table XX

TABLE XX
OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION II
PUTTU PREPARED WITH DEVELOPED MIX

PARAMETERS	VARIATION II SCORES
Appearance	4.2
Colour	4.1
Flavour	4.1
Texture	4.2
Taste	4.2
Total	20.9
Mean	4.4

Table shows overall acceptability and mean value of the variation II puttu total value 20.9 and the mean value 4.4, and other scores are appearance 4.2, colour 4.1, flavour 4.1, texture 4.2, and taste 4.2.

4. The overall acceptability and means scores of variation III puttu prepared with developed mix is given in Table XXI

TABLE XXI

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION III
PUTTU PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARAIATION III SCORES
Appearance	3.0
Colour	2.9
Flavour	3.1
Texture	3.2
Texture	3.1
Total	15.3
Mean	3.1

Table shows overall acceptability and mean value of the variarion III puttu total value 15.3 and the mean value 3.1, and other scores are appearance 3.0, colour 2.9, flavour 3.1,texture 3.2, taste 3.1.

From the above tables, it is revealed that the overall acceptability scores for variation I was 21.2 out of 25 it obtained a mean score of 4.5 when compared to variation II which had a total score of 20.9 with the means score of 4.4. The third variation obtained total score of 15.3 and the mean score was 3.1. The standard puttu scored 21.6 out of a maximum score of 25 with a mean score of 4.3 As the highest score was obtained by variation I puttu with developed mix, it was considered to be the most acceptable.

D. SENSORY EVALUATION OF UPMA

1. The overall acceptability and mean scores of upma is given in Tables XXII.

TABLE XXII
OVERALL ACCEPTABILITY AND MEAN SCORES OF
STANDARD UPMA

[Maximum Scores : 25]

PARAMETERS	STANDARD SCORES
Appearance	4.8
Colour	4.8
Flavour	4.7
Texture	4.8
Taste	4.8
Total	23.9
Mean	4.8

Table shows overall acceptability and mean value of the standard upma total value 23.9 and the mean value 4.8, and other scores are appearance 4.8, colour 4.8, flavour 4.7, texture 4.8 and taste 4.8.

2. The overall acceptability and means scores of variation I upma prepared with developed mix is given in Table XXIII

TABLE XXIII
OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION I
UPMA PREPARED WITH DEVELOPED MIX

PARAMETERS	VARIATION I SCORES
Appearance	3.9
Colour	4.0
Flavour	4.3
Texture	3.5
Taste	3.9
Total	19.6
Mean	3.9

Table shows overall acceptability and mean value of the variation I upma total value 19.6 and the mean value 3.9, and other values are appearance 3.9, colour 4.0, flavour is 4.3, texture 3.5, taste 3.9.

3. The overall acceptability and means scores of variation II upma prepared with developed mix is given in Table XXIV

TABLE XXIV

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION II
UPMA PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION II SCORES
Appearance	3.4
Colour	3.7
Flavour	4.1
Texture	2.1
Taste	3.1
Total	16.4
Mean	3.3

Table shows overall acceptability and mean value of the variation II upma total value 16.4 and the mean value 3.3, and other score are appearance 3.4, colour 3.7, flavour 4.1, texture 2.1, taste 3.1.

4. The overall acceptability and mean scores of variation III upma prepared with developed mix is given in Table XXV

TABLE XXV

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION III
UPMA PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION III SCORES
Appearance	3.1
Colour	2.9
Flavour	3.5
Texture	2.9
Taste	3.2
Total	15.6
Mean	3.1

The table represents overall acceptability and mean value of the variation III upma total value 15.6 and the mean value 3.1, and other scores are appearance 3.1, colour 2.9, flavour 3.5, texture 2.9 and taste is 3.2.

From the above tables it is revealed that the overall acceptability scores for variation I was 19.6 out of 25 it obtained a mean score of 3.9 when compared with variation II which had a total Score of 16.4 with the means score of 3.3. The third variation obtained total score 15.6 and the mean score 3.1. And the standard upma scored 23.9 out of a maximum score of 25 the mean score of 4.8 as the highest score was obtained by variation I puttu with developed mix.

E. SENSORY EVALUATION OF PORRIDGE

The porridge has selected and prepared with developed mix.

1. The overall acceptability and means scores of standard porridge is given in Table XXVI

TABLE XXVI
OVERALL ACCEPTABILITY AND MEAN SCORES OF
STANDARD PORRIDGE

[Maximum Scores:25]

PARAMETERS	STANDARD SCORES
Appearance	4.5
Colour	4.7
Flavour	4.9
Texture	4.8
Taste	4.8
Total	23.7
Mean	4.7

Table shows overall acceptability and mean value of the standard porridge total value 23.7 and the mean value 4.7, and other scores are appearance 4.5, colour 4.7, flavour 4.9, texture 4.8, taste 4.8

2. The overall acceptability and means scores of variation I porridge prepared with developed mix is given in Table XXVII

TABLE XXVII

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION I
PORRIDGE PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION I SCORES
Appearance	4.3
Colour	4.6
Flavour	4.6
Texture	4.1
Taste	4.1
Total	21.7
Mean	4.3

Table shows overall acceptability and mean value of the variation I porridge total value 21.7 and the mean value 4.3, and other scores are appearance 4.1, colour 4.6 flavour 4.6, texture 4.1, taste 4.1.

3. The overall acceptability and means scores of variation II porridge prepared with developed mix is given in Table XXVIII

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TABLE XXVIII

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION II
PORRIDGE PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION II SCORES
Appearance	4.1
Colour	4.1
Flavour	4.2
Texture	3.8
Taste	4.0
Total	20.2
Mean	4.0

Table shows overall acceptability and mean value of the variation II porridge total value 20.2 and the mean value 4.0, and other scores are appearance 4.1, colour 4.0 flavour 4.2, texture 3.8, taste 4.0.

4. The overall acceptability and mean scores of variation III porridge prepared with developed mix is given in Table XXIX

TABLE XXIX

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION III
PORRIDGE PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION III SCORES
Appearance	3.9
Colour	4.0
Flavour	4.3
Texture	3.5
Taste	3.9
Total	19.6
Mean	3.9

Table shows total value and mean value of the variation III porridge total value 19.6 and the mean value 3.9, and other scores are appearance 3.9, colour 4.0, flavour 4.3, texture 3.5, taste 3.9.

From the above tables it is revealed that the overall acceptability scores for variation I was 21.7 out of 25 it obtained a mean score of 4.3 when compared variation II which had a total Score of 20.2 with the means score of 4.0. Variation III obtained total score 19.6 and the mean score is 3.9. The standard porridge scored 23.7 out of a maximum score of 25 and a mean score of 4.7 as the highest score was obtained by variation I porridge with developed mix.

F. NUTRIENT CONTENT OF FIBER RICH MIX

The most acceptable ratio of the developed mix 70 percent varagu flour, 25 percent sprouted Whole Bengal gram flour and 5 percent drumstick leaves powder selected through the sensory evaluation was further analyzed for its nutrient content. The details of nutrient content of the developed mix as analyzed in the laboratory is given in Table XXX and Figures 2a and 2b

TABLE XXX
NUTRIENT CONTENT OF FIBER RICH MIX

NUTRENTS	PER 100grams
Energy (Kcal)	333
Carbohydrate (g)	65
Protein (g)	12
Fat (g)	1.5
Dietary fiber (g)	13
Calcium (mg)	123.5
Iron (mg)	1.73
Moisture %)	19.5
Vitamin C(mg)	23

MACRO NUTRIENT ANALYSIS OF DEVELOPED MIX

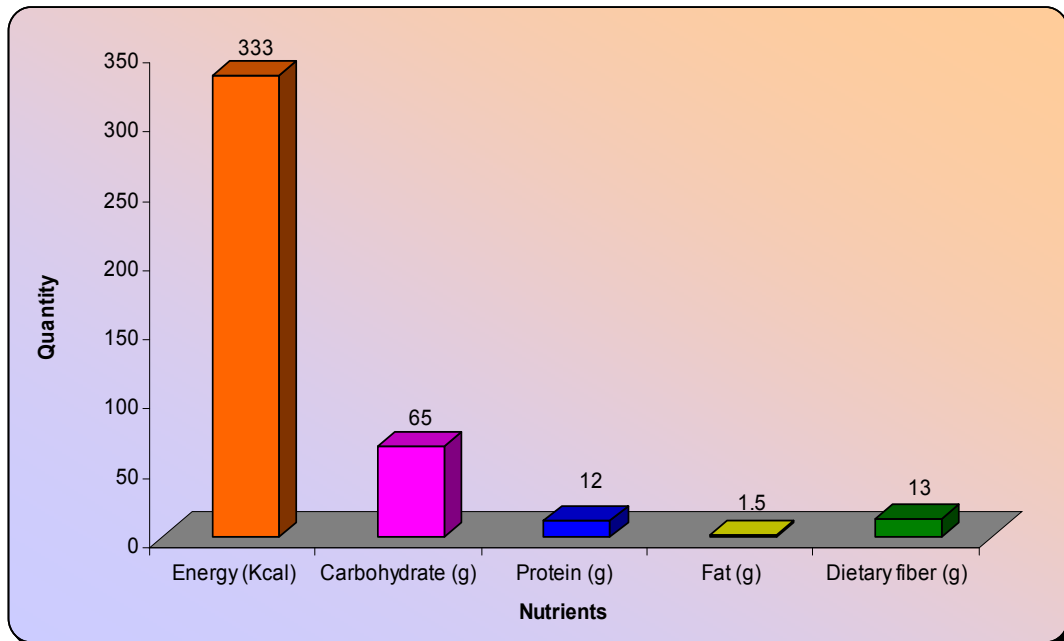


FIGURE 2a

MICRO NUTRIENTS ANALYSIS OF DEVELOPED MIX

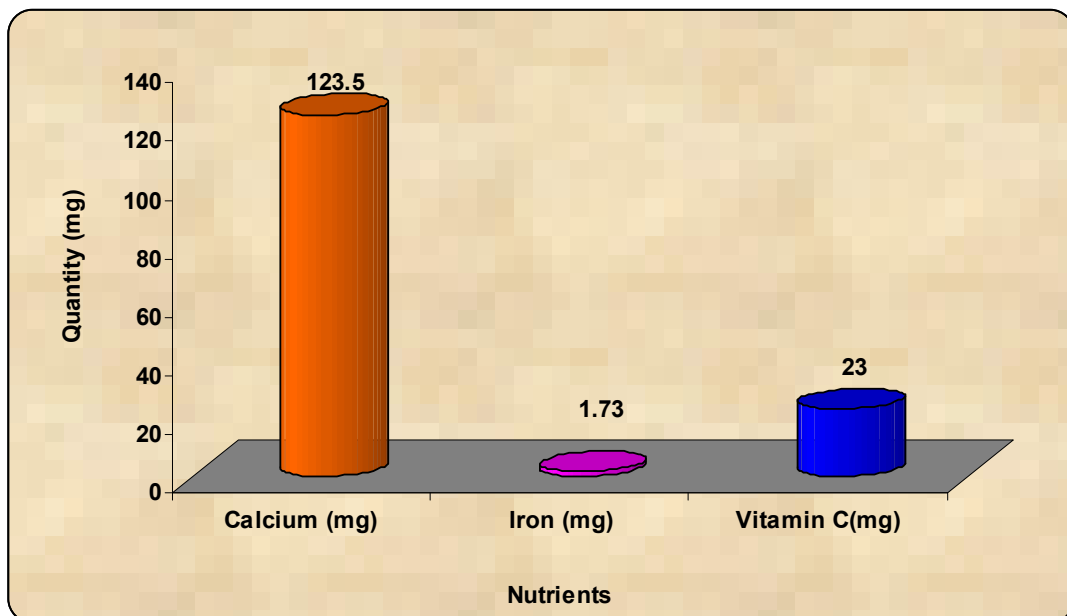


FIGURE 2b

The nutrient content of fiber rich mix presented in Figure 2a, 2b, Figure 2a represents energy, carbohydrate, protein, fat and dietary fiber.

Nutrient analysis of 100gm of developed mix revealed that 333 kcal , and 65 of carbohydrate and 12 grams of protein and fat was 1.5 grams, Dietary fiber was 13g. It was noted that the developed mix was high in protein and low in fat and rich in fiber

Figure 2b represents calcium, iron, vitamin c. The amount of calcium present in fiber rich mix is 123.5 mille grams.1.73mg of iron is present in this mix and Vitamin C was 23mg.

SUMMARY AND CONCLUSION

Dietary fiber is neither inert nor innocuous and does play an important role in relation to human nutrition. Hence the investigator selected varagu, whole Bengal gram and drumstick leaves for the study. Five recipes namely dosa, kozhukatai, porridge, puttu, upma. Were selected. These recipes were prepared with the developed fiber rich mix. The three variations were done with the mixture of varagu, sprouted Bengal gram and drumstick leaves powder. Sensory evaluation of the selected recipes made with developed mix was carried out. From the sensory evaluation the ratio of the mix containing 70 percent of varagu flour, 25 percent of sprouted whole Bengal gram flour and 5 percent drumstick leaves powder was considered to be acceptable.

The salient features of the study are

- Overall acceptability and mean score of the standard dosa i.e. total value was 21.3 and the mean value is 4.3 and other scores are obtained were appearance 4.2, colour 4.3, flavour 4.2, texture 4.0, taste 4.6.
- Overall acceptability and mean value of the variation I dosa i.e. total value was 19.8 and the mean value 4.2 and other scores are appearance 4.1, colour 3.7, flavour 4.0, texture 3.8, taste 4.2.
- Overall acceptability and mean value of the variation II dosa i.e. total value is 18.4 and the mean value 3.7 and other scores are appearance 3.8, colour 3.3, flavour 3.8, texture 3.5, taste 4.0.
- Overall acceptability and mean value of the variation III dosa i.e. total value is 16.2 and the mean value is 3.2 and other values are appearance is 3.2, colour 3.1, flavour 3.7, texture is 2.8, taste is 3.4.
- Overall acceptability scores for variation I was 19.8 out of 25 it obtained a mean score of 4.0 when compared variation II which had a overall acceptability of 18.5 with the mean score of 3.7. The third variation obtained total score 16.2 and the mean score is 3.2. The standard dosa scored 21.3 out of a

maximum score of 25 the mean score of 4.3 as the highest score was obtained by variation I dosa with developed mix. When compared with the standard it can suggested that this preparation is most acceptable.

