"ENRICHMENT OF SAGO-PAPAD WITH PLANTAIN PEEL- A COMPARATIVE STUDY"

PROJECT WORK SUBMITTED TO DEPARTMENT OF PG STUDIES IN

FOOD SCIENCE AND NUTRITION

BESANT WOMEN'S COLLEGE, MANGALORE

IN THE PARTIAL FULFILMENT OF REQUIREMENT FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN FOOD SCIENCE AND NUTRITION

Submitted By,

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October 2021

CERTIFICATE

This is to certify that the project work entitled **"*ENRICHMENT OF SAGO-PAPAD WITH PLANTAIN PEEL- A COMPARATIVE STUDY*"** is an authentic record of independent research work done by ***Ms. SACHITHA.H.B.(Reg. no 193041964)*** under my supervision during the period of **June 2021 to august 2021**, submitted to Mangalore university for the partial fulfilment for the award of the degree of ***Master Of Science In Food Science And Nutrition*** and the present work has not been previously formed the basis for the award of degree, diploma, fellowship, associateship or other titles.

Place: MANGALORE
DATE: 30 OCTOBER 2021

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(Accredited by the NAAC with 'A' Grade)

CERTIFICATE

This is to certify that the project work entitled ***"ENRICHMENT OF SAGO-PAPAD WITH PLANTAIN PEEL - A COMPARATIVE STUDY",*** submitted to the ***Department of PG Studies in Food Science and Nutrition,*** by ***Ms. SACHITHA.H.B.(Reg. no 193041964)*** towards the partial fulfilment of the degree of ***Master of Science in Food Science and Nutrition,*** is a faithful record of original work carried out by her in the academic year **2019-2021**

Place: MANGALORE
DATE: 30 October 2021

HEAD OF THE DEPARTMENT

EXAMINERS:

1.

2.

DECLARATION

I, ***SACHITHA.H.B.,*** hereby declare that project work entitled **"*ENRICHMENT OF SAGO-PAPAD WITH PLANTAIN PEEL - A COMPARATIVE STUDY"*** is a bona fide record of research work done by me under the supervision of ***SHWETHA SINGH,*** **Department of PG Studies in Food Science and Nutrition, Besant Women's College, Mangalore.**

The information depicted in the current report is the result of my own work, except where the reference is made. The information provided in the report is authentic as per my knowledge.

The results embodied in the project work have not been submitted to any other university or institution for the award of any degree, diploma, associateship, fellowship or similar titles.

Place: MANGALORE
Date: 30 OCTOBER 2021

SACHITHA.H.B.

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Place:Mangalore SACHITHA.H.B

Date: 30 OCTOBER 2021

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CHAPTER 1

INTRODUCTION

Product development is nothing but creation of an entirely new product or improving an existing product. Product development begins with deciding the potential of a new food product which will be not only economical but also accepted by the community. The product must be put through a series of checks such as, taste sampling, consumer sampling and shelf life study. Only after this, the product is produced on a large scale, packaged and marketed.

1.0 INTRODUCTION

The true starch palm or Metroxylon sagu Rottb has been represented as humankind's oldest food plant, and therefore, the earliest account of the plant that reached western country dates back to the eighteenth century. The term sago Associate in Nursing edible starch extracted from the pith-like center of many Asian palms (including Metroxylon sagu) or generally of cycads. Palm is that the common name for members of the family Palmae. Palmae could be a massive family and includes tropical trees, shrubs, and vines. Most members of this family are tree-like, characterized by a crown of compound leaves, and terminating during a tall, woody, unbranched stem. Natives adopt completely different techniques to separate sago from the stem. The three types of plants like palm, cycad, cassava from which the starch for sago is produced. The sago comes mainly from Asia significantly Indonesia and Malaysia. It has been a staple for individuals staying in the tropical regions. In India sago or the Sabudana is made from the tapioca tuber. sago is a food product from the milk of tapioca root. The root is cleaned, peeled, and crushed to take the milk. In a tank, the milk is allowed to settle for 3-8 hours. Then it is converted to small globules using a special machine. The sago is dried under direct sunlight. This product is commonly is in the pearl shape. In India, Sabudana is used as weaning food and break their fast. Sabudana is more preferred because it contains only starch doesn't contain any chemicals, sweeteners. Sabudana is available in two varieties like roasted sago and boiled sago. The proximate analysis of sago revealed that 100g of sago contain 322kcal of energy, protein less than 1gram, fats less than 1gram, fiber also less than 1gram. Sago is low in vitamins and minerals. It is gluten-free and suitable for grain-free diets. commonly eaten s source of carbohydrate, nutritionally sago is low in nutrient when compared to other carbohydrate sources. It is not a nutritious carbohydrate choice. Sago is an ideal food to have post-fasting as it provides loads of energy and prevents fatigue, dizziness, headaches. It is organically gluten-free, is a regular ingredient in Indian dishes. often recommended for patients with celiac disease. Although sabudana is high in calories and carbohydrates for instant energy, this lowers high blood sugar. Small servings of sabudana help in managing lifestyle diseases like diabetes and obesity. Sabudana is devoid of cholesterol help to enhance HDL levels lowers LDL levels. Consuming soaked sago benefits the health of pregnant and lactating women.

Sago (Metroxylin sago) is one in all the most sources of native starch. In Asian country sago dishes are normally eaten with sugar. However, different societies use sago as a staple food item

rather than rice or potato. The sago palms grow everywhere geographical region, and are used as staple foods in places wherever there's too little rain to grow wet rice. In India, it's used as ‘sabudana’. Sago pearls may be poached, either alone or mixed with different foods, and consumed directly as a macromolecule supply. Sago is additionally wide used, in conjunction with rice, corn and potatoes, within the manufacture of noodles in Malaysia. However, information on plasma glucose and internal secretion responses when oral uptake of any physical sort of sago meals are scanty. Previous studies exhibited that some styles of starch were higher than different easy CHO like glucose in maintaining higher CHO availability throughout exercise.

