"STUDY ON DEVELOPMENT OF MORINGA LEAVES POWDER AND SORGHUM BASED PEDA"

Dissertation submitted to Mahatma Gandhi University in partial fulfilment of the requirement for the award of degree of

Bachelor of Vocational Studies

B. Voc Food Processing Technology

BY

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ST . TERESA'S COLLEGE (AUTONOMUS),ERNAKULAM

COLLEGE WITH POTENTIAL FOR EXCELLENCE

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DECLARATION

We, **Ceyona Victor** (VB21FPT005), **Nandana Rajan** (VB21FPT012), and **Saumya Saj** (VB21FPT018) hereby declare that this project entitled "Development and analysis of Moringa leaves powder and Sorghum based Peda" is a bona fide record of the project work done by us during the course of study and that the report has not previously formed the basis for the award to us for any degree, diploma, fellowship, or other designation from any other college or organisation.

Date :

Place : Ernakulam

Ceyona Victor

Nandana Rajan

Saumya saj

CERTIFICATE

This is to certify that the project report entitled "Development and analysis of Moringa leaves powder and Sorghum based Peda" submitted in partial fulfilment of the requirements for the award of the degree of B.Voc Food Processing Technology to St. Teresa's College, Ernakulam, is a record of bona fide research work carried out by Ms. Ceyona Victor, Ms. Nandana Rajan and Ms. Saumya Saj under my guidance and supervision, that no part of the project has been submitted for the award of my other degree diploma fellowship or other similar titles or prize and that the work has not been published in part or full in any scientific or popular journal or magazine.

Head of The Department

Er. BHAVYA E.P
Project Guide

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B.Voc Food Processing Technology

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ABSTRACT

In the current scenario, demand for instant and convenient foods is exponentially increasing. Peda, a milk-based concentrated sweet, is gaining the attention of consumers with sedentary lifestyles. Additionally, the number of people with nutrition deficiencies is also increasing. Therefore, a ready-to-eat meal with the title “Development of Moringa leaves Sorghum Peda“ with improvised nutrition has been studied here. The study was carried out to prepare peda with nutritional value from Moringa leaves, sorghum, khoa, and jaggery. The main reason for choosing these ingredients is to increase the iron content in the anaemic patient's body. In this process, moringa leaves are dried and ground to produce moringa leaf powder, and sorghum is roasted and ground to produce sorghum powder. Then milk is concentrated to produce khoa and mixed with moringa leaf powder , sorghum powder and jiggery syrup to produce peda. Standardisation of moringa leaves powder to sorghum powder percentage were done in different ratios like S1 (50% + 50%), S2(60% + 40%) and S3 (40% + 60%). Based on the ratios 3 different variations of the peda were produced and their appearance ,flavour , texture ,taste and overall acceptability was evaluated to determine the most favourable combination . From the evaluation, the optimal ratio was found in sample 1, with a ratio of 50:50.

Proximate analysis resulted in good levels of fat, protein, vitamin, and iron in the final product. The shelf life of the refrigerated peda was longer compared (7 days) to those stored at room temperature, which showed signs of spoilage within the first 3 days. The results suggest that peda developed with moringa leaves and sorghum can be a good source of iron, providing opportunities for the food sector.

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Chapter-1

TERMINOLOGY

ABBREVIATION	TERMS
m	Meter
%	Percentage
et al	And Others
g	Gram
i.e.	That is
mg	Milligram
cfu	colony-forming units
IU	International Unit
Hrs	Hours
mg/100	Milligram per 100 gram
^{o}C	Degree Celsius

Chapter -2

INTRODUCTION

2.1 DRUMSTICK LEAVES

The Moringa oleifera Lam, also known as Moringa pterygosperm a Gaertner, is a member of the onogeneric Moringaceae family of shrubs and trees. It is said to have originated in Agra and Oudh, in the northwest of India, south of the Himalayan Mountains. Evidence suggests that this tree has been cultivated in India for thousands of years, as mentioned in the "Shushruta Sanhita," which was composed at the start of the first century A.D.

The Indians used the seeds for medicinal purposes since they were aware that they contained edible oil. It's likely that the locals were aware of its benefits as a vegetable or fodder as well. This tree was discovered to be expanding in a natural state up to 1,000 metres above sea level. Although it grows well on hillsides, pastureland, and river basins where it is most commonly found, this tree grows quickly in places with less than 40 mm of mean annual rainfall and has been observed to reach heights of 6 to 7 m in a single year. (Odee, 1998).