- Overall acceptability and mean value of the standard kozhukatai i.e. total value 24.2 and the mean value 4.8 and other scores are appearance 4.9, colour 4.8, flavour 4.8, texture 4.8 and taste 4.9.
- Overall acceptability and mean value of the variation kozhukatai i.e. total value 22.6 and the mean value 4.5 and other scores are appearance 4.7, colour 4.5, flavour 4.6, texture 4.4, taste 4.4.
- Overall acceptability and mean value of the variation II kozhukatai i.e. total value 21.9 and the mean value 4.4 and other scores are appearance 4.6, colour 4.5, flavour 4.4, texture 4.2, taste is 4.2.
- Overall acceptability and mean value of the variation III kozhukatai i.e. total value 15.3 and the mean value 3.1 and other scores are appearance 3.0, colour 2.9, flavour 3.1, texture 3.2, taste 3.1.
- Overall acceptability scores for variation I kozhukatai is 22.6 out of 25 it obtained a mean score of 4.5 when compared in the variation II kozhukatai which had a total Score of 21.9 with the means score of 4.4 . The third variation variation-III obtained total score 15.3 and the means score is 3.1 the standard kozhukatai scored 24.2 out of a maximum score of 25 the mean score of 4.8 as the highest score was obtained by kozhukatai with developed mix. This preparation was considered to be the most acceptable.
- Overall acceptability and mean value of the standard puttu. The overall acceptability 21.6 and the mean value 4.3 and other values are appearance 4.3, colour 4.2, flavour 4.3, texture obtained 4.4, and taste 4.4.
- Overall acceptability and mean value of the variation I puttu total value 21.2 and the mean value 4.5 and other scores are appearance 4.2, colour 4.1, flavour 4.2, texture 4.4, and taste 4.3.

- Overall acceptability and mean value of the variation II puttu total value 20.9 and the mean value 4.4, and other scores are appearance 4.2, colour 4.1, flavour 4.1, Texture 4.2, Taste 4.2.
- Overall acceptability and mean value of the variation III puttu total value 15.3 and the mean value 3.1, and other scores are appearance 3.0, colour 2.9, flavour 3.1, texture 3.2, taste 3.1.
- Overall acceptability scores for variation I was 21.2 out of 25 it obtained a mean score of 4.5 when compared to variation II which had a total score of 20.9 with the mean score of 4.4. The third variation obtained total score of 15.3 and the mean score was 3.1. The standard puttu scored 21.6 out of a maximum score of 25 with a mean score of 4.3 As the highest score was obtained by variation I puttu with developed mix, it was considered to be the most acceptable.
- Overall acceptability and mean value of the standard upma total value 23.9 and the mean value 4.8, and other scores are appearance 4.8, colour 4.8, flavour 4.7, texture 4.8, taste 4.8.
- Overall acceptability and mean value of the variation I upma total value 19.6 and the mean value 3.9, and other values are appearance 3.9, colour 4.0, flavour is 4.3, texture 3.5, taste 3.9.
- Overall acceptability and mean value of the variation II upma total value 16.4 and the mean value 3.3, and other score are appearance 3.4, colour 3.7, flavour 4.1, texture 2.1, taste 3.1.
- Overall acceptability and mean value of the variation III upma total value 15.6 and the mean value 3.1, and other scores are appearance 3.1, colour 2.9, flavour 3.5, texture 2.9, and taste is 3.2.
- Overall acceptability scores for variation I was 19.6 out of 25 it obtained a mean score of 3.9 when compared with variation II which had a total Score of

16.4 with the means score of 3.3. The third variation obtained total score 15.6 and the means score 3.1. And the standard upma scored 23.9 out of a maximum score of 25 the mean score of 4.8 as the highest score was obtained by variation I puttu with developed mix.

- Overall acceptability and mean value of the standard porridge total value 23.7 and the mean value 4.7, and other scores are appearance 4.5, colour 4.7, flavour 4.9, texture 4.8, taste 4.8
- Overall acceptability and mean value of the variation I porridge total value 21.7 and the mean value 4.3, and other scores are appearance 4.1, colour 4.6 flavour 4.6, texture 4.1, taste 4.1.
- Overall acceptability and mean value of the variation II porridge total value 20.2 and the mean value 4.0, and other scores are appearance 4.1, colour 4.0 flavour 4.2, texture 3.8, taste 4.0.
- Overall acceptability of the variation III porridge total value 19.6 and the mean value 3.9, and other scores are appearance 3.9, colour 4.0, flavour 4.3, texture 3.5, taste 3.9.
- Overall acceptability scores for variation I was 21.7 out of 25 it obtained a mean score of 4.3 when compared variation II which had a total Score of 20.2 with the means score of 4.0. Variation III obtained total score 19.6 and the mean score is 3.9. The standard porridge scored 23.7 out of a maximum score of 25 and a mean score of 4.7 as the highest score was obtained by variation I porridge with developed mix.
- Nutrient analysis of 100gm of developed mix revealed that 333 kcal, and 65 of carbohydrate and 12 grams of protein and fat was 1.5 grams, Dietary fiber is 13g. It was noted that the developed mix was high in protein and low in fat and rich in fiber
- The amount of calcium present in fiber rich mix is 123.5 milligrams. 1.73mg of iron is present in this mix and Vitamin c was 23mg.

CONCLUSION

From the foregoing results, it is revealed that the formulated and standardized mix can be used to prepare commonly consumed recipes such as dosa, kozhukatai, puttu, upma and porridge. The sensory evaluation showed that the recipes like dosa, kozhukataai, puttu, upma and porridge that were prepared with developed mix were best accepted in the variation I. i.e. 70 percent of varagu flour and 25 percent whole bengal gram flour and then 5 percent of drumstick leaves powder. It can be concluded that this mix is rich in dietary fiber and protein and low fat is beneficial in the context of weight reduction diets.

RECOMMENDATIONS

- Popularization programme and demonstration programme can be done for public to enhance the inclusion of varagu, whole Bengal gram and drumstick leaves in daily diet.
- Formulation and preparation of health mixes using high fiber foods like varagu, whole Bengal gram to overcome nutritional problems.
- Food processing industries can be motivated to produce food products using the developed mix.
- Booklets of recipes can be developed in local languages for convenience of the people.

INTRODUCTION

In a world of highly refined carbohydrates and blood sugar highs and lows, fiber is the healthy standout in the carbohydrate category. It is an indigestible complex carbohydrate found in plants and is considered to have no calories because the body cannot absorb it. According to the National Institute of Nutrition (NIN), only a small amount of fiber is metabolized in the stomach and intestine, while the rest is passed through the gastrointestinal tract and eventually excreted (Cherbut et al., 2007).

Dietary fiber is the component in food not broken down by native enzymes and secretions of the gastrointestinal tract but which may be metabolized by the bacteria in the lower gut (Johnson, 2009).

Dietary fibers are long chain carbohydrates (polysaccharides) that are indigestible by the human digestive tract. Dietary fiber comes from thick cell wall of plants (Singh, 2001).

Dietary fiber are found in plants. While all plants contain some fiber, plants with high fiber concentrations are generally the most practical source. For example, plums have thick skin covering a juicy pulp. The plum's skin is an insoluble fiber source whereas soluble fiber is found inside in the pulp (Spiller, 2004).

Dietary fiber, also known as roughage or bulk, includes all parts of plant foods that our body can't digest or absorb. Unlike other food component such as fats, proteins or carbohydrate which our body breaks down and absorb, fiber is not digested by our body. Therefore, it passes relatively intact through stomach, small intestine and colon and out of our body. It might seem like fiber does not do much, but it has several important role in maintaining health (Susan et al., 2001).

Fiber acts by changing the nature of the contents of the gastrointestinal tract and by changing how other nutrients and chemicals are absorbed. Soluble fiber absorbs water to become a gelatinous, viscous substance and is fermented by bacteria in digestive tract. Insoluble fiber has bulking action and is not fermented, although a

major dietary insoluble source, lignin, may alter the fate and metabolism of soluble fiber (Derkamp et al., 2010).

Advantages of consuming fiber are the production of salubrious compounds during the fermentation of soluble fiber, and insoluble fiber's ability via its passive hydrophilic properties to increase bulk, soften stool and shorten transit time through the intestinal tract (Salovaara et al., 2007).

Fiber rich plants can be eaten directly or alternatively and they can be used to make supplements and fiber rich processed foods. The American Dietetic Association (ADA) recommends a 2000 calorie diet which includes 25 gm of fiber/day. For children over age 2, the recommended intake is the child's age + 5 grams. Both types of fiber are crucial for regular bowel function as it increases stool weight, and improves transit time, as well as decreases absorption of other carbohydrates and fats (Southgate et al., 2003).

A large increase in fiber over a short period of time may result in bloating, diarrhea, gas and general discomfort. An overdose of soluble fiber can cause diarrhea and worsen irritable bowel syndrome. Negative effects of dietary fiber include a reduced absorption of vitamins, minerals, proteins, and calories from the gut. Some insoluble fiber can bind to certain minerals such as calcium, magnesium, phosphorus and iron. Bran, an insoluble fiber, reduces absorption of liquids, may cause it to swell and, in extreme cases, cause choking (Michael et al., 2006).

People who have gastro intestinal tract infections should not take fiber supplements. In the market fiber supplements are a few example forms of fiber that have been sold as supplements or food additives. These may be marketed to consumers for nutritional purposes, treatment of various gastro intestinal disorders, and for such possible health benefits as lowering cholesterol levels, reducing risk of colon cancer, and losing weight (Sareen et al., 2005).

Consumption of high fiber starchy foods, mainly whole wheat flour and brown rice has gone down considerably and has been replaced by low fiber refined wheat

flour and polished rice. Depletion of fiber in our present day diet has resulted in emergence of several disease including diabetes, obesity, cardiovascular disease, gastrointestinal diseases, appendicitis, cancer of colon and constipation (Coulston and Boushy, 2008).

High-fiber diets provide bulk or more satiating and have been linked to lower body weight. Solubility of fiber was thought to determine physiological effect. More recent studies suggested other properties of fiber, perhaps ferment ability or viscosity are important parameters (Salovaara et al.,2007).

Dietary fiber is the part of a plant that cannot be digested by the body, just as there are many types of plants, there are also many types of fibers. Some fibers, such as oat bran, are from a gelatinous bulk that can lower cholesterol. Other fibers, such as wheat bran, are insoluble and add bulk to the stool (Gupta, 2005).

Kodo millet is nutritionally comparable with other common cereals and even superior to rice and wheat in some aspects like minerals and fiber (Bhawna et al., 2008).

Many types of green leaves such as palak, amaranth, curry leaves, fenugreek leaves, drumstick leaves, mint etc., are consumed all over the country as vegetables and most of them are rich sources of calcium, iron, carotene, vitamin-C, riboflavin and folic acid. These vegetables are therefore inexpensive sources of many nutrients which are essential for growth and maintenance of normal health (Frances and Ellie, 2011).

Good health is not only an indicator of socio-economic status and standard of living in the country, but it reflects the values and beliefs of the society (Bella, 2006).

A large shift from consumption of coarse grains and millets to more refined cereals like polished rice and wheat is seen especially among the urban population and higher income groups. These changes could result in a significant decrease in the overall fiber content of the diet and associated with increasing prevalence of over weight/obesity and several chronic degenerative diseases such as diabetes mellitus, cardiovascular diseases and cancer (Popkin et al.,2007).

Although millets are nutritionally superior to cereals their utilization in the country is not widespread. They are mostly used in preparation of traditional dishes (www.agriculture.millets.com).

Millets are small seeded annual cereal grains and are particularly low in phytic acid and rich in dietary fiber, iron, calcium and B vitamins. In the present era of food scarcity, there exists a need of diversity to use millets by developing millet products (Karuppasamy et al., 2011).

The minor millets comprises of kodo millet or varagu (*Paspalumscrobiculatum*), little millet or samai (*Panicumilliare*), proso millet or panivaragu (*Panicummillaceum*). These millets contains high energy and are nutritious compared to other cereals which are consumed by the poor. They guard the people against nutritional deficiency disorders and provides nutritional security (www.agriculture.millets.com).

Traditionally, kodo millets are grown by tribals in certain parts of india. Kodomillet, is nutritionally comparable with other common cereals and even superior to rice and wheat in some aspects like minerals and fiber (Shirsat et al., 2008).

The botanical name of kodomillet is *Paspalamscrobiculatum* and it is commonly known as varagu in tamil. The nutritive value of varagu consists of 308kcal if energy,8 gram of protein, 9 gram of fiber, 1.4 of fat (Bhawna et al., 2008).

In India, different kinds of traditional foods are made from kodomilet which forms a staple diet for many rural and urban households (Vidyavathi,et al.,2004).

According to Harvard school of Public Health, fiber is one of the most nutritional ingredients for human diet. Deficiency of fiber is the major cause of obesity in U.S. citizen and it also increases the risk of diabetes and heart stroke (www.lifestylehealthinfoarticles.com).

The American Dietetic Association recommended the consumption of 25-35 grams of fiber each day. As varagu contains a dietary fiber content of 9g/100gm, it helps in protecting against obesity, hyperglycemia, hypercholesterolemia, heart disease and cancer.

Kodomillet acts as a digestive, appetizer and diuretic. Celiac patients can replace certain cereal grains in their diets by consuming such millets in various forms including breakfast cereals (www.agrisoures.com).

Whole Bengal gram are known as chickpeas or Garbanzo beans. Whole Bengal gram provides an excellent source of molybdenum. They are also a very good source of protein, folic acid and fiber (Yadhav et al.,2007).