sorghum is ancient cereal grain belonging to the grass family Poaceae. They are usually small, round, white, or yellow so varieties are red, brown, black, or purple. sorghum plants are very hardy it can withstand high temperatures. It is grown in U.P, Rajasthan, and Bengal, Bihar. It is successfully grown under temperatures ranging between 15 degree Celsius 40 degree Celsius. It is consumed more in India but is believed to have African origins. Sorghum also called great millet, Indian millet. In India sorghum is known as jowar, cholaam, Jonna. Grains of jowar ground and made the jowar flour. The flour is creamish white and has a neutral flavor so it is consumed plain, made into porridge, roti, and also used in combination with other flours. The proximate analysis of jowar flours per 100g shown 359kcl of energy, 11.5% of protein, 2.7% of fat, 1.3% of fiber, and 72% of carbohydrate. Studies have shown health benefits linked to the consumption of sorghum. Sorghum has anti-inflammatory effects, anti-cancer effects. Starches present in the sorghum are difficult to digest by the human body compared to other grains so they help in feel full without increasing calories that will help in weight loss. They are also safe for celiac disease, eating the grain led to improved blood glucose response. Sorghum is an outstanding option for a person who is on a low sodium diet. The whole grain can be boiled, roasted, popped. ground to make flour and which can be used for the preparation of jowar roti, pancake, pastry, thickening stews. The traditional product like Sorghum papads like Sandoli and Bibadi are very popular in Maharashtra and different a part of the Republic of India, however, preparation of those products is tedious and skill-specific. Thus, urban kitchens are largely away from these products, and the younger generation is deprived of this ancient product because it isn't obtainable within the market. In the close to future, native art and talent could vanish. Therefore, it's necessary to standardize the native processes, art, and

talent to develop a method technology for the preparation of those products on a larger scale to fulfill the need of the urban population. Hence method technology for sorgho papad viz Sandoli and Bibadi was standardized and changed. A water bathtub was used for warm water soaking of sorghum at 90 °C. the entire time required for preparation of Sandoli and Bibadi by ancient strategies was eight days and nine days severally. it had been reduced to a pair of days for Sandoli and three days for Bibadi within the developed method technology. the maximum period of Sorgo papad Viz. Sandoli and Bibadi was found to be 210 and 220 days.

In many tropical areas plantain, which is the major group of banana is the staple food. Plantain plant springs from an underground stem or rhizome. The fruit plantain which is green to yellow is seen in bunches. Plantains originated from southeast Asia. Two varieties of plantains are having a common origin that is horn plantain and French plantain. Both types are grown in India, Africa, Egypt, and tropical America. Plantain has the majority of starch before they ripen, they are usually cooked green, either boiled or fried, in savory dishes. The ripe fruits are cooked with coconut milk or sugar as a flavoring. Plantains may also be dried for later use in cooking or ground for use as a meal, which can be refined to flour. Peel from the unripe plantain is obtained during this process. In production, about 40% are wasted, mainly peel which is used for feeding cattle or pigs. In many parts of India plantain is used for the preparation of deep-fried chips. The processing waste of fruit and vegetables is highly perishable. They are becoming a problem to the industries, so this problem can be recuperated by making use of its high-value compounds, including dietary fibre. Banana peel has a very good source of dietary fibre and antioxidants. peels are rich in total dietary fibre is 64.33g per 100g, vitamins mainly folic acid 33.12mg per 100g, minerals especially potassium 35.61mg per 100g. So the peel is often incorporated as an ingredient in a large form of a food product as an appropriate source of dietary fibre.

In our country sago papad has been made for consumption during the fasting days. It has been prepared hygienically with sago as the base. The technique involved in the preparation of papad is partially cooked Sabudana followed by sun drying. One of the tasty and popular food items in the Indian diet is the papad. Papads are prepared by the combination of pulses, cereals, processed cereals depending on the preferences. Papads can of various selection depending upon the kind of pulses Papads has often consumed artifact in each house it forms a tasty side dish and may be

used any combination. it's popular with people of all ages and it's consumed at mealtime, tea time, as half time snack, or with alcoholic beverages. It will be cooked over a flame or fired before consumption. Papads could be a familiarly known food adjunct consumed extensively in South Bharat and lots of different parts of Southern Asia, wherever it's popularly referred to as pappadam. it's typically created out of a dough containing pulse flour, edible starch flour, and cereal flour with seasoning, carbonates, spices, edible oil, and miscellaneous additives with water. Carbonates facilitate in getting uniform color and desirable look, texture, and style throughout sauteing. Common salt contributes to softness in addition to the desirable rolling property of the dough and diametrical growth. The dough is formed into little spherical balls weighing 5–7 g every and is rolled within the form of skinny circular discs of 10–15 cm in diameter and zero.4–0.7 mm thick. Papads within the raw type are sold in numerous dimensions on a weight basis with differing types of packaging materials. they're deep fat deep-fried or cooked before consumption. attempts have been made up from time to time to enhance the biological process and organoleptic qualities of papads. Bureau of Indian Standards (1984) quoted the usage of the vegetable juices or mucilaginous additives obtained from banana stem, gourds, ladies finger, and nalleru (Cissus quadrangularis) within the preparation of papads. primarily papads area unit ready from black gram red gram, green gram red gram, etc. Black gram red gram papads is that the largest selling papads within the native and national market and these papads area unit staple in each Indian s home and are served as a course. The demand for papads is larger scope for introduction of types for papads ready from a price-effective raw ingredient like sorghum. Papads is one of the Indian ancient food things that may be ready before and served as and once required. Papads could be a skinny crispy wafer-like dish that goes well with meals and snacks. In Bharat production of cereals is abundant; there's a necessity to seek out distributed uses to maximize their utilization and to cater to the quick ever-changing style of the recent generation.

Chapter 2

REVIEW OF LITERATURE

Developing a new product is a complex process. This requires knowledge of ingredients, processing methods, consumer demands and preferences etc. Having knowledge of these aspects helps one to make the right decision. This study focuses on developing a sago papad with plantain peel. Review of available literature related to the two main components provides the foundation for the product development process.

2.0 REVIEW OF LITERATURE

k.b Arun et al (2015) studied plantain peel about its antioxidant dietary fibre for developing functional cookies. he noticed that fruit and vegetable processing waste becoming a problem to the industries and the pollution agencies. He found out that this problem can be recovered by utilizing its valuable compounds in functional food preparation. Currently, peels of a variety of fruits are taken as a natural source of fibre and antioxidants, he found that banana peels as a very good source of dietary fibre and antioxidants. The proximate analysis revealed that peels are rich in dietary fibre that is 64.33g per 100g and in vitamins folic acid 33.12mg per 100g and minerals mainly potassium is 35.6mg per 100g. The moisture content was found to be 5.84g per 100g, protein is 5.89g per 100g, fat is 5.12g per 100g and carbohydrate is 11.03g per 100g. The above study has shown that banana peel is a rich source of dietary carbohydrates and minerals and other nutrients.

E. Agama Acevedo et al (2015) examined the potential of plantain peel flour. they have taken peel from unripe banana and the flour was made from them, then they conducted the study on the chemical composition of the plantain peel which includes dietary fibre, polyphenol content, antioxidant activity, and functional properties. They have found that plantain peel flour contains relevant amounts of total dietary fibre, starch, ash, protein. peels from the unripe banana present 6-10% of protein, 6-12% ash, 2-6% lipids, 11.39% starch, 33-43% total dietary fiber. They concluded that plantain peel flour has a high amount of total dietary fibre with a high level of insoluble dietary fibre and it had an antioxidant capacity.