Many local names for this tree exist in the Dravidian language, but they are all derived from the generic root "Morunga." Only the names Horseradish Tree, Drum Stick Tree, Never Die Tree, West Indian Ben Tree, and Radish Tree are commonly used in English (Ramachandran et al., 1980).

Nowadays, it's grown across the Middle East and pretty much the entire tropical belt. It was brought from India to eastern Africa around the start of the 20th century. Moringa oleifera, known locally as Marango, was brought to Nicaragua in the 1920s as an ornamental shrub and as a live fence. Although it may be found in forest inventories around the nation, the tree grows best and is primarily found in Nicaragua's Pacific region. It is well-known for its tolerance to illnesses and droughts because it is an uncultivated plant.

Among the most beneficial tropical trees is the moringa. Its production and management are made simple by the relative simplicity with which it propagates through both sexual and asexual means, as well as by its low requirement for soil nutrients and water after planting. It can be advantageous for the farm's owner as well as the local ecosystem to introduce this plant into a biodiverse farm setting.

Compared to many other plant species, Moringa oleifira quantitatively offers more nutrients per gram of plant material in relation to human micronutrient and macronutrient demands. It offers more than seven to nine times the protein in yoghurt, fifteen times the potassium in bananas, twenty-five times the iron in spinach, ten times the vitamin A in carrots, seventeen times the calcium in milk, and nine

times the vitamin C in oranges (Fahey 2005; Fuglie 2000; Gopalan et al; 1998; Rockwood et al., 2003).

For nutrition and healing, moringa offers a unique and rich blend of minerals, amino acids, antioxidants, anti-ageing, and anti-inflammatory qualities. Moringa is sometimes referred to as the "Miracle Tree" and "Mothers' Best Friend." Since 1998, the World Health Organisation has endorsed moringa as a treatment for malnutrition that can replace imported food supplies (Manzoor et al., 2007; Sreelatha and Padma, 2005). (Joshi, P. & Mehta, 2010).

NUTRIENTS	NUTRITIONAL VALUES	% of RDA
Energy(Kcal)	64	
Protein(g)	9.4	17%
Carbohydrate(g)	8.28	6%
Fat(g)	1.7	1.4%
Fibre(g)	2	5%
Iron(mg)	4	50%
Phosphorous(mg)	112	16%
Calcium(mg)	185	18.5%

Table 2.1 USDA Nutrition database

2.2 SORGHUM

Sorghum bicolor L. is the scientific name for this adaptable crop that belongs to the Poaceae family and has a high carbohydrate content. It is among the primary foods consumed by Africans. One significant dry land crop that is grown on marginal soils is sorghum. In addition to providing food, these self-pollinating crops have high photosynthetic efficiency and a high resistance to abiotic stress.

They are also a source of feed fodder. This crop goes by several names, including Great Millet, Broomcone, Dura, and Milo. Sorghum is referred to as "The King of Millet" and Jowar in India. It can be used for a number of specialised uses, including flavourings, chewing, roasting, and malting. It is abundant in vitamins, minerals, dietary fibre, protein, and calories.

Like maize, sorghum does not have a true hull or husk because of its similarity to maize (hard and floury endosperm and large fat-rich germ). The technologies of dry and wet milling applied to maize can also be used to process sorghum. (Mbulwe et al., 2020). In Africa, it is generally cultivated by small farmers and consumed locally where it was grown. The scarcity of commercially accessible meals, such as breads, cereals, flours, and other products, has limited consumption for those who are not farmers and cannot spend their time to manufacture flour from sorghum grain. (Lindsay 2010)

A great progress has been achieved in the field of sorghum biotechnology, including genomics over the last two decades. Adoption of genomic tools and molecular breeding strategies can help in tailoring sorghum cultivators with desired traits to enhance productivity under various limiting factors in the years to come.