Whole Bengal gram contains phytochemicals called saponins, which can acts as antioxidants. It could lower the risk of breast cancer, protect against osteoporosis and minimize hot flushes in post menopausal women (Brink et al., 2006).

In South Asia the whole Bengal gram is most of the developed world. Bengal gram is a major pulse crop in India, widely grown for centuries and accounts for nearly 40 percent of the total pulse production (Yadhav et al.,2007).

Whole Bengal gram is widely appreciated as health food. It is an protein rich supplement to cereal based diets, especially to the poor in developing countries, where people are vegetarians or cannot afford animal protein (Dulling 2008).

Whole Bengal gram offers the most practical means of eradicating protein malnutrition among vegetarian children and nursing mothers. It has a very important role in human diet in our country (Williams, 2007).

Whole Bengal gram contains both soluble and insoluble dietary fiber, which help to remove cholesterol containing bile from the body, and also prevent digestive disorders like irritable bowel syndrome and diverticulitis (Rulliere, 2003).

Whole Bengal gram can help in improving blood sugar levels. It is a cofactor in a variety of enzymes that help with the body's energy production. It is good source of minerals like iron copper and zinc (Dulling 2008).

Whole Bengal gram the world third most important food legume is currently grown on about 10 million hectare worldwide with 95% calculation in the developing countries. India is the major producer as well as consumer of channa in the world (Braun et al 2004).

Whole Bengal gram consumption is also a common practice in rural areas and farming community. Cooking of seeds by traditional method and also the nutritional quality adversely (Malleshi and Desikachar, 2011)

The leaves of drumstick tree have no parallel in the plant kingdom. The moringa tree is the most nutritious in the world, with most of its benefits stored in the small green leaves of this unassuming plant (Retka, 2008).

Moringa is known as the tree of life, it contains more than 90 nutrients including 40 powerful antioxidants. In fact, practically every part of the plant contains important minerals and are a good source of protein, vitamins, beta carotene, amino acids, and various phenolics (www.moringasource.com).

Moringa leaves are small, thick, and tear drop shaped and grow rapidly as plant matures. The leaves are strong and firm and can be easily picked from the tree's branches (www.moringaleaves.net).

Drumstick leaves powder contains all eight essential amino acids required for proper protein synthesis. It is rich in flavonoids, including Quercetin, Kaempferol, Beta-sitosterol, Caffeoylquinic acid and Zeatin. Stacked full of nutrients, antioxidants, and vital proteins, it is quite possibly the most amazing botanical ever studied (Schwarz et al., 2008).

Drumstick leaves increases the body's immune system, and provides nourishment to the brain and body, promotes energy, decreases anxiety, depression, and sleep related disorders, promotes cell structure of the body (Janick et al., 2008).

For centuries, people in many countries have used moringa leaves as traditional medicine for common ailments. Clinical studies have begun to suggest that at least some of these claims are valid. With such great medicinal value being suggested by traditional medicine, further clinical testing is very much needed at this time. If studies conclude that even some of the claims are correct, these could become an invaluable resource for people in areas where other forms of treatment (Robert et al., 2008).

In India drumstick leaves are traditional medicine used for cure anemia, anxiety, asthma, blackheads, blood impurities, bronchitis ,scurvy, headaches, pain in joints, etc (Baker et al., 2007).

In this view, the present study was carried out with the following objectives

To

- Identify and selection of fiber rich millet, pulse and green leafy vegetables.
- Develop a standardized mix with the selected foods.
- Formulate recipes with the developed and standardized mix.
- Analysis the nutrient content of the developed high fiber mix.
- Find out the acceptability of the formulated recipes.

REVIEW OF LITERATURE

The literature pertaining to the study titled “**Formulation and Evaluation of Recipes with Standardized High Fiber Mix**” is reviewed under the following headings.

- A. Introduction to dietary fiber.
- B. Health benefits of dietary fiber.
- C. Nutritive value of dietary fiber-kodomillet, bengalgram, drumstick leaves.
- D. Nutritional benefits of dietary fiber-kodomillet, bengalgram, drumstick leaves.

A. INTRODUCTION TO DIETARY FIBER

Dietary fiber, also known as roughage or bulk, includes all parts of plant foods that your body can't digest or absorb. Unlike other food components, such as fats, proteins or carbohydrates which your body breaks down and absorbs fiber isn't digested by your body. Instead, it passes relatively intact through your stomach, small intestine, colon and out of your body (Susan et al., 2001).

Fiber is commonly classified as soluble or insoluble Soluble fiber dissolves in water. It is readily fermented in the colon into gases and physiologically active byproducts, and can be prebiotic and/or viscous. Soluble fibers tend to slow the movement of food through the system (Derkamp et al.,2010).

Insoluble fiber does not dissolve in water. It can be metabolically inert and provide bulking or prebiotic, metabolically fermenting in the large intestine. Bulking fibers absorb water as they move through the digestive system, easing defecation Fermentable insoluble fibers mildly promote stool regularity, although not to the extent that bulking fibers do, but they can be readily fermented in the colon into gases and physiologically active byproducts. Insoluble fibers tend to accelerate the movement of food through the system (Barry et al.,2001).

Dietary fibers can act by changing the nature of the contents of the gastrointestinal tract and by changing how other nutrients and chemicals are absorbed. Some types of soluble fiber absorb water to become a gelatinous, viscous substance and is fermented by bacteria in the digestive tract (Birch et al, 2010).

Some types of insoluble fiber have bulking action and are not fermented. A major dietary insoluble fiber source may alter the rate and metabolism of soluble fibers. Other types of insoluble fiber, notably resistant starch, are fully fermented (Baily, 2003).

Chemically, dietary fiber consists of non-starch polysaccharides such as arabinoxylans, cellulose, and many other plant components such as resistant starch, resistant dextrans, inulin, lignin, waxes, chitins, pectins, beta-glucans, and oligosaccharides (Sareen et al., 2005).

A novel position has been adopted by the US Department of Agriculture to include *functional fibers* as isolated fiber sources that may be included in the diet. The term "fiber" is something of a misnomer, since many types of so called dietary fiber are not actually fibrous (Don Ross, 2007).

Disadvantages of a diet high in fiber is the potential for significant intestinal gas production and bloating. Constipation can occur if insufficient fluid is consumed with a high-fiber diet (Premnath, et al 2010).

Originally, fiber was defined to be the components of plants that resist human digestive enzymes, a definition that includes lignin and polysaccharides. The definition was later changed to also include resistant starches, along with inulin and other oligosaccharides (Jhonson, 2009).

Some plants contain significant amounts of soluble and insoluble fiber. For example, plums and prunes have a thick skin covering a juicy pulp. The skin is a source of insoluble fiber, whereas soluble fiber is in the pulp. The root of the konjac plant, or glucomannan, produces results similar to fiber and may also be used to relieve constipation (Banerjee, 2010).

Some fruits and fruit juices (including prune juice, plums, berries, ripe bananas, and the insides of apples and pears) certain vegetables such as broccoli, carrots, and Jerusalem artichokes root tubers and root vegetables such as sweet potatoes and onions (Spiller, 2004).

Psyllium seed husk (a mucilage soluble fiber) and flax seeds nuts, with almonds being the highest in dietary fiber. Sources of insoluble fiber include: whole grain foods, wheat and corn bran, legumes such as beans and peas, nuts and seed as potato skins. Vegetables such as green beans, cauliflower, zucchini, celery, and nopal some fruits including avocado, and unripe bananas the skins of some fruits, including kiwifruit and tomatoes are sources of insoluble fibers (Freeman, 2009)

Dietary fiber has many functions in diet, one of which may be to aid in energy intake control and reduced risk for development of obesity. The role of dietary fiber in energy intake regulation and obesity development is related to its unique physical and chemical properties that aid in early signals of satiation and enhanced or prolonged signals of satiety (Gardner, 2006).

Glucomannan is sold in various forms, and while safe in some forms, it can be unsafe in others, possibly leading to throat or intestinal blockage. Soluble fiber is found in varying quantities in all plant foods, including legumes (peas, soybeans, lupines and other beans)oats, and barley (Zilli *et al.*,. 2002).

B. HEALTH BENEFITS OF DIETARY FIBER

A high-fiber diet has many benefits, which include Normalize bowel movements. Dietary fiber increases the weight and size of your stool and softens it. A bulky stool is easier to pass, decreasing your chance of constipation. If you have loose, watery stools, fiber may also help to solidify the stool because it absorbs water and adds bulk to stool (Evans, 2006).

Helps maintain bowel health. A high-fiber diet may lower your risk of developing hemorrhoids and small pouches in your colon (diverticular disease). Some fiber is fermented in the colon. Helps control blood sugar levels. In people with

diabetes, fiber particularly soluble fiber can slow the absorption of sugar and help improve blood sugar levels. A healthy diet that includes insoluble fiber may also reduce the risk of developing type 2 diabetes (Burton, 2007).

Another benefit attributed to dietary fiber is prevention of colorectal cancer. However, the evidence that fiber reduces colorectal cancer is mixed.

TABLE I
DIFFERENT FIBERS AND THEIR CONTRIBUTION IN VARIOUS
PHYSIOLOGICAL FUNCTIONS

Type of fiber	Sources	Physiological functions
Insoluble fiber	Wheat bran, corn bran, fruit skins.	May contribute to maintenance of a healthy digestive tract may reduce the risk of some types of cancer.
Soluble fiber	Psyllium seed husk, pears, beans, apples, citrus fruit.	May reduce risk of CHD and some types of cancer.

(Mehta and Kaur, 2005).

C. NUTRITIVE VALUE OF DIETARY FIBER, KODOMILLET, WHOLE BENGALGRAM, DRUMSTICK LEAVES

TABLE-II
THE AMOUNT OF FIBER PRESENT IN THE FOOD

Food group	Quantity	Per 100 grams
Fruit.	0.5 cup	1.1gm
Dark green vegetables.	0.5 cup	6.4gm
Orange vegetables.	0.5 cup	2.1gm
Cooked dry beans.	0.5 cup	8.0gm
Starchy vegetables.	0.5 cup	1.7gm
Other vegetables.	0.5 cup	1.1gm

(Parisi, 2008).

TABLE-III
NUTRITIVE VALUE OF VARAGU

Nutrients	Per 100grams
Energy (Kcal)	309
Carbohydrate (g)	65.9
Protein (g)	8.3
Fat (g)	1.4
crude fiber (g)	9.0
Calcium (mg)	27
Iron (mg)	0.5
Moisture (%)	12.8

(Gopalan, 2006).

TABLE-IV
NUTRITIVE VALUE OF WHOLE BENGAL GRAM

Nutrients	Per 100grams
Energy (Kcal)	360
Carbohydrate (g)	60.9
Protein (g)	17.1
Fat (g)	5.3
Crude fiber (g)	3.9
Calcium (mg)	202
Iron (mg)	4.6
Moisture (%)	9.8
Vitamin –c (mg)	0.9

(Gopalan, 2006)

Bengal gram are a source of zinc, folate and protein. Bengal gram are low in fat and most of this is polyunsaturated. Nutrient profile of desi chana (the smaller variety) is different, especially the fiber content which is much higher than the light coloured variety (Devraj, 2007).

One hundred grams of mature boiled contains Bengal gram 164 calories, 2.6 grams of fat (of which only 0.27 grams is saturated), 7.6 grams of dietary fiber and 8.9 grams of protein. Bengal gram also provides dietary phosphorus (168 mg/100 g), which is higher than the amount found in a 100-gram serving of whole milk. (Maria, 2000).

TABLE-V
NUTRITIVE VALUE OF DRUM STICK LEAVES

Nutrients	Per 100grams
Energy (Kcal)	92
Carbohydrate (g)	12.5
Protein (g)	6.7
Fat (g)	1.7
Crude fiber (g)	0.9
Calcium (mg)	440
Iron (mg)	0.85
Moisture (%)	75.9
Vitamin –c (mg)	22

(Gopalan, 2006).

Much of the plant is edible by humans or by farm animals. The leaves are rich in protein, vitamin A, vitamin B, vitamin C and minerals. One hundred grams of fresh Moringa leaves have 2 times the protein of 100 g yogurt (Moringa 8.3 g, yogurt 3.8 g) 4 times the calcium of 100 g milk (Moringa 434 mg, whole cow milk 120 mg) the same potassium as 100 g banana (Moringa 404 mg, banana 376 mg) the same vitamin A as 100 gm carrot (Moringa 738 µg, carrot 713 µg) 3 times the vitamin C of 100 g orange (Moringa 164 mg, orange 46.9 mg (www.morigaleaves.net)).

D. NUTRITIONAL BENEFITS OF DIETARY FIBER- KODOMILLET, BENGALGRAM, DRUMSTICK LEAVES

Most people have not even heard of millet, much less understand the benefits of millet nutrition. And yet, millet is one of the best-kept secrets of our ancient

ancestors. Traced back to its origin, millet has been used throughout the ages and across many countries.

For centuries millet has been a prized crop in China, India, Greece, Egypt and Africa, used in everything from bread to couscous, and as cereal grain. Millets are even mentioned as a treasured crop in the Bible (Franke, 2005).

This tiny "grain" is gluten-free and packed with vitamins and minerals. In fact, while it's often called a grain because of its grain-like consistency, *millet is actually a seed*. It's often used in birdseed mixture, but if you think it's just for the birds, you're missing out on important benefits of millet nutrition (Kharkar 2007).

Millet is one of the four gluten-free grain-like seeds on the Body Ecology program. Some of the key reasons millet is part of your healthy Body Ecology diet is because it: Highly nutritious – ideal for children.

High amounts of fiber Rich in phytochemicals including phytic acid, which is believed to lower cholesterol, and phytate, which is associated with reducing cancer risks. All Millet varieties show high antioxidant activity. Millet helps to control Blood sugar and Cholesterol Digests easily. Millet Consumption decreases Triglycerides and C-Reactive Protein ([just eat.in/articles](http://www.justeat.in/articles)).

Many studies have been done on millet nutrition to identify its benefits for your health. Here are some of the findings Magnesium in millet can help reduce the affects of migraines and heart attacks.