Akinasanmi et al (2014) investigated the assessment of the nutritional, antioxidant capacity of unripe, ripe, and overripe plantain peels. They observed that plantain peels are the major by-product of plantain fruits. They have done the mineral analysis, proximate analysis, antinutrient, antioxidant capacity of the peel. The result showed a high amount of potassium that is 235mg/g. The highest amount of crude protein was found in the unripe plantain peel when compared with the overripe plantain peel. The crude fibre content of unripe plantain peels is also higher than the overripe plantain peel. This study revealed that plantain peels which are thrown away as waste contain a good amount of nutrients, vitamins, mineral elements.

Abubakar et al (2016) conducted a study on the proximate and mineral composition of corn cob, banana, and plantain peels. Banana is a valuable source of potassium, fibre, vitamin B, vitamin c. Plantain waste material has been considered as fertilizer the recent studies done to determine the proximate and mineral composition which show that they have a good source of nutrients. They concluded that corn cob had lower ash content may suggest that has a lower mineral content, in the case of plantain peel they have a good amount of ash so they contain a good amount of minerals. when compared to the corn cob plantain have a high amount of minerals and other nutrients.

A.s Adamu et al (2017) evaluated the nutritional value of ripe and unripe, boiled and roasted plantain pulp and peel. Result shown that the highest fat content was found in unripe plantain peel. A higher amount of carbohydrate content was observed in roasted unripe plantain pulp and also in unripe plantain peel. they have concluded that all the minerals present in the peels of ripe and unripe plantain are compared with pulp. They recommend that plantain peel powder should be added to the plantain pulp flour to increase its nutritional value.

P.I Akubor et al (2013) examined the chemical composition, physical and sensory properties of cakes supplemented with plantain peel flour. plantain peel flour was prepared by cleaning the peels then cutting and drying, milled, and then sieved. Proximate analysis of this shown they contain 62.2% of carbohydrate, lower moisture content that is 8% and crude protein 7% then the mineral content high amount of potassium is found that is 739 mg/100g and sodium 30mg/100g. They concluded that the development and utilization of plantain peel improve the nutritional status of the population.

Thomas happi emaga et al (2010) studied the ripening influences of banana and plantain peels composition and energy content. Here the peel samples were analyzed for starch, free sugars, and fibre composition. Banana and plantain peels are rich in fibre, polyphenols and low in protein. Studies indicate that banana and plantain peel have energy values. Plantain peels have higher energy when compared to the banana. Concluded that the main influence of both maturations of fermentability and energy value of the peels seem to be linked with carbohydrate fraction alternation, including starch, fibre.

Ighodaro et al (2012) conducted a study on plantain peel which constitutes about 40% of the whole fruit, the presence of phytochemicals, minerals, and nutrient components in ripe and

unripe is examined. The ripe and unripe peel of banana showed carbohydrate contents of 42.95 and 48.18% respectively. The crude protein was found to be 6.89 to 7.18%. Ash content was found in both ripe and unripe peel. The antimicrobial activity of the plantain peel is checked and found it is effective for most bacteria and fungi. Finally, he concluded that plantain peels and a good source of nutrients, minerals.

Ibhafidon Shadrach et al (2019) this study investigated the nutraceutical potential of both ripe and unripe plantain peels. For that, he has done the proximate analysis of both the sample and he have found that they contain a good amount of nutrients. From the mineral analysis, they have found the presence of potassium, sodium, magnesium, phosphorus, iron, zinc, copper. The presence of potassium and sodium in both ripe and unripe peel sample have been considered advantages towards good health. This comparative study of ripe and unripe plantain peel contains more fat, ash, fibre, carbohydrate, essential minerals, and phytochemicals.

Andi patiware metaragakusuma (2015) examined that sago is an important raw material for food industry and predicted that demand of sago in future is going to increase. They have noted that sago provide a lot of benefits, has a high potency to be developed for acceptance purpose. The proximate analysis indicated that sago contain good amount of nutrients, carbohydrate content 84.7g/ 100g which is higher than rice, wheat flour. They concluded that sago has great potential to develop support in food diversification this is because they contain a high carbohydrate, also has a low calorie and fat content.

Renu Yadav et al (2013) investigated physiochemical properties, chemical modifications, concisely the extraction and pharmaceutical application of Indian sago starch. in chemical modification, in sago starch, they have seen the addition of galactomannans to sago starch results slight increase in gelatinization temperature, hydrolyzation process of sago starch granules, the addition of cellulose result in an increase the ability of raw starch digesting amylase for digesting sago granules. they found that the application of sago is a binder, disintegrant, and diluent and modified for delivering novel drug and also packaging material.

Anil bukya et al (2018) studied on preparation and standardization of papads using urad flour, raw banana, and sweet potato and its self-life studies. proximate analysis of papads showed protein 21.8%, fat (2.5%), ash (6%), fiber (10%), energy (350 kcal). The moisture content varied from 19.2-21.5%. the organoleptic evaluation was done by a hedonic scale. There was no

significant evidence of microbial spoilage. They concluded that prepared papads can be stored for 30-40 days at room temperature. the investigation was undertaken to assess the shelf life of papads during storage up to 6 months under ambient condition.

Mamatha (1994) investigated the quality attributes of papads incorporating different levels of rice bran. Here they have taken different levels of defatted rice bran were incorporated into two base materials rice flour and sago flour for making the papads. the overall quality of the product is exhibited in color and texture. by measuring the size of the papads expansion volume was determined. They have seen an increase in the size of the papads after frying. Among the two product sago flour papads had a higher increase in size on frying. They also found the moisture and protein content of raw papads. the moisture content was at the desired level, which helps in increasing the storage life of the product.

Shwetha Kamath (2008) in her article mentions about consumption pattern of papads at the household level and its availability in the local market. consumption patterns of papads were collected by personal interview. the preparation of papads traditional pattern was still followed. Pulses, cereals, processed cereals, fruit, and tubers were used for the preparation of papads. the study concludes the papads is a popular food item, the traditional practice of preparation of papads still followed at the household level.

Iain A. brownie et al (2009) studied the physiological roles of dietary fibre. dietary fibre impact all aspects of gut physiology and are an important part of a healthy diet. Initial observations linking dietary fibre to health shown the advantages of consumption of fibre wealthy foods. there's would like for development of novel fibre wealthy foods that are acceptable to the patron and conjointly they note that in terms of dietary fibre product acceptability, it's conjointly necessary to contemplate channel consequence of consumption instead of style tests. they need to highlight the requirement for a specializer to extend the event of a sale, appetizing, and fibre enriched. throughout the 1950's 1970's empiric studies prompt that dietary fibre intake was related to a variety of health edges.