NUTRIENTS	NUTRIENT VALUE	% RDA
Energy (kcal)	632	
Fat (g)	6.6	8 %
Carbohydrate (g)	138	50%
Dietary Fibre(g)	13	46 %
Protein (g)	20	40 %
Ash (g)	2.75	

Table 2.2 https://www.nutritionvalue.org/categories_in_standard_reference_foods.html

2.3 MILK

Milk is an opaque fluid that female mammals' mammary glands generate, store, and release, mostly for nursing their young ones. It provides all the nutrients needed for a mammal's survival and growth, up to weaning.

The practice of humans frequently consuming the milk of other mammals began during the Neolithic period. Starting in Mesopotamia about 9000–7000 BC and continuing until 3500–3000 BC in America, this development happened independently in many different parts of the globe. . Cattle, sheep, and goats are the three most important dairy animals that humans initially domesticated in Southwest Asia.. Approximately from 7000 BC, the introduction of domestic dairy animals from Southwest Asia to Europe started (Lambrini et al., 2021).

In 2023, the EU was the world's largest producer of cow's milk. The 27 countries that are part of the European Union generated almost 143 million metric tonnes of cow milk in that year. The United States was ranked second, with a manufacturing volume of nearly 104 million metric tonnes. Global milk production has increased considerably during the last 50 years. According to Our World in Data, global milk production has nearly tripled since 1961, with an expected value of 918 million metric tonnes in 2021.

As we know, milk is the liquid secreted by the mammary glands of mammals. Cow milk consists of 87% water, 3.7% fat, 4.9% lactose, 3.5% protein, 0.7% vitamins, and other minor components. In addition to its primary ingredients, it contains hundreds of other constituents at lesser concentrations, including enzymes, dissolved gases, and other lipids, which define its biological capabilities. Milk

proteins present in the milk are casein (αS1-Casein,αS2-Casein,β-Casein,κ-casein), followed by vitamins (A,B1, B2,C,D), minerals (calcium, magnesium, and potassium), and enzymes (catalase, phosphatase, and lipase) (Lambrini et al., 2021).

Milk can be consumed in different forms; some of them are fresh milk, pasteurised milk, condensed milk, sugar milk, sterilised milk, powdered milk, etc. Other products obtained from milk are paneer, yoghurt, butter,cheese, khoa,curd , hee, cream, etc.

NUTRIENTS	NUTRIENT VALUE	% OF RDA
Energy(Kcal	64	
Carbohydrates(g)	4.65	3.5%
Protein (g)	3.28	6%
Total Fat(g)	3.66	18%
Vitamins(mg)	1.9	2%
Minerals(mg)	132	12%

Table 2.3 (Source: USDA National Nutrient data base)

2.4 JAGGERY

Jaggery, also known as Gur, is a substance made by condensing the sweet fluids of sugarcane or palm trees into a solid or semi-solid condition. It is appropriate for a plethora of desserts that are well-known throughout the world. People prefer it over white sugar because of its distinct qualities when making several sweet foods. In accordance with FSSAI (2018), "jaggery, or gur, refers to the product that is made by processing or boiling juice that is extracted from palmyra, date, or coconut palms, or that is pressed out of sugarcane.". Its flavour and aroma are sweet and winy, and it's a natural sweetener. It's a flavorful blend that is tasty and reminiscent of molasses and brown sugar.

Proteins, minerals, and vitamins can be found in jaggery. It contains more iron and copper than refined sugar, making it a powerful source of iron as well.

Regarding vitamin content, it is also a better product in the natural sweetener category. It is an energy food that is supposed to maintain bodily health, control liver function, and purify blood. It is a type of sugar that creates an essential component of the diet that can be eaten on its own or used as a sweetener in baked goods.

Commonly referred to as "medicinal sugar," jaggery is used in pharmaceutical formulations and may lengthen human life expectancy when consumed regularly. . (Hirpara et al., 2020).

Jaggery has a high phenol content and is rich in minerals. Numerous writers have detailed the health advantages of jaggery in literature, including how it enhances digestion, aids in liver cleansing, eases constipation, increases energy, purifies the blood, has anti-toxic and anti-carcinogenic qualities, eases tension, relieves lung infections, and has antioxidant activity.

India is the world's biggest producer and user of jaggery. In comparison to global jaggery output, over 70% of it is produced in India. November through April are the months when jaggery is primarily produced. Of all the jaggery produced in India, sixty-five sugarcane accounts for 70% of the manufacturing process, with the remainder coming from other crops.