Niacin (vitamin B3) in millet can help lower cholesterol. Phosphorus in millet helps with fat metabolism, body tissue repair and creating energy (phosphorus is an essential component of *adenosine triphosphate* or ATP, a precursor to energy in your body).Millet can help lower risk of type 2 diabetes. Fiber from whole grains has been shown to protect against breast cancer. Whole grains have been shown to protect against childhood asthma (www.miletexports.com).

Bengal gram is called Chickpea or Gram (*Ciceraritinum L.*) in South Asia and Garbanzo bean in most of the developed world. Bengal gram is a major pulse crop in India, widely grown for centuries and accounts for nearly 40 percent of the total pulse production. India is the major growing country of the world, accounting for 61.6 per cent of the total world area under Bengal gram and 68.1 per cent of the total world production (Prakash et al., 2005).

Bengal gram is widely appreciated as health food. It is a protein-rich supplement to cereal-based diets, especially to the poor in developing countries, where people are vegetarians or cannot afford animal protein. It offers the most practical means of eradicating protein malnutrition among vegetarian children and nursing mothers. It has a very important role in human diet in our country (David, 2003).

Recent studies have also shown that they can assist in lowering of cholesterol in the bloodstream. Sprouted Bengal gram is reported to possess higher antioxidant potential along with inhibitory potential against carbohydrate digestive enzymes relevant to type-2 diabetes (alpha-amylase and alpha-glycosidase) (Robert, 2008).

Bengal gram or chick pea (Channa) is regarded as to generally be the greatest significant pulses inside India. Literally it is ingested within the type of dried out seeds or dal, which well prepared by splitting of the seed-stock towards two halves by separating it from the husk (Khatarpaul, 2004).

Bengal gram broadly grown within the fields of Burma, India, Egypt, Ethiopia, South America, Australia and also Mediterranean international locations. It may be consumed within cooked, boiled or perhaps sprouts style. Their flour is widely applied within Indian confectionery for making snacks for example Chile, pakoras (David, 2003).

Bengal gram got a lot of medicinal properties. It really is a trusted tonic towards the physique any time ingested immersed on water for whole night and also later chewed within the morning having honey. Sprouted Bengal gram is noticed to be ripe through Vitamin C plus B-complex (Higgins, 2004).

Drumstick leaves (*Moringaoleifera*), with a total carotene of 40,000 g/100 g fresh weight and beta-carotene 19,000 g/100 g fresh weight can be a suitable protocol for dietary diversification/improvement strategy. These Green leafy vegetables with their storehouse of polyphenols as well as calcium, iron, folic acid, riboflavin, vitamin C and beta-carotene, should be used in abundance in order to maintain the body against oxidative damage caused by everyday pollutants (Hemangini and Gandhi, 2006).

Drumstick is also preserved and exported worldwide. Tender drumstick leaves, finely chopped, make an excellent garnish for any vegetable dishes, dals, sambers, salads, etc (Nambiar et al, 2005).

Drumstick leaves are also rich sources of flavonols such as kaempferol and 3'-OMe quercetin. A flavone, acacetin and a glycoflavone 4-OMe Vitexin was also identified. The phenolic acids identified included melilotic acid, p-coumaric acid, and vanillic acid (Nambiar et al, 2005).

Diabetes mellitus is a metabolic disorder of multiple etiology characterized by chronic hyperglycemia with disturbance of carbohydrate, fat and protein metabolism resulting from in insulin secretion, insulin action on both (WHO) (Biliaderis and Marta, 2007).

Pomace is the residue that remained after juice extraction from fruits. It is source of dietary fiber with 50% soluble dietary fiber in total dietary fiber (Anjali and Ronate, 2005).

Dietary fiber plays an important role in human health. Dietary fiber is not only desirable to nutritional properties, but also for their functional and technological properties and because of that they can be used to upgrade agricultural products and by products for use as a food ingredient. This is used in various food preparations like biscuits etc (Kannan and Susheela, 2006).

Plant fibers can moderate postprandial glucose and insulin concentrations in non-insulin dependent diabetic if administered with meals (Brigenti, 2004).

Fiber nutrition has been an area of increasing interest for study by nutritionist of the world over for the past 25 years. Dietary fiber, unavailable carbohydrate or roughage are the different terms used to define that part of the plant food which is not digested by the endogenous secretions of the human digestive system.

According to researchers in the department of pharmacology, *paspalumscobiculatum* shows antidiabetic potential and used in traditional medicine systems to treat diabetes (www.livestrong.com).

Kulkarni and Naik (2009) reported that kodo millet decreased cholesterol levels and helped to maintain healthy body weight.

Kodomillet served as a nutraceutical and functional food in health promotion and disease risk reduction and can be included in therapeutic diets (Chandrasekhara and Shalidi, 2011).

Jain et al., (2010) revealed that every single millet is a solution for malnutrition that affects a vast majority of the Indian population.

Kodomillet contains dietary fiber and it has a role in weight control, obesity, cardiovascular disease and gut-health (Jain, 2008).

The nutritive value of millets are comparable to other cereals with slightly higher content of proteins and minerals (Ugare, 2008).

Legumes, which are used as pulse, the most important pulse crop in India are Bengal gram or channa, belongs to leguminosae family, and is also known as garbanzo beans (Banga and Mogra, 2008).

Bengal gram or channa the world third most important food legume is currently grown on about 10 million hectare worldwide, with 95% calculation in the developing countries (Devrai and Sharma, 2007).

Bengal gram seeds are eaten fresh as green vegetables, parched, fried, roasted, boiled, in snack food and condiments and their flour (made by grinding channa) can

be used as soup, dhal. Both whole legumes and split are used for making curries and consumed along with the rice, chapattis and poories (Singh, 2002).

Whole legumes take much longer time for cooking than splits and washed dhal reduction in cooking time of pulses by a simple process is a consumer requirement (Khatarpaul, 2004).

The desi types the main variety of India has a smaller seed is Indian origin. Desi channa accounts for about 85% of world production. While Kabuli channa for 15% production (Sodhi, 2005).

The Moringa or Drumstick tree (aka Munaga, Muruggai, Muranka) is perennial, erect, slender, medium-sized with many arching branches. It has drumstick-like fruits, small white flowers and small and tear- drop shaped round leaves, which are cooked and eaten as vegetable (Tanna ,2001).

In the developing countries like India, sources of vitamin-A such as drumstick leaves are valuable in overcoming the problem of vitamin A deficiency. These findings also accentuate the importance of carotene on the vitamin A status, and underscore its equivalence to synthetic vitamin A when fed in the right amount (Nambiar and Seshadri 2001).

Bioavailability trials using fresh as well as blanched and sulphited shade dehydrated drumstick leaves were conducted on vitamin A deficient rats. Male *Charlesfoster* strain of rats were fed on a synthetic vitamin A deficient diet for 4 weeks and there after replete with 4000 IU vitamin A/kg diet from either fresh or dehydrated drumstick leaves (Nambiar, 2001).

Varagu was domesticated in India almost 3000 years ago. It is found across the old world in humid habitats of tropics and subtropics. It is a minor grain crop in India and an important crop in the Deccan plateau. The fiber content of the whole grain is very high (Dykes and Rooney,2007).

Varagu has around 11% protein, and the nutritional value of the protein has been found to be slightly better than that of Thinai but comparable to that of other small millets (Sudharshana et al.,2006).

As with other food grains, the nutritive value of Varagu protein could be improved by supplementation with legume protein. It has high source of Protein, Calcium, fiber and Minerals. It can reduce body weight. Varagu increases liver functionality and good for lymphatic disorder (Marlette ,2010).

People who are diabetic and fasting prefer varagu as a major cereal for the day (Lupien, 2005).

Varagu has been used as a human food since ancient times. It can adapt itself and thrive in soils of variable salt concentration and degree of rain fall (Mahdi and Abdal, 2008).

Kodo millet has 37-38 percent of dietary fiber which is highest among cereals, the fat content ranging from 1.1 to 3.4g which has higher poly unsaturated fatty acid(PUFA). The mineral content (4.9%) is also higher than rice and wheat (Hedge and Chandra, 2005).

Bengal gram has many medicinal properties. Soaked i water overnight and chewed in the morning with honey, the whole gram seed acts as a general tonic. The liquid, obtained by soaking the seeds and then macerating them, also serves as tonic. Sprouted Bengal gram supply plenty of B-complex and vitamins (Siddiq, et al.,2008).

Cooked germinated gram is a wholesome food for children and invalids. However excessive use of Bengal gram causes indigestion and may precipitate urinary calcium due to high concentration of oxalic acid and form urinary stone of calculi (Brink et al., 2006).

Diabetic patients who are on a prescribed diet which does not severely restrict the intake of carbohydrates. but includes liberal amounts of Bengal gram extract, have shown considerable improvement in their fasting blood sugar levels, glucose

tolerance, urinary excretion of sugar and general condition (Malleshi, Desikchar, 2011).

Fresh juice of Bengal gram leaves is a very rich source of iron. It is therefore, highly beneficial in the treatment of iron deficiency anemia. A table spoonful of fresh juice mixed with honey should be taken in this condition. An acid liquid is obtained by collecting the dew drops from the leaves by spreading a thin white cloth over the crop at night or by any other means. This acid liquid contains about 94 per cent malic acid and 6 per cent oxalic acid and is used medicinally. It is a valuable astringent for use in dyspepsia, vomiting, indigestion, costiveness, diarrhea and dysentery (Zohary, 2007).

Flour of the unroasted Bengal gram is a very effective cleansing agent and its regular use as a cosmetic bleaches the skin. In allergic skin diseases like eczema, contact dermatitis, scabies, washing the skin with this flour will be highly beneficial. The Bengal gram flour can be beneficially used in the treatment of pimples. The flour should be mixed with curd to make a paste (Daniel, 2007).

Bengal gram is one of the most important pulses in India. Whole dried seeds or splitted seeds are the forms in which they are usually used. This 'dal' is a rich source of proteins, carbohydrates, B group vitamins and certain minerals and thus the food and nutritive value of such food are excellent (Shirley, 2008).

In addition to their excellent nutritive properties, Bengal gram (Whole and dhal) exhibit good curative properties. Bengal gram has many natural therapeutic benefits (Daniel, 2007).

The soaked seeds taken along with honey early morning serves as an excellent general tonic. Isoflavones like Biochanin A and formononetin that have been isolated from Bengal gram have shown hypolipidemic activity. Experiments have also shown that the intake of water extract of Bengal gram enhances the utilization of glucose both in diabetic and normal individuals (Siddiq et al.,2008).

Another important value of this product is its use in the infant feed formulae. Studies have shown that food products prepared by combining rice chicken pea (Bengal gram presoaked) and milk in the proportion (58:30:18) have excellent nutritive properties, rationalizing its use as an infant food. Leaves of Bengal gram are a very rich source of iron and experiments have successfully isolated a haemo protein from them and thus claiming highly beneficial effect in the treatment of iron deficiency anemias. Proteins isolated from Bengal gram have good digestibility and also the protein energy utilization from them is optimum. Processing the chicken pea by cooking increases its net protein utilization and rendering it more nutritive (www.aayurvedatips.blogspot.com).

Thus, Chana Dal that forms a staple part of our diet can be rated as having good nutritive and curative properties (www.aayurvedatips.blogspot.com).

Drumstick leaves as a source of vitamin A These leaves could retain 50% of their B-carotene on shade dehydration and the dehydrated leaves could be easily rehydrated and incorporated into traditional Western Indian recipes without altering their acceptability characteristics (www.moringasource.com).

Fresh leaves gram for gram fresh leaves contain about:4 times the vitamin A of carrots, 7 times the vitamin C of oranges, 4 times the calcium of milk, 3 times the potassium of bananas, $\frac{3}{4}$ the iron of spinach, 2 times the protein of yogurt. Dried leaves gram for gram dried leaves contain about 10 times the vitamin A of carrots, $\frac{1}{2}$ times the vitamin C of oranges, 17 times the calcium of milk, 15 times the potassium of bananas, 25 times the iron of spinach, 9 times the protein of yogurt (www.moringaleaves.net).

Drumstick leaves as a source of vitamin A These leaves could retain 50% of their B-carotene on shade dehydration and the dehydrated leaves could be easily rehydrated and incorporated into traditional Western Indian recipes without altering their acceptability characteristics (www.moringasource.com).

Drumstick sag is beneficial in asthma, bronchitis, arthritis, diabetes, and low blood pressure. It shows positive effects in amenorrhea and reduction of weight. Being warm in potency, it is very effective against digestive disorders such as anorexia and flatulence. The rejuvenating effect of drumstick on the nervous system makes this is useful in nervous debility and paralysis. This drumstick sag increases lactation. The leaves are highly nutritious, being a significant source of beta carotene, vitamin-c, protein, iron, and potassium (Kosambia, 2004).

METHODOLOGY

The methodology pertaining to the study titled “**Formulation and Evaluation of Recipes with Standardized High Fiber Mix**” is presented under the following headings:

- A. Identification and selection of fiber rich millet, pulse and green leafy vegetable.
- B. Development of mix with the selected foods-Varagu, whole Bengal gram and drumstick leaves.
- C. Formulation of recipes with the developed mix.
- D. Acceptability of the formulated recipes using the fiber rich mix.
- E. Nutrient analysis of the mix.

A. IDENTIFICATION AND SELECTION OF FIBER RICH MILLET, PULSE, AND GREEN LEAFY VEGETABLE

Dietary fiber is neither inert nor innocuous and does play an important role in relation to human nutrition (Chopra 2012).