Guine. R et al (2017). studied on benefits of dietary fibre to human health. dietary fibre has recognized as important for the maintenance of a healthy body. they have aimed to study the level of knowledge of a relatively wide range of people about the health effects. A descriptive cross-sectional study was undertaken on a sample of 6010 participants and they have measured

the knowledge of different health benefits from dietary fibre. the results obtained a considerable degree of information about the benefits of fibre. they have finally concluded that the participants in the study were quite well informed about the benefits of dietary fibre. provided information on the levels of information of a wide range of people about the health benefits of adequate intake of dietary fibre.

Butti. p (2017) examined screening of sorghum varieties for papads preparation. They have taken sorghum varieties like parbani moti, parbhani Jyothi, Akola Kranti, Phule revati, and Phule vasuda are considered and they have prepared papad out of it. Here they have analyzed physiochemical analysis and organoleptic evaluation, proximate analysis. They have found that sorghum contains 12-13.9 % moisture content, fat 3.8 to 4.71 %, protein 9.8 to 15.08 percent then carbohydrate 65.8 to 70.52%, and their ash content was 1.89 to 2.06 %. they have also found that as the soaking time of grains is increased there is an off-flavor in the fried papad. While the papad which is soaked for five days found to have mild off-flavor so from this they have concluded that three days of soaking sorghum grain is suitable for papads making.

C.Anglani (1997) investigated sorghum for human food and the relationship among some kernel characteristics and foo quality is presented. The foods prepared with sorghum such as tortilla, porridge, couscous, and baked foods are described. The nutritive value of sorghum is lower because of the low content of some essential amino acids. The endosperm texture, flour particle size distribution, and milling affect the quality of sorghum. Sorghum protein becomes less digestible after cooking; the mineral content of sorghum is similar to millet. The major minerals in sorghum grain are potassium and phosphorus, while calcium is low. They have also found that sorghum contains polyphenolic compounds which are antinutritional factors. They are concluded that parboiling improves the sorghum grain characteristics, but has disadvantages such as higher energy requirements. More research is necessary to study the effects of cooking on the nutritional value of sorghum foods.

Prabhakar b. et al (2015) conducted studies on physico-chemical analysis of sorghum varieties. Sorghum varieties analyzed for ash, moisture content, fat, total carbohydrate, protein. The result was expressed as the average value. Moisture content was estimated adopting AOAC (1990) method and they have found moisture content of 12-13.9%, fat 3.8-4.71%, protein 9.8-15.08%,

the total carbohydrate content of the sample was determined as a total carbohydrate by difference, by subtracting the measured fat, ash, protein, moisture from 100.

U.D Chavan et al (2015) investigated on preparation and nutritional quality of sorghum papads. This study was undertaken to prepare the sorghum papads and to study the nutritional composition, sensory characteristics of sorghum papads, to identify the genotype of sorghum for papads preparation and to study the nutritional analysis of sorghum grain as well as its papads. The result showed that crude protein content in grain ranged from 1.21 to 1.90%. The genotype Dadar local gave a higher level of fat 1.90% as compared to other genotypes, the oil content of papads ranged from 23.59 to 35.42%. The organoleptic evaluation of papads prepared from sorghum was judged based on color, appearance, texture, flavor, taste. The papads also has good frying qualities like puffiness, crispiness and expansion, and low oil absorption. Nutritional composition of sorghum revealed the calcium content in the sorghum grain ranged from 21.77 to 36.44 mg/100g, phosphorus content in the different genotypes of sorghum grain found to be 491-517 mg/100g, and potassium content was found to be 537mg/100g. Oil absorption capacity is measured by the amount of oil absorbed by the papad after frying. They have found that higher oil absorption can reduce the shelf life of the papad, less oil required for frying is more beneficial. Chemical composition analysis of sorghum papad revealed that crude protein ranges from 10.11 to 11.35%.

vannalli et al (2008) examined the nutritive value and quality characteristics of sorghum genotypes. Ten sorghum genotype were taken for the study, visual observation of different genotype of sorghum revealed that sorghum was white in color, and other genotypes were blackish white and pearly white. The proximate analysis of sorghum indicated that moisture content of the sorghum varied for different genotypes and the moisture content ranged from 6.55 to 8.58%, the protein content of sorghum varied from 8.73 to 12.81%, fat content of sorghum was found to be 2.36%, the ash content of different sorghum genotypes ranged from 1.14 to 1.72%, the crude fiber content of the sorghum ranged from 1.21 to 2.48%.

Stanley j. et al (1983) in their article mentions the value of Metroxylon palm sago as plant food. they noted that a final aspect of cultivation must be considered namely the length of time to maturity of the palm, and timing of harvest to ensure maximum yield. It must be harvested soon after flowering because yield is high at that time. starch extraction from the palm is done by

cutting down the palm. The cooking of sago is traditionally done by boiling water to produce thick porridge, stew produced by them. Compared to other staples such as sweet potato, taro, yam sago is a poor source of all nutrients except energy. By the proximate analysis of raw sago found that they contain energy 1.19 MJ (285 kcal), calcium 30.0mg, carbohydrate 71.0g, iron 0.7g. Palm sago is almost pure starch and it is abundantly available. They also noted that the people who use sago as their main staple have low B-vitamin status.

kulamarva, A. et al (2009) in their article mentions nutritional and rheological properties of sorghum and their mode of consumption. Sorghum is consumed in various forms around the world like baked bread, porridge, tortillas, steam-cooked products, and so on. The objective is to highlight the nutritional benefits of sorghum. They also found that sorghum bran is low in ash, protein and rich in fiber. Processing removes the outer pericarp, and thus proportionally increase the protein and reduce the cellulose, lipid, and mineral content of the grain. They are of importance in terms of product formulation and quality control.

V. Velu et al (2004) examined the effect of various ingredients and additives on papad. Attempts have been done to enhance the nutritional and organoleptic qualities of papad. This study was done to study the effect of various additives based on frying characteristics of papad concerning the expansion of the diameter of the papad and their oil absorption during deep frying and the organoleptic evaluation of fried papad with storage. Here they deep fried the papad at regular intervals of 15, 30, 45, 60 days of storage in a frying pan. The fat content of the deep fat fried papad is estimated. They have found that soy flour reduces fat absorption.

R.G, math et al (2003) studied the effect of frying conditions on moisture, fat, and density of papad. The moisture transfers mechanism uptake oil when frying was studied. Several researchers described the transport of moisture but still, it is not clear that when the product absorbs the oil. From this study, they have concluded that deep fat frying is the mass transfer of moisture that leaves the food due to the high temperature of the frying oil. It was clear that at an increased temperature the moisture loss increased with an increase in frying time. The result found that moisture 1.2%, expansion 46.4%, oil absorption 47.3, frying time 20s, and the frying temperature 185±1℃.