About 80–90% of the jaggery produced in India comes from the major sugarcane-producing states of Karnataka, Maharashtra, Tamil Nadu, Uttar Pradesh, and Andhra Pradesh. (Hirpara et al., 2020).

A jaggery of superior grade has a golden yellow colour, a firm texture, a crystalline structure, a sweeter flavour, and less moisture. Granules, liquids, and solid forms are all possible for jaggery. Present-day producers produce organic jaggery devoid of chemicals such as sodium bicarbonate, sulphur dioxide, citric acid, alum, etc. Jaggery is sometimes referred to as "medicinal sugar" and is used in drug compositions. (Hirpara et al., 2020).

NUTRIENTS	NUTRIENT VALUE
Energy (kcal)	375
Carbohydrate(g)	92.86
Calcium(mg)	29
Iron(mg)	2.57

Table 2..4 (Source: USDA National Nutrient data base)

2.5 GHEE

Ghee is mainly produced by indigenous methods in Asia, the Middle East, and Africa, and the method of manufacture may vary. In India, heat is the primary method used to preserve milk and milk products.(Ganguli et al., 1973)

Ghee is obtained by clarification of milk fat at high temperature; it is used in ayurvedic as well as therapeutic agents and also for religious rituals. It has many nutritional attributes and characteristic flavours and aromas. Due to its low moisture level and potential natural antioxidant components, it has an appropriate level of shelf stability. (Kumar et al., 2018)

The majority of consumers agree that ghee is a better fat for human consumption than other fats, primarily due to the presence of short-chain fatty acids, which are responsible for its better digestibility and anti-cancer properties. (Kumar et al., 2018) Ghee is also an important carrier

of fat-soluble vitamins (A, D, E, and K) and essential fatty acids, apart from having rich and pleasant sensory properties.

Ghee is thought to be a coolant that can boost mental power, improve physical appearance, and treat ulcers and eye ailments. (Kumar et al., 2018) However, there have also been reports that it might contain certain levels of cholesterol oxidation compounds (COPS) in particular circumstances, which could have a negative impact on health. (Serunjogi et al., 1998)

NUTRIENTS	**NUTRIENT VALUE**	**% Daily Value**
Energy (cal)	900	
Total Fat (g)	100	128
Saturated Fat (g)	60	300
Cholesterol (mg)	300	100
Polyunsaturated fatty acids (g)	4	

Table 2.5 USDA Standard reference

Chapter – 3

RELEVANCE OF STUDY AND OBJECTIVE

3.1 RELEVANCE OF STUDY

It is estimated that around 40% of children below 5 years, 37% of pregnant women, and 30% of women below 49 years of age worldwide are anaemic. In order to prevent anaemia, various steps have been taken by different government agencies, like creating nutritional awareness, promoting iron-fortified and enriched foods, and providing iron and folic acid tablets, etc. Moringa leaf powder and sorghum are highly nutrient-dense foods that are rich in vitamins and minerals, amino acids, and antioxidants. By doing this study, we aim to develop a peda that can provide iron to anaemic people and can effectively replace normal sweets.

3.2 OBJECTIVES

- To develop peda from moringa leaves powder and sorghum
- To ascertain the sensory properties of the developed peda
- To study the nutrient quality of the developed peda

Chapter -4

REVIEW OF LITERATURE

4.1 HEALTH BENEFITS OF MORINGA

The presence of numerous vital phytochemicals in the leaves, pods, and seeds of moringa plants makes them high in nutrients. Moringa is actually claimed to have seven times the amount of vitamin C as oranges, ten times the amount of vitamin A as carrots, seventeen times the amount of calcium as milk, nine times the amount of protein as yoghurt, fifteen times the amount of potassium as bananas, and twenty-five times the amount of iron as spinach.

With more protein than eggs, more iron than spinach, more vitamin A than carrots, and more calcium than milk, the tiny leaves of Moringa are a nutritious powerhouse. In addition to its potential applications in pharmacology and cosmetics (seed oils for hair and skin care), the moringa plant is considered a good source of energy. Minerals and vitamins abound in moringa seeds.

In addition to having antimicrobial properties, seed extracts are used to cleanse water. Moringa seeds were shown in numerous studies to have anti-inflammatory, anti-oxidative stress, anti-blood sugar, and anti-blood pressure properties. Because of its superior nutritional value, those experiencing poverty and malnutrition discovered that moringa is a super food.