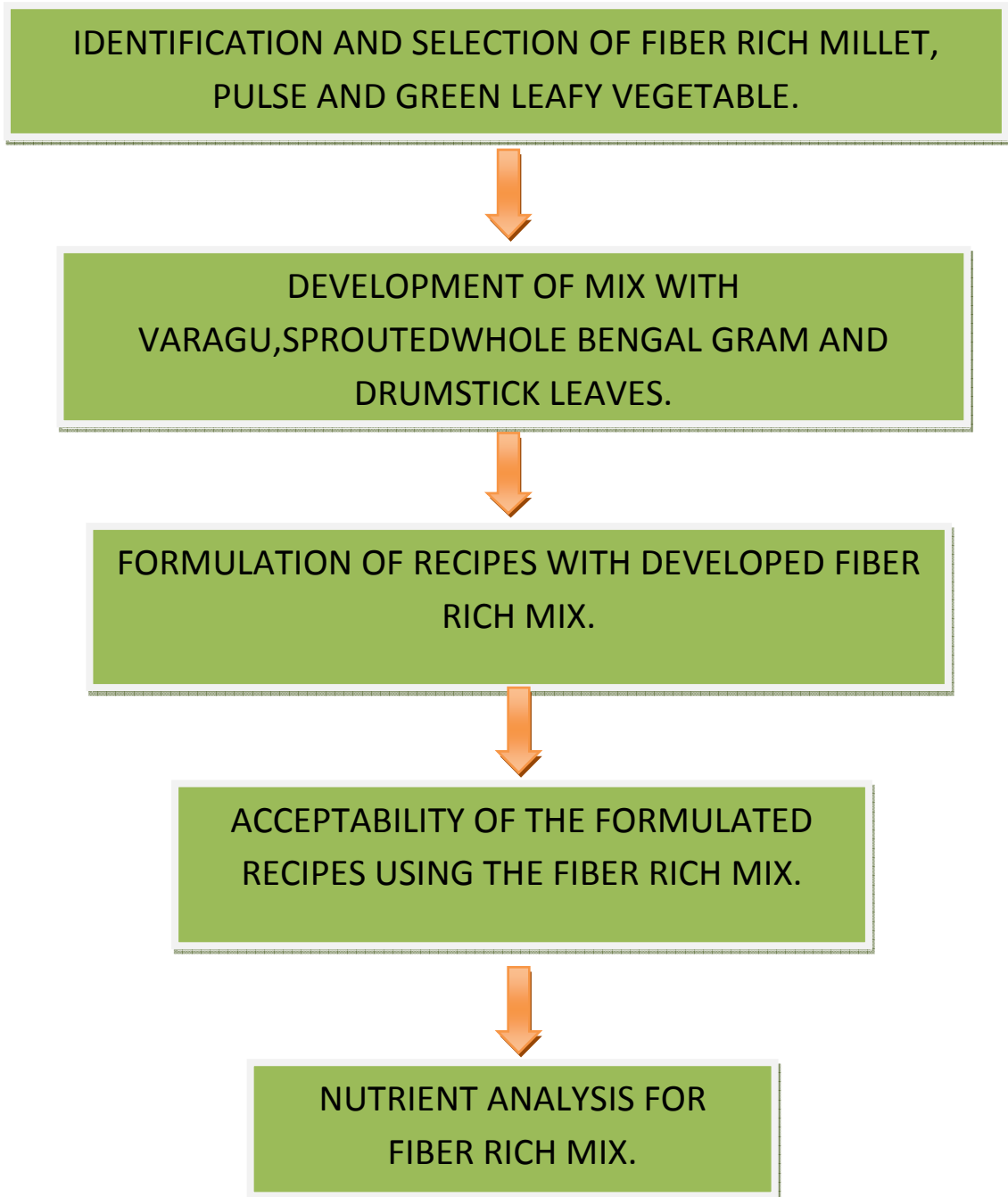
Varagu (kodomillet) has around 11 percent protein. It has high source of protein, calcium, fiber and minerals. Varagu increases liver functionality and good for lymphatic disorders and reduce body weight (Marlette, 2010)

Bengal gram is a good source of protein and fiber. Bengal gram is low in fat and most of this is poly unsaturated. The fiber content is much higher than light coloured variety of the gram.

Sprouted Bengal gram is reported to possess higher antioxidant potential along with inhibitory potential against carbohydrate digestive enzyme, relevant to type-II diabetes. (Malleshi and Desikachar, 2011).

Drumstick leaves are good sources of beta carotene, fiber and also rich source flavonols such as kaempferol. A flavonacacetin and a glycoflavon 4-ome viteexin is also present (Prynne, 2001).

Hence the investigator selected varagu, whole Bengal gram and drumstick leaves for the study. The research design is presented in Figure I



RESEACH DESIGN

FIGURE 1

B. DEVELOPMENT OF MIX WITH THE SELECTED FOODS-VARAGU, WHOLE BENGAL GRAM, DRUMSTICK LEAVES

1. Preparation of mix

Varagu was purchased from departmental store and cleaned thoroughly and then roasted in a pan for 5-7 mins and then cooled at room temperature and powdered very finely.

Bengal gram was purchased and cleaned, and then it was soaked in a bowl of water and tied in a wet cotton cloth and sprouted. The sprouted Bengal gram was dried under the shade and powdered.

Drumstick leaves were cleaned, and dried under the shade and made in to powder.

2. Preparation of powder mix at three different ratios

The three variations was done with the mixture of varagu, sprouted Bengal gram and drumstick leaves powder. The variations are presented in the following tables

TABLE VI
VARIATIONS OF VARAGU FLOUR

VARAGU FLOUR	QUANTITY (g)
Variation I	70
Variation II	60
Variation III	50

TABLE VII
VARIATIONS OF WHOLE BENGAL GRAM FLOUR

WHOLE BENGAL GRAM FLOUR	QUANTITY (g)
Variation I	25
Variation III	30
Variation III	35

TABLE VIII
VARIATIONS OF DRUMSTICK LEAVES POWDER

DRUM STICK LEAVES POWDER	QUANTITY(g)
Variation I	5grams
Variation II	10 grams
Variation III	15 grams

C. FORMULATION RECIPES WITH FIBER RICH MIX

Five recipes namely dosa, kozhukatai, porridge, puttu, upma. Were selected. These recipes were prepared with the developed fiber rich mix. Three variations of each recipe were prepared with the ratios mentioned in the tables.

1. PREPARATION OF RECIPES

a. Standard recipes- Dosa, kozhukatai, upma, puttu, porridge were prepared using standard method and proportions using their respective ingredients.

b. Variations using mix

Dosa

The fiber rich mix was taken in a bowl with the selected variation. And then added water. Mixed with salt. Made it in to a dosa batter

consistency. Taken required amount of batter then made dosa in the pan. Fried it both sides without oil and served it on a clean plate.

Kozhukatai

Water was boiled for 5mins. Added hot water in to the mix and then added salt. For taste added onions and other vegetables also. Mixed it and made it into kozhukatai shapes. Steamed these kozhukatais in a idly steamer, and served it on a clean plate.

Porridge

Water is taken, in a bowl and boiled .Added the mix, stir it continuously to prevent lumps. Cooked it for 5 mins. Added little bit of salt and pepper. Served it on a clean bowl.

Puttu

The mix was taken, added little amount of water. Mixed it once and added salt. As this is Karaputtu, there is no addition of sugar and coconut. Added little spices for taste. Steamed it in a steamer for 10 mins. Served it on a bowl.

Upma

Took a pan and added half spoon of oil for seasoning. Heated the oil and added seasoning material. Fried it for 2mins. Added vegetables like carrot, tomato, potato etc. Fried it for 2mins and then added one cup of water boil it. After boiling added the mix stir it. Cooked it for 5mins. Served it in a clean plate.

All the recipes were developed in the Foods Laboratory, Department of Food science and Nutrition, Avinashilingam Institute for Home science and Higher Education for Women, Coimbatore, as it was convenient for the investigator to conduct the research work.

During the preparation accurate weight, equal measurement of ingredients, maintenance of temperature and time controls were followed for all recipes.

Vessels used for the preparation of recipes were cleaned and standardized in shape and size.

D. SENSORY EVALUATION OF SELECTED RECIPES

Sensory evaluation is a scientific tool that uses the human senses. Smell, sight, taste, texture and hearing to examine the properties which influence the quality of product.(Dermoth and Murray,2007).

Sensory evaluation have to be done because from the evaluation the invistigator have to select standard ratio from three variations.

Hence, the following steps:

- 1.Selection of venue.
- 2.Selection of panel members.
- 3.Formulation of score card.
- 4.Conduct of palatability.

1. Selection of venue

The selection of evaluation room is an essential requisite to sensory evaluation. The Foods laboratory in the Department of Food Science and Nutrition, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore was selected as the venue for sensory evaluation .During evaluation, each panel member was allowed to take their own time to assess the product presented to them. The recipes were arranged neatly, placed on a plate with a spoon or fork as required. The panel members were provided with an evaluation form and pen. A clear glass of water was placed to enable the evaluator to rinse the mouth between tasting.

2. Selection of panel members

Panel members are a group of assessors chosen to participate in a sensory test. A taste panel consisted of people who are requested to assess food quality of samples presented for evaluation and may vary in number depending up on the testing technique used.

Thirty semi-trained panel members were selected based on their health, co-operation, willingness and knowledge of quality characteristics and sensory analysis of foods. A similar study has been conducted using twenty semi trained panel members to find out the acceptability of value addition in biscuits using whey protein concentrate (Uthira and Lakshmi, 2009).

3. Formulation of score card:

Score card is a tool which helps in evaluation through direction and degree of judgment using suitable defined scores. Scoring is form of rating of the prepared food items using a numerical scale where the numbers form an internal or ratio scale (Manay and Shadaksharaswamy, 2007).

A five point scale was formulated for studying the acceptable of the recipes in terms of appearance, colour, flavour, texture, taste and a score card was formulated (Appendix I.)

4. Conduct of palatability:

All the five recipes and its variations made out of developed mix were presented to the panel members for sensory evaluation at different points of time. To prevent any changes in their quality due to storage, temperature changes and reheating, recipes were evaluated immediately after preparation. The portion sizes for all the recipes were kept consistent and uniform.

An evaluation sheet with allotted codes and details of the attributes and number of samples to be evaluated were prepared and given to each panel member. The scores obtained through sensory evaluation of the products by the panel members were

recorded and the mean scores were calculated for each recipe. From the sensory evaluation the ratio of the mix containing 70 percent varagu flour, 25 percent sprouted whole bengal gram flour and 5 percent drumstick leaves powder was considered to be acceptable. The standard and all the variations are presented in plates I, Ia, Ib and II

E. NUTRIENT ANALYSIS OF THE MIX:

The best acceptable ratio with fiber rich mix was analyzed for selected nutrients. Moisture, ash, dietary fiber was carried out by using the methods given by the Association of Analytical Chemists International (2006). Carbohydrate estimation was done by anthrone method. The amount of protein present was estimated by macro kjeldhal's method. The iron content was estimated using colorimetric method and calcium by using titrimetric method. Fat was estimated by sox let extraction method. The total energy was calculated by multiplying the total amount of carbohydrates, fat and protein by their calorific value.(AOAC, 2006).The estimation procedure for nutrient content of the developed mix are given in Appendix II.

Dosa



Standard



Variation

Upma



Standard



Variation

PLATE I

RECIPES PREPARED WITH HIGH FIBER MIX

Kozhukatai



Standard



Variation

Porridge



Standard



Variation

PLATE Ia

RECIPES PREPARED WITH HIGH FIBER MIX

Puttu



Standard



Variation

PLATE Ib

RECIPES PREPARED WITH HIGH FIBER MIX



PLATE II
EVALUATION OF RECIPES

RESULTS AND DISCUSSION

The results of the study on the topic “**Formulation and Evaluation of Recipes with Standardized High**” Fiber Mix discussed under the following headings

- A. Variations of the mix
- B. Sensory evaluation of dosa
- C. Sensory evaluation of kozhukatai
- D. Sensory evaluation of puttu
- E. Sensory evaluation of upma
- F. Sensory evaluation of porridge
- G. Nutrient analysis of fiber rich mix

A. VARIATIONS OF THE MIX

1. Three variations were selected for making the mix and are presented in Table IX

TABLE IX
SELECTED VARIATIONS FOR THE MIX

Varagu flour (g)	Whole Bengal gram flour (g)	Drumstick leaves powder (g)
70	25	5
60	30	10
50	35	15

In the first variation, 70gm of varagu flour, 25gm of whole Bengal gram flour and 5gm of drum stick leaves powder were used. Second variation consisted of 60gm of varagu flour, 30gm of whole Bengal gram flour and 10gm of drum stick leaves powder were used. 50gm varagu flour, 35gm of whole Bengal gram flour and 15gm of drum stick leaves powder were used for the third variation.

These variations are selected for making recipes like dosa, kozhukatai, puttu, upma, porridge and evaluated for their attributes of appearance, colour, flavour, texture, and taste,

B. SENSORY EVALUATION OF DOSA

Dosa is commonly used tiffin item. Dosa was selected for making more nutritious food by using developed mix. Dosa was prepared with developed mix in three variations.

1. The overall acceptability and the mean scores of standard dosa is given in Table X.

TABLE X
OVERALL ACCEPTABILITY AND MEAN SCORES OF
STANDARD DOSA

[Maximum Scores:25]

PARAMETERS	SCORES
Appearance	4.2
Colour	4.3
Flavour	4.2
Texture	4.0
Taste	4.6
Total	21.3
Mean	4.3

The above table shows overall acceptability and mean score of the standard dosa i.e. total value was 21.3 and the mean value is 4.3 and other scores are obtained were appearance 4.2, colour 4.3, flavour 4.2, texture 4.0, taste 4.6.

2. The overall acceptability and the mean scores of variation I dosa with developed mix is given in Table XI

TABLE XI

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION I
DOSA PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION I SCORES
Appearance	4.1
Colour	3.7
Flavour	4.0
Texture	3.8
Taste	4.2
Total	19.8
Mean	4.0

The table shows overall acceptability and mean value of the variation1 dosa i.e. total value was19.8 and the mean value 4.2 and other scores are appearance 4.1, colour 3.7, flavour 4.0,texture 3.8, taste 4.2.