Chapter 3

MATERIALS AND METHODS

The study aims to develop a nutritious yet tasty Sago-plantain peel papads. The papads was made in different formulations. The papads which was the most accepted in sensory evaluation, was further subjected to proximate analysis and shelf life study.

3.0 MATERIALS AND METHODOLOGY

3.1 MATERIALS

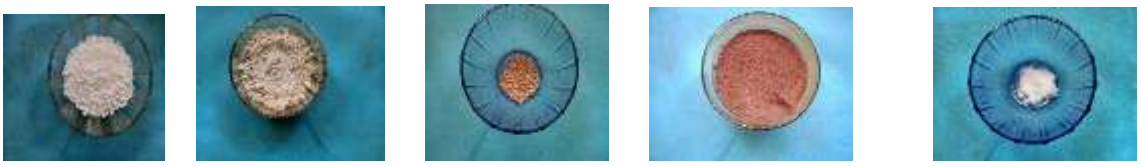
3.1.1 INGREDIENTS

The raw ingredients required for papads preparation (sago, sorghum flour, plantain peel) were purchased from the local whole sale retailer in Mangalore.

Table 1: Ingredients used for papads preparation

INGREDIENTS	**COMPOSITION OF SAGO-PLANTAIN PEEL PAPAD (100Grams)**
SAGO	53g
SORGHUM FLOUR	30g
PLANTAIN PEEL POWDER	15g
CUMIN SEED	1g
SALT	1g

Plate1: Ingredients used for papads preparation



Sago sorghum flour cumin seed plantain peel powder salt

3.1.2. Equipment

Weighing balance (Essae-Teraoka Pvt. Ltd), Hot air oven (B.D. instrumentation, Ambala Cantt), muffle furnace (Rotek instruments, Kerala)

3.1.3. Reagents and Chemicals

All the reagents and chemicals used were of AR grade procured from Fisher Scientific, Mumbai; Medilise, Kerala; Emplura, Mumbai.

Sulphuric acid, sodium hydroxide.

3.1.4. Glassware used

Conical flask, petri dish, crucible, funnel, beaker

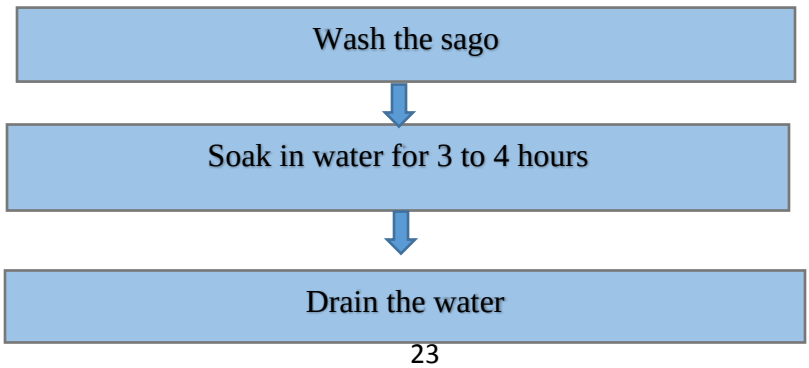
3.2 METHODOLOGY

3.2.1 collection of the sample

The raw ingredients required for papads preparation (sago, sorghum flour, plantain peel) were purchased from the local whole sale retailer in Mangalore

3.2.2 preparation of sago papads

Firstly, wash the sago (Sabudana) and soak the Sabudana in enough water for 3 to 4 hours or till it gets mashed up easily. After soaking the water is drained off and transfer to a kadai, to that add required amount of water and add cumin seeds, salt. Boil for 20 minutes stirring occasionally, cook till the Sabudana pearls turns translucent and swell. Mix well and cool for 10 minutes, take a clean plastic sheets and pour a tablespoon of Sabudana mixture making a small round. Sun dry them for 2-3 days or till they dry out completely. Store them in an air tight containers.



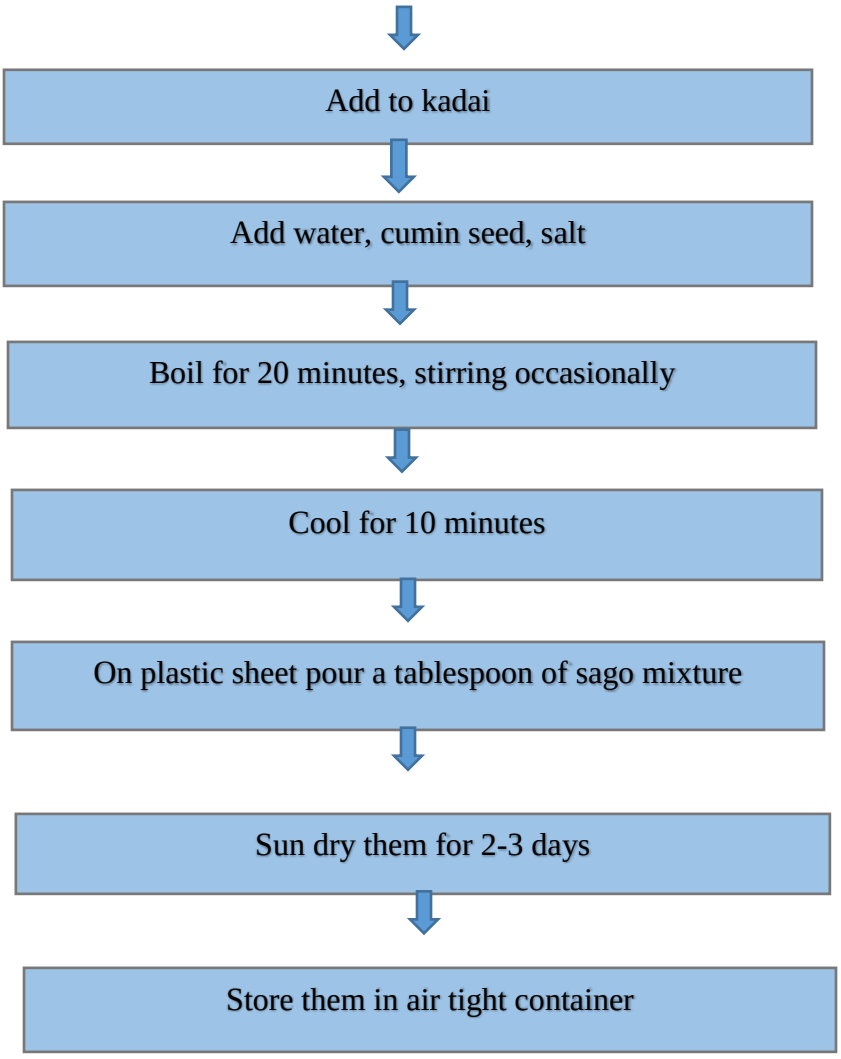


Figure 1 schematic representation of the preparation

3.2.3 preparation of plantain peel powder

Plantain peel was collected from the local banana chips making industry, located at Kasaragod district of Kerala, India. The peels were washed and pretreated with cold water for 10 minutes, drained and sliced into small pieces. It was then sun dried for 2-3 days. The peel was then ground in a blender and sieved to get plantain peel powder.