Moringa leaves are rich in important nutrients, including protein, vitamin C, calcium, iron, ascorbic acid, and antioxidants (phenols, carotenoids, and flavonoids). Children are fed moringa in several undeveloped or underdeveloped nations across the world.

The leaf powder of Moringa oleifera obtained without treatment at a dehydration temperature of 60°C further enhances fractionation, and the fine fraction may be regarded as a crucial functional and ideal biomaterial to be utilised in the meal that is high in healing properties. (Kashyap et al., 2022).

Fresh leaves contain a sizable amount of carotenoids, including trans-lutein (about 30%), trans-b-carotene (about 18%), and trans-zeaxanthin (about 6%). Leaves contain good levels of carotenoids as well as tocopherol (36.9 mg/100 g) and ascorbic acid (271 mg/100 g). A trace number of anti-nutrients, such as phytates, saponins, tannins, and oxalates, are also included in Moringa oleifera's nutritional composition. They are neither poisonous nor harmful. High doses of them have the potential to obstruct the absorption and digestion of several supplements, including calcium, magnesium, iron, zinc, and so forth. Compared to other legumes like soybeans, it has fewer phytates and saponins in its seeds and leaves. Because of this, leaves are thought to be a safer and healthier food to eat. **(**Kashyap et al., 2022).

4.2 HEALTH BENEFITS OF SORGHUM

Nutrient-dense sorghum grain contains phenolic chemicals that are good for your health. Compared to other common cereal grains, sorghum has a phenolic profile that is remarkably distinct, plentiful, and complex. The primary constituents of sorghum's phenolic compounds are condensed tannins, 3-deoxyanthocyanidins, and phenolic acids. Sorghum whole grain diet may enhance gut health and lower the risk of chronic diseases, according to studies that demonstrate the strong antioxidant activity of sorghum phenolic compounds in vitro. Grain sorghum has been utilised recently to create functional foods and drinks as well as an ingredient added to other foods. Additionally, it is possible to separate the phenolic compounds, condensed tannins, and 3-deoxyanthocyanidins and employ them as natural multifunctional additives with promising results in a variety of food applications.(Yun Xiong et al., 2019)

Sorgo refers to the sweet, juicy stem varieties that are utilised to obtain syrup. The main issues with utilising sorghum grains for human consumption are their tannin content, anti-nutritional polyphenol content, and lack of appropriate milling techniques. The availability of protein and other nutrients in sorghum grains is decreased by the tannins and other polyphenolic substances. The milling yield of sorghum grains ground using a wheat milling process is decreased. Sorghum endosperm in large quantities ends up in short fractions. The bioavailability of protein and other nutrients in sorghum grains is decreased by the presence of tannins and other polyphenolic substances. The bioavailability

of protein and other nutrients in sorghum grains is decreased by the presence of tannins and other polyphenolic substances.(Moharram et al., 1995)

4.3 HEALTH BENEFITS OF MILK

As we all know, milk is regarded as "the most ideal food found in nature" because it contains important nutrients such as protein (which builds and repairs muscle tissue and serves as a source of energy), vitamin D (which stimulates the synthesis of calcium and strengthens bones), calcium (which promotes the development and maintenance of strong teeth and bones), potassium (which helps regulate the body's fluid balance and maintain normal blood pressure), and phosphorus (which helps to strengthen bones and generate energy in the body's cells), all of which work together to keep the human body healthy. Other than the above nutrients, it also contains casein, a protein found only in milk that contains all of the essential amino acids and accounts for 82% of the total proteins in milk. Additionally, milk contains a substantial amount of riboflavin, or vitamin B2, which supports good skin and eyes. Apart from the nutritional benefits of milk, it has been shown that physiologically active components contained in milk, like whey and casein proteins, are becoming more and more significant for physiological and biochemical processes that are vital to human health and metabolism. (Patil etal;2015)