3. The overall acceptability and the mean scores of variation II dosa with developed mix is given in Table XII

TABLE XII
OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION II
DOSA PREPARED WITH DEVELOPED MIX

PARAMETERS	VARIATION II SCORES
Appearance	3.8
Colour	3.3
Flavour	3.8
Texture	3.5
Taste	4.0
Total	18.4
Mean	3.7

Table shows overall acceptability and mean value of the variation II dosa i.e. total value is 18.4 and the mean value 3.7 and other scores are appearance 3.8, colour 3.3, flavour 3.8, texture 3.5, taste 4.0.

4. The overall acceptability and the mean scores of variation III dosa with developed mix is given in Table XIII

TABLE XIII
OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION III
DOSA PREPARED WITH DEVELOPED MIX

PARAMETERS	VARIATION III SCORES
Appearance	3.2
Colour	3.1
Flavour	3.7
Texture	2.8
Taste	3.4
Total	16.2
Mean	3.2

Table shows overall acceptability and mean value of the variation III dosa i.e. total value is 16.2 and the mean value is 3.2 and other values are appearance is 3.2, colour 3.1, flavour 3.7, texture is 2.8, taste is 3.4.

From the above tables, it is revealed that the overall acceptability scores for variation I was 19.8 out of 25 it obtained a mean score of 4.0 when compared variation II which had a overall acceptability of 18.5 with the mean score of 3.7. The third variation obtained total score 16.2 and the mean score is 3.2. The standard dosa scored 21.3 out of a maximum score of 25 the mean score of 4.3 as the highest score was obtained by variation I dosa with developed mix. When compared with the standard it can suggested that this preparation is most acceptable. Similar studies have been done by using millets and pulses based foods like biscuits etc.,(Banerjee, 2010).

B. SENSORY EVALUATION OF KOZHUKATAI

Kozhukatai has different varieties, kozhukatai is a steamed item, we can make sweet kozhukatai and also spicy kozhukatai. The investigator selected and prepared kozhukatai with the developed mix.

1. The overall acceptability and means scores of standard kozhukatai is depicted in Table XIV.

TABLE XIV
OVERALL ACCEPTABILITY AND MEAN SCORES OF
STANDARD KOZHUKATAI

[Maximum Scores:25]

PARAMETERS	STANDARD SCORES
Appearance	4.9
Colour	4.8
Flavour	4.8
Texture	4.8
Taste	4.9
Total	24.2
Mean	4.8

Table shows overall acceptability and mean value of the standard kozhukatai i.e. total value 24.2 and the mean value 4.8 and other scores are appearance 4.9, colour 4.8, flavour 4.8, texture 4.8 and taste 4.9.

2. The overall acceptability and means scores of variation I kozhukatai prepared with developed mix is depicted in Table XV.

TABLE XV

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION I
KOZHUKATAI PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION I SCORES
Appearance	4.7
Colour	4.5
Flavour	4.6
Texture	4.4
Taste	4.4
Total	22.6
Mean	4.5

Table shows overall acceptability and mean value of the variation kozhukatai i.e. total value 22.6 and the mean value 4.5 and other scores are appearance 4.7, colour 4.5, flavour 4.6, texture 4.4, taste 4.4.

3. The overall acceptability and means scores of variation II kozhukatai prepared with developed mix is given in Table XVI

TABLE XVI

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION II
KOZHUKATAI PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION II SCORES
Appearance	4.6
Colour	4.5
Flavour	4.4
Texture	4.2
Taste	4.2
Total	21.9
Mean	4.4

The table represents overall acceptability and mean value of the variation II kozhukatai i.e. total value 21.9 and the mean value 4.4 and other scores are appearance 4.6, colour 4.5, flavour 4.4, texture 4.2 and taste is 4.2.

4. The overall acceptability and mean scores of variation III kozhukatai prepared with developed mix is given in Table XVII

TABLE XVII

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION III
KOZHUKATAI PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION III SCORES
Appearance	3.0
Colour	2.9
Flavour	3.1
Texture	3.2
Taste	3.1
Total	15.3
Mean	3.1

The table represents overall acceptability and mean value of the variation III kozhukatai i.e. total value 15.3 and the mean value 3.1 and other scores are appearance 3.0, colour 2.9, flavour 3.1, texture 3.2, taste 3.1.

The overall acceptability scores for variation I kozhukatai is 22.6 out of 25 it obtained a mean score of 4.5 when compared in the variation II kozhukatai which had a total score of 21.9 with the mean score of 4.4. The third variation variation III obtained total score 15.3 and the mean score is 3.1 the standard kozhukatai scored 24.2 out of a maximum score of 25 the mean score of 4.8 as the highest score was obtained by kozhukatai with developed mix. This preparation was considered to be the most acceptable.

C. SENSORY EVALUATION OF PUTTU

Puttu is very famous food in Kerala. Generally the puttu is in sweet taste but the researcher prepared puttu with spicy taste.

1. The overall acceptability and mean scores of standard puttu is given in Table XVIII.

TABLE XVIII
OVERALL ACCEPTABILITY AND MEAN SCORES OF
STANDARD PUTTU

[Maximum Scores:25]

PARAMETERS	STANDARD SCORES
Appearance	4.3
Colour	4.2
Flavour	4.3
Texture	4.4
Taste	4.4
Total	21.6
Mean	4.3

Table shows overall acceptability and mean value of the standard puttu. The overall acceptability 21.6 and the mean value 4.3 and other values are appearance 4.3, colour 4.2, flavour 4.3, texture obtained 4.4, and taste 4.4.

2. The overall acceptability and means scores of variation I puttu prepared with developed mix is given in Table XIX

TABLE XIX

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION I
PUTTU PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION I SCORES
Appearance	4.2
Colour	4.1
Flavour	4.2
Texture	4.4
Taste	4.3
Total	21.2
Mean	4.5

Table shows overall acceptability and mean value of the variation I puttu total value 21.2 and the mean value 4.5. and other scores are appearance 4.2, colour 4.1, flavour 4.2, texture 4.4, and taste 4.3.

3. The overall acceptability and mean scores of variation II puttu prepared with developed mix is given in Table XX

TABLE XX
OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION II
PUTTU PREPARED WITH DEVELOPED MIX

PARAMETERS	VARIATION II SCORES
Appearance	4.2
Colour	4.1
Flavour	4.1
Texture	4.2
Taste	4.2
Total	20.9
Mean	4.4

Table shows overall acceptability and mean value of the variation II puttu total value 20.9 and the mean value 4.4, and other scores are appearance 4.2, colour 4.1, flavour 4.1, texture 4.2, and taste 4.2.

4. The overall acceptability and means scores of variation III puttu prepared with developed mix is given in Table XXI

TABLE XXI

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION III
PUTTU PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARAIATION III SCORES
Appearance	3.0
Colour	2.9
Flavour	3.1
Texture	3.2
Texture	3.1
Total	15.3
Mean	3.1

Table shows overall acceptability and mean value of the variarion III puttu total value 15.3 and the mean value 3.1, and other scores are appearance 3.0, colour 2.9, flavour 3.1, texture 3.2, taste 3.1.

From the above tables, it is revealed that the overall acceptability scores for variation I was 21.2 out of 25 it obtained a mean score of 4.5 when compared to variation II which had a total score of 20.9 with the means score of 4.4. The third variation obtained total score of 15.3 and the mean score was 3.1. The standard puttu scored 21.6 out of a maximum score of 25 with a mean score of 4.3 As the highest score was obtained by variation I puttu with developed mix, it was considered to be the most acceptable.

D. SENSORY EVALUATION OF UPMA

1. The overall acceptability and mean scores of upma is given in Tables XXII.

TABLE XXII
OVERALL ACCEPTABILITY AND MEAN SCORES OF
STANDARD UPMA

[Maximum Scores : 25]

PARAMETERS	STANDARD SCORES
Appearance	4.8
Colour	4.8
Flavour	4.7
Texture	4.8
Taste	4.8
Total	23.9
Mean	4.8

Table shows overall acceptability and mean value of the standard upma total value 23.9 and the mean value 4.8, and other scores are appearance 4.8, colour 4.8, flavour 4.7, texture 4.8 and taste 4.8.

2. The overall acceptability and means scores of variation I upma prepared with developed mix is given in Table XXIII

TABLE XXIII
OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION I
UPMA PREPARED WITH DEVELOPED MIX

PARAMETERS	VARIATION I SCORES
Appearance	3.9
Colour	4.0
Flavour	4.3
Texture	3.5
Taste	3.9
Total	19.6
Mean	3.9

Table shows overall acceptability and mean value of the variation I upma total value 19.6 and the mean value 3.9, and other values are appearance 3.9, colour 4.0, flavour is 4.3, texture 3.5, taste 3.9.

3. The overall acceptability and means scores of variation II upma prepared with developed mix is given in Table XXIV

TABLE XXIV

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION II
UPMA PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION II SCORES
Appearance	3.4
Colour	3.7
Flavour	4.1
Texture	2.1
Taste	3.1
Total	16.4
Mean	3.3

Table shows overall acceptability and mean value of the variation II upma total value 16.4 and the mean value 3.3, and other score are appearance 3.4, colour 3.7, flavour 4.1, texture 2.1, taste 3.1.

4. The overall acceptability and mean scores of variation III upma prepared with developed mix is given in Table XXV

TABLE XXV

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION III
UPMA PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION III SCORES
Appearance	3.1
Colour	2.9
Flavour	3.5
Texture	2.9
Taste	3.2
Total	15.6
Mean	3.1

The table represents overall acceptability and mean value of the variation III upma total value 15.6 and the mean value 3.1, and other scores are appearance 3.1, colour 2.9, flavour 3.5, texture 2.9 and taste is 3.2.

From the above tables it is revealed that the overall acceptability scores for variation I was 19.6 out of 25 it obtained a mean score of 3.9 when compared with variation II which had a total Score of 16.4 with the means score of 3.3. The third variation obtained total score 15.6 and the mean score 3.1. And the standard upma scored 23.9 out of a maximum score of 25 the mean score of 4.8 as the highest score was obtained by variation I puttu with developed mix.

E. SENSORY EVALUATION OF PORRIDGE

The porridge has selected and prepared with developed mix.

1. The overall acceptability and means scores of standard porridge is given in Table XXVI

TABLE XXVI
OVERALL ACCEPTABILITY AND MEAN SCORES OF
STANDARD PORRIDGE

[Maximum Scores:25]

PARAMETERS	STANDARD SCORES
Appearance	4.5
Colour	4.7
Flavour	4.9
Texture	4.8
Taste	4.8
Total	23.7
Mean	4.7

Table shows overall acceptability and mean value of the standard porridge total value 23.7 and the mean value 4.7, and other scores are appearance 4.5, colour 4.7, flavour 4.9, texture 4.8, taste 4.8

2. The overall acceptability and means scores of variation I porridge prepared with developed mix is given in Table XXVII

TABLE XXVII

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION I
PORRIDGE PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION I SCORES
Appearance	4.3
Colour	4.6
Flavour	4.6
Texture	4.1
Taste	4.1
Total	21.7
Mean	4.3

Table shows overall acceptability and mean value of the variation I porridge total value 21.7 and the mean value 4.3, and other scores are appearance 4.1, colour 4.6 flavour 4.6, texture 4.1, taste 4.1.

3. The overall acceptability and means scores of variation II porridge prepared with developed mix is given in Table XXVIII

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TABLE XXVIII

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION II
PORRIDGE PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION II SCORES
Appearance	4.1
Colour	4.1
Flavour	4.2
Texture	3.8
Taste	4.0
Total	20.2
Mean	4.0

Table shows overall acceptability and mean value of the variation II porridge total value 20.2 and the mean value 4.0, and other scores are appearance 4.1, colour 4.0 flavour 4.2, texture 3.8, taste 4.0.

4. The overall acceptability and mean scores of variation III porridge prepared with developed mix is given in Table XXIX

TABLE XXIX

**OVERALL ACCEPTABILITY AND MEAN SCORES OF VARIATION III
PORRIDGE PREPARED WITH DEVELOPED MIX**

PARAMETERS	VARIATION III SCORES
Appearance	3.9
Colour	4.0
Flavour	4.3
Texture	3.5
Taste	3.9
Total	19.6
Mean	3.9

Table shows total value and mean value of the variation III porridge total value 19.6 and the mean value 3.9, and other scores are appearance 3.9, colour 4.0, flavour 4.3, texture 3.5, taste 3.9.

From the above tables it is revealed that the overall acceptability scores for variation I was 21.7 out of 25 it obtained a mean score of 4.3 when compared variation II which had a total Score of 20.2 with the means score of 4.0. Variation III obtained total score 19.6 and the mean score is 3.9. The standard porridge scored 23.7 out of a maximum score of 25 and a mean score of 4.7 as the highest score was obtained by variation I porridge with developed mix.