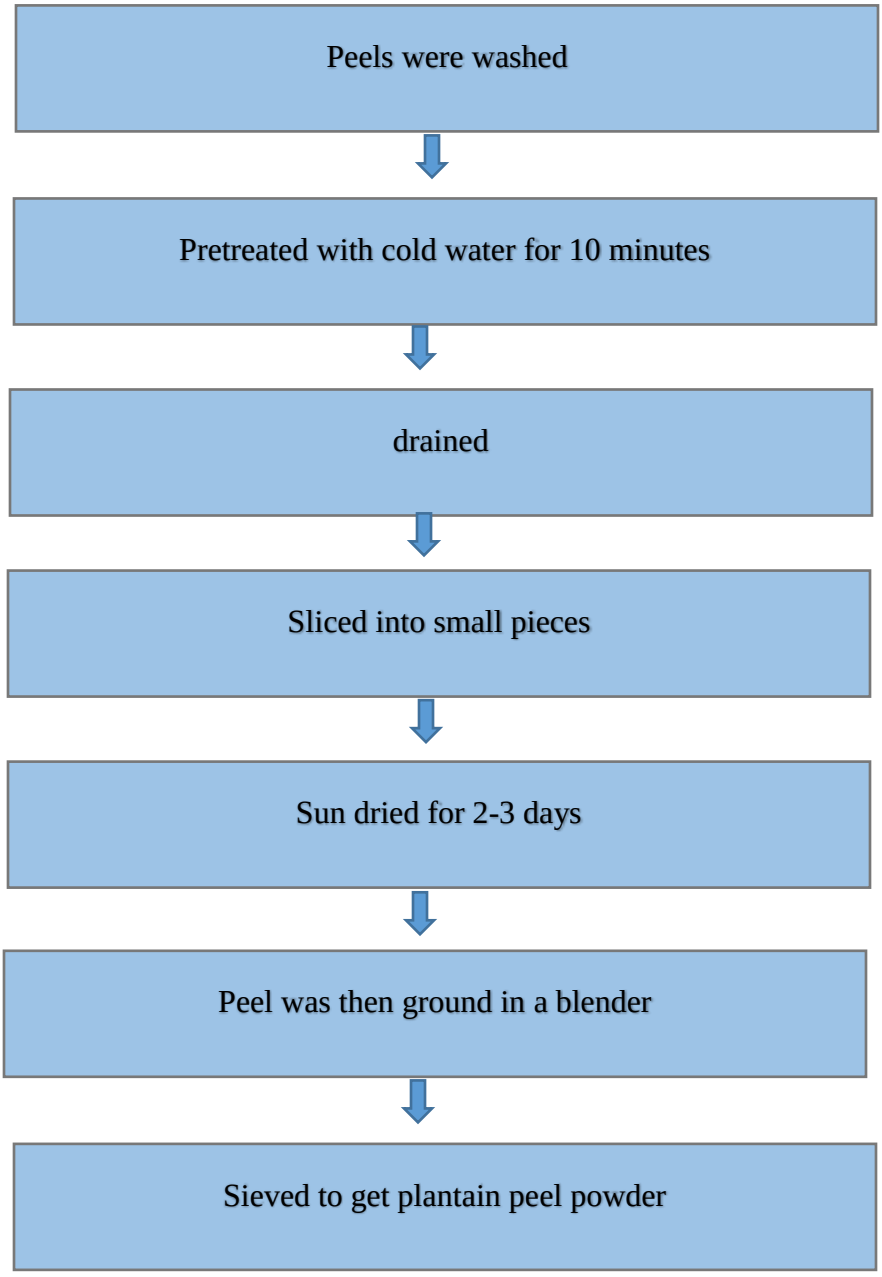


Figure 2 schematic representation of preparation of plantain peel powder

3.2.4 DEVELOPMENT OF SAGO PLANTAIN PEEL PAPAD

3.2.4.1 formulation of sago plantain peel papads

The sago plantain peel papads prepared according to different formulation given in the table

In formulation A1 the percentage of plantain peel powder incorporated is 5%

In formulation A2 the percentage of plantain peel powder incorporated is 10%

In formulation A3 the percentage of plantain peel powder incorporated is 15%

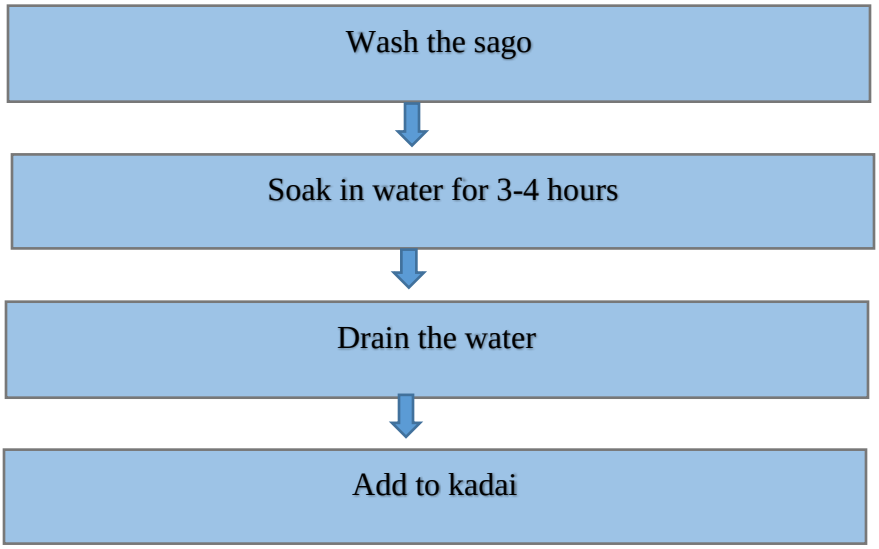
Table 2

Formulation of sago plantain peel papads

INGREDIENTS	FORMULATION A1 (g)	FORMULATION A2 (g)	FORMULATION A3 (g)
SAGO	63	58	53
SORGHUM FLOUR	30	30	30
PLANTAIN PEEL	5	10	15
CUMIN SEED	1	1	1
SALT	1	1	1

3.2.4.2 Preparation of sago plantain peel papads

The sago washed and soaked in water for 3 to 4 hours till it gets mashed up easily. After soaking the water is drained off and transfer to kadai, to that add required amount of water, cumin seed, plantain peel powder, salt. Boil for 20 minutes stirring occasionally, cook till it become translucent and swells and cool for 10 minutes. Clean plastic sheets taken and pour a tablespoon of the mixture making a small round. Sun dry them for 2 days or till they dry out completely. Stored them in an air tight container.