Extended heating of milk during the preparation of plain peda causes significant browning and nutritional quality loss. Reverse osmosis (RO) technology was used by (Dewani P et al., 2006) to solve this issue. The method of producing peda using vacuum evaporation and RO pre-concentrated milk was optimised. Using a single-effect vacuum evaporator, the milk was first standardised to include 5% milk fat and 8.5% MSNF. It was then heated to 90°C/10 minutes, pre-concentrated to 30% total solids (TS) by RO, and then concentrated to 40% TS at 54–56°C. A vacuum of 630 mm of Hg was obtained. To make peda, this condensed milk was used. According to reports, the peda made using RO pre-concentrated milk showed a noticeable improvement in body, texture, colour, and look. (Dhariya et al., 2019)

4.4 HEALTH BENEFITS OF GHEE

One of the complicated types of lipids found in nature is milk fat. Ghee, often called anhydrous milk fat or clarified butter fat, is processed milk fat. It is mostly made up of glycerides (which are typically mixed), with trace amounts of free fatty acids, phospholipids, cholesterols, sterol esters, fat-soluble vitamins, carbonyls, hydrocarbons, and carotenoids (found solely in cow's milk fat) also present. (Kumar et al., 2018)

In addition, it has trace levels of iron, calcium, phosphorus, and burned casein. Ghee mostly consists of glycerides, making up around 98% of its overall composition, with very little moisture content (0.3%). About 0.5% of the remaining ingredients are primarily cholesterol, or 2% of the total. Conjugated linoleic acid, which has been shown to have anti-cancer properties, may also be present in good amounts in ghee. (Kumar et al., 2018)

Adding a delightful taste to food and promoting health are two reasons why ghee is an essential cooking medium. Among Indian homes, it continues to be the most preferred fat or oil when compared to other options. Several reliable brands, such as Gowardhan, Anik, Milkfood, Madhusudhan, Verka, Amul, Healthhaid, Gopaljee, Nestle Everyday, Patanjali, and Britannia, occupy a significant portion of the market.

Along with vital fatty acids like arachidonic acid and linolenic acid, which are linked to wellness, it is an excellent source of fat-soluble vitamins A, D, E, and K. The only thing about ghee that has to be worried about is its low (0.2–0.4%) cholesterol content, which, when ingested in large quantities, contributes significantly to cholesterol consumption. Consumer awareness of meals high in cholesterol has increased recently, which had an impact on the applications and market expansion of these goods (Kumar et al., 2010).

4.5 HEALTH BENEFITS OF JAGGERY

Jaggery (Gur) is produced by concentrating the sweet fluids of palm trees or sugarcane into a solid or semi-solid form. It contains nutrients like protein and vitamins and is a potent source of minerals like iron and copper. Other than its nutritional properties, it serves as an energy source with therapeutic benefits, including blood cleansing, liver function, and blood health maintenance. It also has numerous health benefits, including improved digestion, liver cleansing, constipation relief, increased energy, blood purification, anti-toxic and anti-carcinogenic characteristics, stress relief, treatment of bronchial or lung infections, and pre-menstrual syndrome. Since jaggery has many health and therapeutic benefits, it is also known as'medicinal sugar’.

Investigation of the physico-chemical characterization of jaggery from different sugarcane varieties; The current study aimed to investigate the physical and chemical properties of jaggery produced from the sugarcane types Co 86032, Co 419, and Co 62175. These sugarcane varieties have dominated peninsular India because of their many features, which include yield, sucrose content, disease resistance, and salt tolerance. The experimental production of jaggery from three different sugarcane cultivars (Co 86032, Co 419, and Co62175) was examined in this paper, along with its

physical and chemical properties. (Singh et al., 2022). We also tested a number of other variables, including transmittance at 720 nm, moisture, water activity (aw), ash, minerals, reducing sugars, sucrose, pH, colour, and filterability. Additionally, flavonoid and total phenolic content were also measured. According to the result, Sample Co 62175 had the highest observed total sugar level, whereas Sample Co 419 had the lowest, and sugarcane variation Co62175 generates the best jaggery when compared to sugarcane variants Co 419 and Co86032 (Singh et al., 2022).

4.6 VALUE ADDED PRODUCTS

4.6.1 DRUMSTICK LEAVES

Plants of the Moringa oleifera Lam (Moringaceae) family are highly nutritious and therapeutic. The leaves are abundant in proteins, flavonoids, phenolic components, and other vital phytochemicals, as well as minerals like calcium, potassium, iron, and others, and vitamins like β-carotene and ascorbic acid. In addition to being utilised as a malnutrition treatment, the leaf extracts have potential antibacterial, antioxidant, anticancer, and anti-inflammatory properties.