F. NUTRIENT CONTENT OF FIBER RICH MIX

The most acceptable ratio of the developed mix 70 percent varagu flour, 25 percent sprouted Whole Bengal gram flour and 5 percent drumstick leaves powder selected through the sensory evaluation was further analyzed for its nutrient content. The details of nutrient content of the developed mix as analyzed in the laboratory is given in Table XXX and Figures 2a and 2b

TABLE XXX
NUTRIENT CONTENT OF FIBER RICH MIX

NUTRENTS	PER 100grams
Energy (Kcal)	333
Carbohydrate (g)	65
Protein (g)	12
Fat (g)	1.5
Dietary fiber (g)	13
Calcium (mg)	123.5
Iron (mg)	1.73
Moisture %)	19.5
Vitamin C(mg)	23

MACRO NUTRIENT ANALYSIS OF DEVELOPED MIX

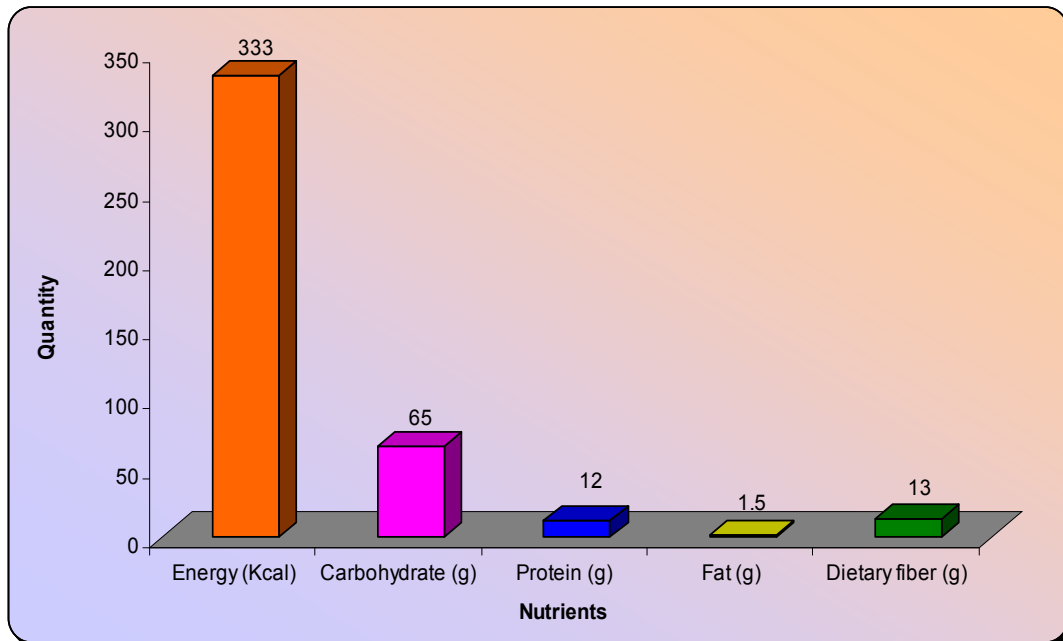


FIGURE 2a

MICRO NUTRIENTS ANALYSIS OF DEVELOPED MIX

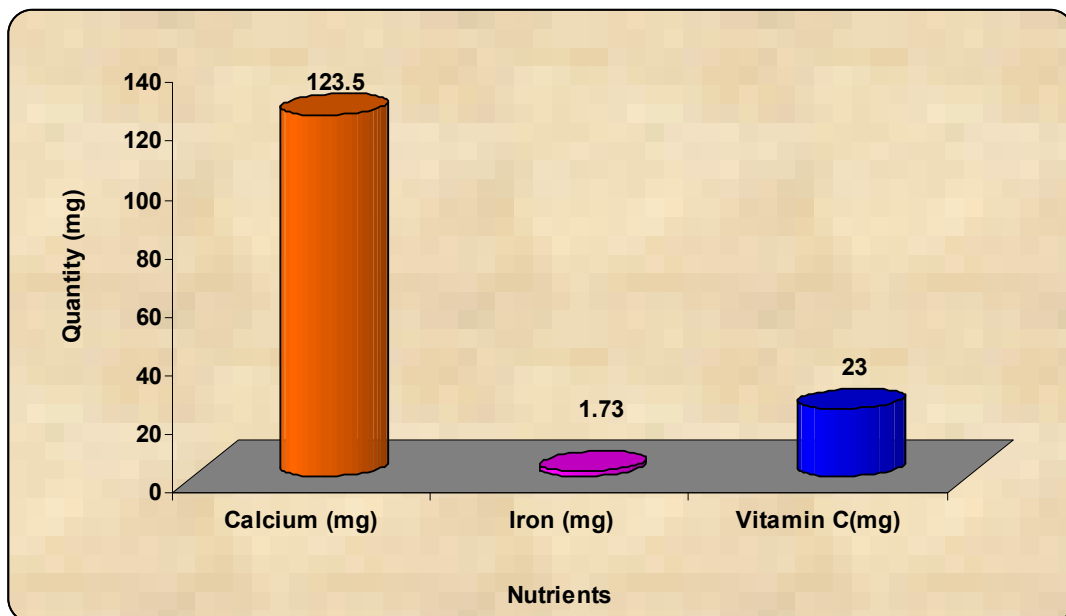


FIGURE 2b

The nutrient content of fiber rich mix presented in Figure 2a, 2b, Figure 2a represents energy, carbohydrate, protein, fat and dietary fiber.

Nutrient analysis of 100gm of developed mix revealed that 333 kcal , and 65 of carbohydrate and 12 grams of protein and fat was 1.5 grams, Dietary fiber was 13g. It was noted that the developed mix was high in protein and low in fat and rich in fiber

Figure 2b represents calcium, iron, vitamin c. The amount of calcium present in fiber rich mix is 123.5 mille grams.1.73mg of iron is present in this mix and Vitamin C was 23mg.

SUMMARY AND CONCLUSION

Dietary fiber is neither inert nor innocuous and does play an important role in relation to human nutrition. Hence the investigator selected varagu, whole Bengal gram and drumstick leaves for the study. Five recipes namely dosa, kozhukatai, porridge, puttu, upma. Were selected. These recipes were prepared with the developed fiber rich mix. The three variations was done with the mixture of varagu, sprouted Bengal gram and drumstick leaves powder. Sensory evaluation of the selected recipes made with developed mix was carried out. From the sensory evaluation the ratio of the mix containing 70 percent of varagu flour, 25 percent of sprouted whole Bengal gram flour and 5 percent drumstick leaves powder was considered to be acceptable.

The salient features of the study are

- Overall acceptability and mean score of the standard dosa i.e. total value was 21.3 and the mean value is 4.3 and other scores are obtained were appearance 4.2, colour 4.3, flavour 4.2, texture 4.0, taste 4.6.
- Overall acceptability and mean value of the variation I dosa i.e. total value was 19.8 and the mean value 4.2 and other scores are appearance 4.1, colour 3.7, flavour 4.0, texture 3.8, taste 4.2.
- Overall acceptability and mean value of the variation II dosa i.e. total value is 18.4 and the mean value 3.7 and other scores are appearance 3.8, colour 3.3, flavour 3.8, texture 3.5, taste 4.0.
- Overall acceptability and mean value of the variation III dosa i.e. total value is 16.2 and the mean value is 3.2 and other values are appearance is 3.2, colour 3.1, flavour 3.7, texture is 2.8, taste is 3.4.
- Overall acceptability scores for variation I was 19.8 out of 25 it obtained a mean score of 4.0 when compared variation II which had a overall acceptability of 18.5 with the mean score of 3.7. The third variation obtained total score 16.2 and the mean score is 3.2. The standard dosa scored 21.3 out of a

maximum score of 25 the mean score of 4.3 as the highest score was obtained by variation I dosa with developed mix. When compared with the standard it can suggested that this preparation is most acceptable.

- Overall acceptability and mean value of the standard kozhukatai i.e. total value 24.2 and the mean value 4.8 and other scores are appearance 4.9, colour 4.8, flavour 4.8, texture 4.8 and taste 4.9.
- Overall acceptability and mean value of the variation kozhukatai i.e. total value 22.6 and the mean value 4.5 and other scores are appearance 4.7, colour 4.5, flavour 4.6, texture 4.4, taste 4.4.
- Overall acceptability and mean value of the variation II kozhukatai i.e. total value 21.9 and the mean value 4.4 and other scores are appearance 4.6, colour 4.5, flavour 4.4, texture 4.2, taste is 4.2.
- Overall acceptability and mean value of the variation III kozhukatai i.e. total value 15.3 and the mean value 3.1 and other scores are appearance 3.0, colour 2.9, flavour 3.1, texture 3.2, taste 3.1.
- Overall acceptability scores for variation I kozhukatai is 22.6 out of 25 it obtained a mean score of 4.5 when compared in the variation II kozhukatai which had a total score of 21.9 with the mean score of 4.4. The third variation variation-III obtained total score 15.3 and the mean score is 3.1 the standard kozhukatai scored 24.2 out of a maximum score of 25 the mean score of 4.8 as the highest score was obtained by kozhukatai with developed mix. This preparation was considered to be the most acceptable.
- Overall acceptability and mean value of the standard puttu. The overall acceptability 21.6 and the mean value 4.3 and other values are appearance 4.3, colour 4.2, flavour 4.3, texture obtained 4.4, and taste 4.4.
- Overall acceptability and mean value of the variation I puttu total value 21.2 and the mean value 4.5 and other scores are appearance 4.2, colour 4.1, flavour 4.2, texture 4.4, and taste 4.3.

- Overall acceptability and mean value of the variation II puttu total value 20.9 and the mean value 4.4, and other scores are appearance 4.2, colour 4.1, flavour 4.1, Texture 4.2, Taste 4.2.
- Overall acceptability and mean value of the variation III puttu total value 15.3 and the mean value 3.1, and other scores are appearance 3.0, colour 2.9, flavour 3.1, texture 3.2, taste 3.1.
- Overall acceptability scores for variation I was 21.2 out of 25 it obtained a mean score of 4.5 when compared to variation II which had a total score of 20.9 with the mean score of 4.4. The third variation obtained total score of 15.3 and the mean score was 3.1. The standard puttu scored 21.6 out of a maximum score of 25 with a mean score of 4.3 As the highest score was obtained by variation I puttu with developed mix, it was considered to be the most acceptable.
- Overall acceptability and mean value of the standard upma total value 23.9 and the mean value 4.8, and other scores are appearance 4.8, colour 4.8, flavour 4.7, texture 4.8, taste 4.8.
- Overall acceptability and mean value of the variation I upma total value 19.6 and the mean value 3.9, and other values are appearance 3.9, colour 4.0, flavour is 4.3, texture 3.5, taste 3.9.
- Overall acceptability and mean value of the variation II upma total value 16.4 and the mean value 3.3, and other score are appearance 3.4, colour 3.7, flavour 4.1, texture 2.1, taste 3.1.
- Overall acceptability and mean value of the variation III upma total value 15.6 and the mean value 3.1, and other scores are appearance 3.1, colour 2.9, flavour 3.5, texture 2.9, and taste is 3.2.
- Overall acceptability scores for variation I was 19.6 out of 25 it obtained a mean score of 3.9 when compared with variation II which had a total Score of

16.4 with the means score of 3.3. The third variation obtained total score 15.6 and the means score 3.1. And the standard upma scored 23.9 out of a maximum score of 25 the mean score of 4.8 as the highest score was obtained by variation I puttu with developed mix.

- Overall acceptability and mean value of the standard porridge total value 23.7 and the mean value 4.7, and other scores are appearance 4.5, colour 4.7, flavour 4.9, texture 4.8, taste 4.8
- Overall acceptability and mean value of the variation I porridge total value 21.7 and the mean value 4.3, and other scores are appearance 4.1, colour 4.6 flavour 4.6, texture 4.1, taste 4.1.
- Overall acceptability and mean value of the variation II porridge total value 20.2 and the mean value 4.0, and other scores are appearance 4.1, colour 4.0 flavour 4.2, texture 3.8, taste 4.0.
- Overall acceptability of the variation III porridge total value 19.6 and the mean value 3.9, and other scores are appearance 3.9, colour 4.0, flavour 4.3, texture 3.5, taste 3.9.
- Overall acceptability scores for variation I was 21.7 out of 25 it obtained a mean score of 4.3 when compared variation II which had a total Score of 20.2 with the means score of 4.0. Variation III obtained total score 19.6 and the mean score is 3.9. The standard porridge scored 23.7 out of a maximum score of 25 and a mean score of 4.7 as the highest score was obtained by variation I porridge with developed mix.
- Nutrient analysis of 100gm of developed mix revealed that 333 kcal, and 65 of carbohydrate and 12 grams of protein and fat was 1.5 grams, Dietary fiber is 13g. It was noted that the developed mix was high in protein and low in fat and rich in fiber
- The amount of calcium present in fiber rich mix is 123.5 milligrams. 1.73mg of iron is present in this mix and Vitamin c was 23mg.

CONCLUSION

From the foregoing results, it is revealed that the formulated and standardized mix can be used to prepare commonly consumed recipes such as dosa, kozhukatai, puttu, upma and porridge. The sensory evaluation showed that the recipes like dosa, kozhukataai, puttu, upma and porridge that were prepared with developed mix were best accepted in the variation I. i.e. 70 percent of varagu flour and 25 percent whole bengal gram flour and then 5 percent of drumstick leaves powder. It can be concluded that this mix is rich in dietary fiber and protein and low fat is beneficial in the context of weight reduction diets.

RECOMMENDATIONS

- Popularization programme and demonstration programme can be done for public to enhance the inclusion of varagu, whole Bengal gram and drumstick leaves in daily diet.
- Formulation and preparation of health mixes using high fiber foods like varagu, whole Bengal gram to overcome nutritional problems.
- Food processing industries can be motivated to produce food products using the developed mix.
- Booklets of recipes can be developed in local languages for convenience of the people.

APPENDIX I
SCORE CARD FOR DOSA

Name:

Date:

Time:

CRITERIA	SCORE	STANDARD	V1	V2	V3
<u>APPEARANCE</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				
<u>COLOUR</u>	5				
Excellent	4				
Very good	3				
Good	2				
Fair	1				
Poor					
<u>FLAVOUR</u>	5				
Excellent	4				
Very good	3				
Good	2				
Fair	1				
Poor					
<u>Texture</u>	5				
Excellent	4				
Very good	3				
Good	2				
Fair	1				
Poor					
<u>Taste</u>	5				
Excellent	4				
Very good	3				
Good	2				
Fair	1				
Poor					

Comments:

Signature:

SCORE CARD FOR KOZHUKATAI

Name:

Date:

Time:

CRITERIA	SCORE	STANDARD	V1	V2	V3
<u>APPEARANCE</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				
<u>COLOUR</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				
<u>FLAVOUR</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				
<u>Texture</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				
<u>Taste</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				

Comments:

Signature:

SCORE CARD FOR PUTTU

Name:

Date:

Time:

CRITERIA	SCORE	STANDARD	V1	V2	V3
<u>APPEARANCE</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				
<u>COLOUR</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				
<u>FLAVOUR</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				
<u>Texture</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				
<u>Taste</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				

Comments:

Signature:

SCORE CARD FOR UPMA

Name:

Date:

Time:

CRITERIA	SCORE	STANDARD	V1	V2	V3
<u>APPEARANCE</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				
<u>COLOUR</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				
<u>FLAVOUR</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				
<u>Texture</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				
<u>Taste</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				

Comments:

Signature:

SCORE CARD FOR PORRIDGE

Name:

Date:

Time:

CRITERIA	SCORE	STANDARD	V1	V2	V3
<u>APPEARANCE</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				
<u>COLOUR</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				
<u>FLAVOUR</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				
<u>Texture</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				
<u>Taste</u>					
Excellent	5				
Very good	4				
Good	3				
Fair	2				
Poor	1				

Comments:

Signature:

APPENDIX II

1. ESTIMATION OF CARBOHYDRATE BY ANTHRONE METHOD

Aim :

To estimate the amount of carbohydrate present in the given food sample.