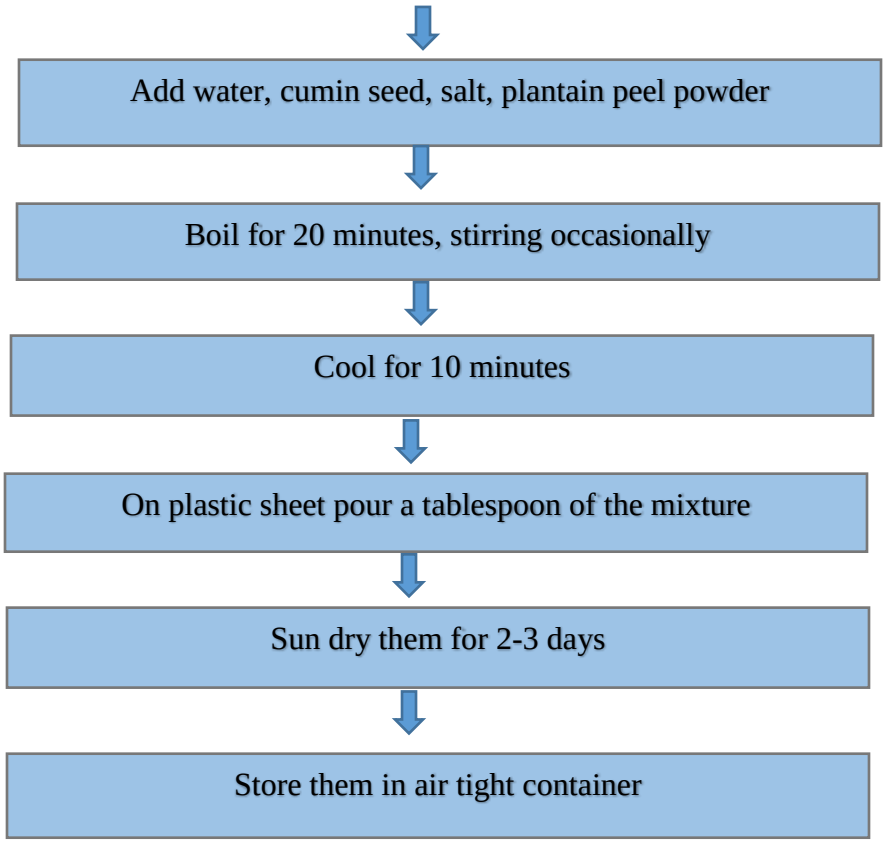


Figure 3 schematic representation of preparation of sago plantain peel papads

BEFORE FRYING

Plate1: sago papad **plate2 : A1 papad** **plate3 : A2 papad** **plate4 : A3 papad**

AFTER FRYING




Plate 5: sago papad plate 6: A1 papad plate 7: A2 papad plate 8: A3 papad

3.2.5 Sensory evaluation of sago plantain peel papads

A sensory evaluation of three variations of papads was carried out. The papads were rated on 5-point hedonic scale by 50 panel members. The panel members were selected by random sampling. Out of the three papads, the most acceptable papads was subjected to nutritional analysis. The sample were coded by a random three-digit number and presented in containers. The papads were rated from 5 to 1, keeping 5 for like a lot and 1 for dislike a lot as per the method given in (PDST, sensory analysis teachers manual, Dublin,2017).

The scores were assigned as follows:

5-like a lot

4-like a little

3-neither like nor dislike

2-dislike a little

1-dislike a lot

3.2.6 PROXIMATE ANALYSIS

3.2.6.1 Estimation of moisture content (AOAC,2000)

Empty petri dish and lid were dried in the oven at 105℃ for 3 hours and transferred to desiccator to cool. Weight of empty dish and lid was noted about 3 grams of the sample was weighed in the dish. The dish was placed in the oven at 105℃ for 3 hours. After drying, the petri dish cooled in the desiccator. The dish containing the dried sample was reweighed.

Calculation:

$$\text{Moisture (\%)} = \frac{W1-W2}{W2} \times 100$$

Where,

W1 = weight (g) of the sample before drying

W2 = weight (g) of the sample after drying

3.2.6.2 Estimation of crude fiber (Raghuramulu et al., 2003)

2g of the sample was weighed in a 500ml conical flask. 200ml of 0.255N sulphuric acid was added and heated gently on a hot plate and boiled for exactly 30 minutes. The mixture was filtered in another conical flask through a muslin cloth over a funnel. The residue on the cloth was washed with 200-300ml of hot water until it was free from acid. The material was transferred from the cloth to the same beaker. 200ml of 0.313N sodium hydroxide was added and was boiled exactly for 30 minutes. The mixture was filtered through the same cloth through a funnel. The residue was washed with 200-300ml of hot water until it was free from alkali. The residue was transferred to a crucible and was heated at 150-200ºC in a hot air oven for a minimum of 4 hours. It was cooled and weighed. The crucible was heated in a muffle furnace at 600ºC for 30 minutes. It was cooled and weighed.

Calculation:

$$\text{Crude fiber (g/100g sample)} = \frac{\textit{weight of the crucible with contents before ashing} - \textit{weight of the crucible with contents after ashing}}{\textit{sample weight (grams)}}$$

3.2.6.3 Estimation of folic acid

The food sample for estimation of folic acid was outsourced to the Mangalore biotech laboratory for estimation as per AOAC 2000 method.

3.2.7 Shelf life study

3.2.7.1. Sensory evaluation

The food product was subjected to sensory evaluation using 9-point hedonic scale rating on the overall acceptability for the time period of 4 days with 4 sessions of analysis on day 1^{st} day, 1^{st} month, 2^{nd} month, 3^{rd} month.

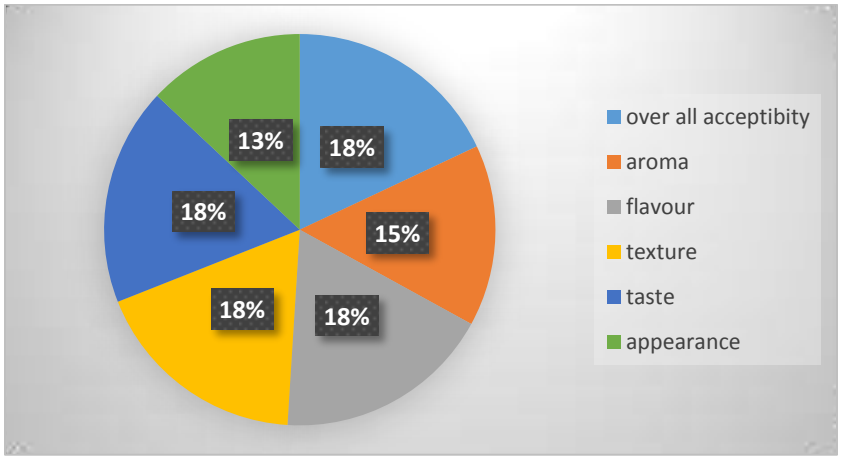
Chapter 4 RESULT AND DISCUSSION

The section depicts the outcome and results of the methods that were used for development and quality evaluation of the sago-plantain peel papad. Based on the sensory evaluation the formulation A2 was selected, which was subjected to proximate analysis and shelf life study.

4.0 Result and discussion

4.1 Sensory evaluation of sago-plantain peel papads

Sensory evaluation is a process whereby; the quality of food is judged by a panel of judges. When a product is developed for the consumers from the viewpoint of health, one must make sure that the taste and other characteristics of the food are also well accepted by the consumers. Only then, will people choose a healthy product over any other unhealthy food. The color, taste, texture, flavor etc., are some of the factors that determine the overall acceptability of the product. The panel members were asked to taste each burfi and rate the overall acceptability. The overall acceptability was rated on a 5-point hedonic scale.



4.2 PROXIMATE ANALYSIS

Table 3

Parameter	Control papads (100grams)	A2 papads (100 grams)
Moisture(g)	2.5	2
Crude fibre(g)	0.5	58.98
Folic acid(mg)	0	33.12

The proximate analysis of both the control and A2 papads was conducted table 3gives a comparative picture of the nutritional composition of both the control and A2 papads contained higher amount of fiber and folic acid. Crude fiber content of the A2 papads (58.98g) was much higher as that of control sago

papads (0.5g). Folic acid content of the A2 papads (33.12mg) was higher than the control sago papads (0.0g). The moisture content on the other hand, was seen to be 2.5g in control, 2g in A2 papads.

4.3 shelf life study

Each product has a shelf life. Shelf life study is an important aspect of product development. Shelf life was determined based on sensory evaluation and microbial testing.

4.3.1 Sensory evaluation

The sensory attributes have a profound effect on consumer's preference. Different food products undergo deterioration in sensory profile because of various chemical and biochemical changes that progress during storage. Sensory evaluation was conducted on a 9point hedonic scale rating. The papads was evaluated for its appearance, color, texture, aroma, taste, and overall acceptability every alternate day (1^{st} day, 1^{st} month, 2^{nd} month, 3^{rd} month). Both the papads had a shelf life of 3 months. For the first month, 2^{nd} month there is no changes seen, by the third month also no changes seen in the papads.

Chapter 5 Summary and conclusion

This section gives an insight into the outcome of this study. Sago-plantain peel papads was rich in fiber and folic acid when compared to the normal sago papads.

5.1 SUMMARY

- The project endeavored to formulate a unique combination of sago, plantain peel and sorghum the aim of providing a comparative study of the normal sago papads and sago papads enriched with plantain peel.
- Three different formulation of papads were developed by incorporating plantain peel in varying level namely A1 with 5% of plantain peel powder, A2 with 10% of plantain peel powder, A3 with 15% of plantain peel powder.
- Sensory evaluation was done for all the three formulation of papads, in which A2 was further subjected to nutritional analysis and shelf life study.
- Along with A2 papads, the proximate analysis and shelf study of control papads was done. The papads which served as control is the sago papads.
- Nutritional analysis of both papads revealed that the A2 papads had higher amount of crude fiber and folic acid than the control papads.
- Sensory evaluation showed that both the papads had a shelf life of 3 months. Though the control papads had higher rating in all characteristics when compared to A2 papads, both had sensory rating with in the acceptable range.

5.2 CONCLUSION

The study intended to develop a comparative study of normal sago papads and sago and sago papads enriched with plantain peel. The nutritional analysis revealed that the A2 10% of plantain peel powder added papads had good amount of crude fiber, folic acid compared to the normal sago papads. This work has got satisfactory results in developing a nutritionally enriched and palatably accepted papads using plantain peel. Both ingredients are inexpensive and available all year round.

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APPENDIX

APPENDIX -1

SENSORY EVALUATION OF PAPAD USING 5-POINT HEDONIC SCALE

NAME: _____

AGE: _____

Taste each of the following samples and tick how much you like it or dislike it.

	CONTROL	A1	A2	A3
Like a lot				
Like a little				
Neither like nor dislike				
Dislike a little				
Dislike a lot				

SIGNATURE: _____

<u>Paired preference test to choose the best papads.</u>

Name: _____ Date: _____ Rinse your mouth before starting the test.

Taste at least half of both the samples A2 and A3 given, you may drink water after tasting each sample. Re -tasting is not allowed.

Circle the best sample you liked out of the two on the basis of overall acceptability

A2 *A3*

Answer these questions considering the Papads you preferred;

1. Did you like the product?

Yes☐ No☐

2.What quality did you like the most?

Appearance ☐ Taste ☐

Flavour☐ Texture☐ Aroma☐ Overall ☐

3.Would you like to buy this product if it is introduced in the market?

Yes ☐ No☐

4. Would you recommend people to buy this product?

Yes ☐ No ☐

If the product is cost-effective then

how frequently would you purchase this product?

Weekly Once in 15 Days ☐ Monthly ☐

5.If the size of the papads is increased, how many Papads would you consume at one time?

Yes ☐ No ☐

7.Could you make out that the Papads was make from Sabudana and plantain peel?

Yes ☐ No ☐

If yes, based on what did you recognize _____

8. Did you feel that the bland taste of Sabudana improved in the form of Papads?

Yes ☐ No ☐

9. Do you think that this Papads would be liked by all age group?

Yes ☐ No ☐

10.whole what did you feel about the product?

Very Good☐ Good ☐ Average Bad ☐ Very Bad☐

APPENDIX-2

Shelf life Study of papads Using 9 Point Hedonic Scale Rating

Taste the sample given and rate it from 9 to 1 based on your preference for the particular characteristics mentioned below;

9-Like Extremely
8-Like Very Much 7-Like Moderately
6-Like Slightly,
5-Neither Like nor Dislike
4-Dislike Slightly
3-Dislike Moderately 2-Dislike Very Much
1-Dislike Extremely

Sensory characteristics	1st day	1st month	2nd month	3rd month
Appearance				
Colour				
Texture				
Taste				
Aroma				
Overall acceptability				

APPENDIX-3

Reagents used and preparation:

1. ESTIMATION OF CRUDE FIBER:

- 0.255N Sulphuric acid:

7ml of concentrated sulphuric acid was dissolved in one-liter distilled water in a standard flask.

- 0.313N sodium hydroxide:

12.78g of sodium hydroxide was dissolved and made up to mark with distilled water in a one-liter standard flask.

- Distilled water