Principle :

Carbohydrates are hydrolyzed into simple sugar using dilute hydrochloric acid. In hot acidic medium glucose is dehydrated to hydroxyl methyl furfural. This compound forms with anthrone, a green colour product with an absorption maximum at 630nm.

Reagents :

1. 2.5N HCL
2. Anthrone reagent : Dissolved 200mg anthrone in 100ml of ice cold H_2SO_4 prepared fresh before use.
3. Stock standard : Dissolved 100mg of glucose in 100ml of water.
4. Working standard : 100ml of stock standard solution is diluted with 100ml of distilled water.

Procedure :

1. Weigh 100mg of sample in a boiling tube.
2. Hydrolyze by keeping it in boiling water bath. Boiled for 3 hours with 5ml of 2.5 HCL and cool to room temperature.
3. Neutralize it with solid sodium carbonate until effervescence ceases.
4. Make up the volume to 100ml and centrifuge. Collect the supernatant and 0.5ml is taken for analysis.
5. Prepared the standard. Make up the volume to 1ml in all the tubes by adding water.
6. Then added 4ml of anthrone reagent and heat to 8 minutes.
7. Cool rapidly and read the colour at 630nm.
8. Draw the graph. From the graph, calculate the amount of carbohydrate present in the sample tube.

2.DETERMINATION OF MOISTURE CONTENT

Aim:

To determine the moisture content of the given food sample and calculate the percentage of moisture content.

Principle:

Estimation of moisture is one of the most often performed determination in food analysis. Moisture is lost when food is heated not much higher than the temperature of boiling water or by allowing to stand overnight over dehydrating agent or by heating over vacuum.

Apparatus:

Low flat-bottomed dishes, asbestos, analytical balance, weight box, tongs, desiccator where they remained for half an hour. Recorded their weights in an analytical balance. Repeated this procedure till two successive weights obtained were constant (with maximum difference of 0.0002g).

Weighed definite amounts of food material (2g) in each and placed in a electric oven thermostatically controlled at 100-105°C . Heated for a stipulated time (2 hours), cooled in a desiccator for half an hour and weighed. This was also weighed till successive weightings showed no further loss.

Precaution needed:

1. Handle the bottles always with a clean pair of tongs.
2. Always keep the oven closed.
3. Do not expose the bottles to atmospheric air to avoid the chance of atmospheric moisture getting in.
4. Checking for the appropriate placement of the lid of the desiccators.
5. Avoid placing a dish in a desiccators for more than half an hour.

6. Keep the door of the analytical balance shut.
7. Take care of the food sample for its purity, i.e. free from non-edible impurities.

The loss of weight equals the moisture present in the sample. The loss of weight divided by the weight of the original sample multiplied by 100 gives the percentage of moisture.

3. DETERMINATION OF ASH CONTENT

Aim:

To determine the ash content of the given food sample.

Principle:

By continuous heating, the substance gets charred which can be used for the determination of minerals present.

Apparatus:

Porcelain Crucible, clay pipe triangle, Muffle furnace, Desiccator, Weighing balance, Asbestos sheet.

Procedure:

About 5g of the sample was weighed accurately into a tarred platinum or porcelain crucible (which had previously been heated to about 600°C and cooled). The crucible was then placed on a clay pipe triangle and heated in a muffle furnace for about 3-5 years, at 600°C. the crucible was then cooled in a desiccator and weighed.

To ensure completeness of ashing the crucible was again heated in a muffle furnace for half an hour, cooled and weighed. This was repeated till two consecutive weights were the same the was almost white or grayish white in colour.

4. DETERMINATION OF CALCIUM

Aim:

To estimate the amount of calcium present given sample.

Principle:

Calcium is determined by precipitating it as calcium oxalate and titrating the oxalate solution in dilute sulphuric acid against potassium permanganate.

Apparatus:

Beaker, burette, pipette, flask and standard flask.

Reagents :

1. Ammonium oxalate: Ammonium oxalate was dissolved in 20ml of water till it was saturated.
2. 0.01N Oxalic acid: 0.063g Oxalic acid crystals were weighed and dissolved in 100ml of distilled water.
3. 0.01N Potassium permanganate: 0.316g of potassium permanganate was dissolved in 1000ml of distilled water.
4. Strong Ammonia
5. Glacial Acetic acid
6. 2N sulphuric acid: 5.5 ml of sulphuric acid was dissolved in 94.5 ml of distilled water.

Procedure:

Ash from the ignited sample was dissolved in hydrochloric acid made up to 100ml. 10ml of the solution was pipette out in a conical flask and 90 ml of distilled water was added to it. Added 2 drops methyl red indicator. It was made strongly alkaline by adding ammonia and kept for boiling. 20ml of saturated ammonium oxalate was added to the solution, 10ml each time to ensure complete precipitation directly. When it was hot, a few drops of acetic, was added to render

the medium acidic. The precipitate was allowed to settle overnight. The next morning the solution was filtered with what men No.40 filter paper. The precipitate was washed first with ammoniacal water and then with hot water several times until it was free from chloride .To test it 5ml of the washing was collected, in a test tube and a drop of silver nitrate or calcium chloride solution was added . the washing was continued till there was no precipitate with silver nitrate or calcium chloride solution. The filter paper was collected in a flask by making a hole in the filter paper. To this, 2ml of 2N sulphuric acid was added. This solution was heated to 60-80°C and when still hot was titrated against N/100 potassium permanganate solution. From the volume of potassium permanganate solution used up the milligrams of calcium present in 100g of the sample was calculated.

5.ESTIMATION OF IRON

Aim:

To estimate the amount of iron present in 100g of the given food sample.

Principles:

The food sample is oxidized with ignition or oxidation. Iron as ferric iron reacts with ammonium thiocyanate or with potassium thiocyanate to give ferric thiocyanate which is red in colour. The colour which is a measure of the concentration is measured colorimetrically.

Apparatus:

Volumetric flask, test tubes, klett, pipette.

Reagents :

1. Stock iron solution: Dissolved 0.0702gm (70.2mg) of reagent grade crystalline ferrous ammonium sulphate (Mohr's salt) in 100ml of water.
2. Working standard: Prepared a working solution in a 100 ml volumetric flask by adding 10ml of the stock solution and diluted to the mark with distilled water.
3. Saturated potassium persulphate solution: Shook 7 to 8g of reagent grade potassium per sulphate in 100ml of water in a glass stoppered flask. The undissolved crystals settled to the bottom and compensates the loss by decomposition.
4. 3N Potassium thiocyanate: Dissolved 146g of reagent grade potassium thiocyanate in water and diluted to 50ml with water . Filtered if turbid . Added 20ml of pure acetone to improve the keeping quality. Deterioration will be evident from the rapid fermentation of a yellow colour in the blank. Stored in brown bottles.

Procedure:

2g of the sample was ashed by ignition. When ashing had been completed 5ml of hydrochloric acid was added and made up to 100ml in a volumetric flask. Took different aliquots of the standard solution (1m-5ml)

Corresponding to 10-50 gamma in a series of test tubes. 2ml of the unknown solution was taken in the test tube. Added 1 ml of 30% H_2SO_4 1ml of potassium persulphate and 1.5ml of potassium thiocyanate to all the test tubes. This was made upto 10ml with water. A blank was prepared by adding the reagents except the standard or the read at 530 – 540 μ filter in the colorimeter.

6.ESTIMATION OF NITROGEN

Aim:

To determine the amount of nitrogen present in the given sample.

Principle:

The given sample is digested with concentrated sulphuric acid in a macrokjeldahl flask when nitrogen gets converted to ammonium sulphate. Ammonium is liberated by the action of strong alkali in a macrokjeldahl steam distillation apparatus. This nitrogenous substance is converted to ammonium borate by absorbing 2% boric acid and is titrated against N/70 H_2SO_4 . The volume of acid required to bring the test sample to the colour of the blank gives the acid equivalent to the ammonium.

Reagents:

1. N/70 Sulphuric acid.
2. 40% Sodium Hydroxide
3. 2% Boric acid (in warm water)
4. Digestion mixture: A mixture of copper sulphate potassium sulphate in the ratio of 2:98.
5. Concentrated Sulphuric acid.
6. Mozazaga indicator: A mixture of bromocresol green and methyl red indicator in 95% alcohol in the ratio of 4:1 (80 mg and 20mg in 100ml alcohol).

Procedure:

1. 0.5g of the sample was taken into the digestion flask. To this added 15ml of concentrated sulphuric acid and a pinch of digestion mixture as a catalyst. Kept at boiling gently over a heating mantle.
2. After digestion, the flask was cooled and the contents were transferred to a 100ml standard flask and made up to the mark with distilled water.

3. The whole apparatus was washed with distilled water and allowed to back suck.
4. 10ml of boric acid was taken in a conical flask. A drop of indicator was added to it and kept under the condenser.
5. The tip of the condenser was well below the liquid.
6. 5ml of the digested blank was added into the distillation chamber through the funnel. Then added 10ml of 40% NaOH. Washed the funnel with 2 to 3 ml of distilled water.
7. Closed the tap and steam was generated.
8. Steam entered the distillation chamber and drove ammonia which is in turn absorbed by boric acid.
9. Solution was pinkish white in colour, turned blue.
10. Steam was passed for 5 min and then the conical flask was lowered and the tip of the condenser washed.
11. The boric acid solution containing the liberated ammonia was against N/70 H_2SO_4 .
12. The end point was the appearance, the apparatus was washed.
13. Between each estimation, the apparatus was washed.
14. The experiment was repeated to get concordant values.

7.DETERMINATION OF TOTAL DIETARY FIBRE CONTENT

Definition

This method is the simplified modification of the AOCC total dietary fiber (TDF) methods, 35-05, and AOAC soluble/insoluble dietary fiber method (for oat products).

1.Principle:

1 g dried food sample (duplicate) are subjected to sequential enzymatic digestion by heat-stable amylase, protease, and amyloglucosidase.

2. Soluble / insoluble dietary fibre determination:

Insoluble dietary fibre (IDF) is filtered, and then residue is washed with warm distilled water, combined solution of filtrate and water washing are precipitated with 4 volumes of 95% ethanol (EtOH) for soluble dietary fibre (SDF) determination. Precipitate is then filtered and dried. Both SDF and IDF residues are corrected for protein, ash, and blank for the final calculation of SDF and IDF values.

3. Total dietary fiber determination:

SDF is precipitated with EtOH, and residue is then filtered, dried and weighed. Total dietary fiber (TDF) value is corrected for protein and ash content.

Reagents:

1. Ethanol, 95%
2. Ethanol, 78%, place 207ml. water into 1-l volumetric flask. Dilute to volume with 95% ethanol, Mix.
3. Acetone, reagent grade.
4. Enzymes for TDF assay

- a. Amylase
- b. Protease
- c. Amyloglucosidase
- 5. Deionised water
- 6. Celite, acid – washed, per-ashed
- 7. Hydrochloric acid solution, 0.561 N. Add 93.5ml of 6N HCL to approximately 700 ml of water in 1-L Volumetric Rask. Dilute to 1-L with water.
- 8. Ph standards. Buffer solution at 4.0, 7.0 and 10.0.

9. Filtration Setup

- a. Tare crucible containing celite to nearest 0.1mg.
- b. Wet and redistribute the bed of celite in the crucible, using 15ml of 78% EtOH from wash bottle.
- c. Apply suction to crucible to draw celite onto fritted glass as an even mat.

10 Filtration:

- a) Filter precipitated enzyme digest from crucible.
- b) Using a wash bottle with 78% EtOH and a rubber spatula, quantitatively transfer all remaining particles to crucible.

11. Wash

Using a vacuum, wash residue successively with two 50ml portions.

- a. 78% EtOH
- b. 95% EtOH
- c. Acetone
- d. Dry crucible containing residue overnight in 103°C oven.

8. ESTIMATION OF FAT CONTENT

Aim:

To determine the fat content of the food stuff.

Principle:

Ether extraction of the crude fat in vegetable products is carried out in a continuous extractor that is an apparatus in which the ether, after dissolving a portion of the fat of the material and discharging into the extraction flask, is volatilized, condensed and again allowed to act on the material. The step in the process are repeated continuously and automatically until the extraction is complete.

The soxhlet extraction used depends on the intermittent action of a glass siphon. The ether gradually condenses into the extraction tube containing the material until it rises to the top when it is discharged into the extraction flask.

Reagents:

Petroleum ether (60-80°C boiling point).

Procedure:

The soxhlet flask was weighted to consecutive concordant weight. 2g of the moisture free sample was packed into an extraction thimble and placed in an extractor which was fixed into a soxhlet flask. Poured sufficient amount (150) of petroleum ether so as to permit siphon action. The thimble and the contents were allowed to soak in ether for 24 hours. The entire set up was kept over an electric water bath and the extractor was connected to the condenser. The nozzle of the condenser was always plugged with moistened cotton. the temperature was maintained at 60°C. A steady Stream of water in the condenser was maintained. The ether evaporated rose up but owing to the condenser arrangement, it fell back into the condenser extractor . when the extractor got firkled with ether, it was siphoned back into the flask. This went on till the ether that got collected in the extractor was free from any yellow colour indicating the presence of fat. The soxhlet flask was then disconnected and ether was evaporated in a water bath maintained at 60° C. When the ether in the flask was evaporated, the flask was weight again to get concordant values. Form the difference in Wight, the fat content was calculated.