A. **INSTANT MORINGA IDLY MIX** : It is being developed as a value-added product because of its extensive variety of nutritional qualities. The current investigation was carried out to examine the physiochemical characteristics and nutritional value of supplementing with moringa leaf powder. Moringa leaf powder was added to an instant moringa idly mix in three different proportions—5%, 10%, and 15%—and the results were assessed organoleptically and physiochemically in relation to control samples. As a result, the product containing 10% more moringa leaf powder was approved, receiving sensory evaluation ratings between 8.0 and 8.5 and having a higher nutritional value than moringa alone.(Reddy et al ; 2020)

B. **CRACKERS** : Types of recommended crackers were made with a continuous level of formula made from moringa leaves powder at replacement levels of 2.5, 5.0, and 7.5% from whole meal barley flour or maize flour with fragrant herbs (black cumin, cumin, or chili). The crackers that were created were assessed from a chemical, organoleptic, microbiological, and financial standpoint. The findings demonstrated that the highest values of protein, fat, ash, and crude fibre were found in all samples of crackers made with corn flour or whole meal barley flour combined with powdered moringa leaves at all levels. When compared to control crackers, they also had the highest concentrations of calcium, potassium, iron, zinc, and magnesium. In contrast to control crackers, all samples had the lowest values of total calories and total carbohydrates. Every cracker that was prepared and included moringa leaves at replacement levels of 2.5 and 5.0% was accepted (excellent).(Amer et al., 2015)

C. **MORINGA OLEFEIRA MUFFINS** : The study concentrated on using powdered dry moringa leaves powder in muffin batter to make moringa muffins. The majority of our calories come from bakery goods, which are significant staple foods in the majority of nations and civilizations. They also play a crucial role in a diet that is well-balanced diet . Muffins are one of the bakery treats that people of all ages like the most. Over time, the creation of functional muffins has become more popular. The current study was conducted to evaluate the feasibility of making an acceptable muffin with better nutrition by including powdered dried moringa leaves in order to reach a large consumer base. In addition to sensory evaluations (appearance, taste, aroma, and texture), experiments were carried out to measure the amount of protein and calcium present. Consequently, it was discovered that the protein and calcium content of the Moringa leaf muffins was higher than that of the standard sample. Based on their replies, the panellists found that the moringa-enriched muffin was preferred and accepted when compared to the standard muffin in terms of acceptance and preference. The moringa-enriched muffin's protein and calcium levels increased when moringa powder was added, according to nutrient analysis. It was allowed to use senses of smell, texture, appearance, and taste. (Harusekwi Julien et al ;2015)

D. **MORINGA LEAVES POWDER INCORPORATED CHOCOLATE** :. This study set out to evaluate the impact of powdered Moringa oleifera (Moringa) leaf on the antioxidant content and sensory attributes of chocolate. We looked at three formulations including different amounts of powdered moringa leaf (1, 3, and 5%). With the exception of taste, there is no discernible difference ($p < 0.05$) between the formulations according to the hedonic sensory test. When compared to the other formulations, chocolate with 5% moringa leaves had the highest total phenolic content and antioxidant activity. The addition of moringa leaves increased the average particle size of the chocolate while decreasing its hardness. The chocolate did not exhibit any bloom growth on its surface after 8 weeks of storage, but it was found that its hardness had decreased. Chocolate that has been infused with powdered moringa leaf has the potential to be healthy while retaining its excellent chocolate flavour. (Hamida et al ; 2021)

4.6.2 SORGHUM FLOUR

A. **SORGHUM WHEAT FLOUR COOKIES** : The purpose of the study was to assess the sensory properties and quality of cookies made with wheat (Triticum aestivum) and sorghum (Sorghum Vulgare) flour . The chemical, physical-chemical, and sensory characteristics of flours and cookies were examined and compared with wheat flour-made control cookies. Sorghum flour was made from whole sorghum grains and then mixed with 5-50% wheat flour. The study found that replacing wheat flour with sorghum flour considerably ($p < 0.05$)

enhanced the moisture, ash, crude fibre, protein, and fat content of the mixture. The sugar and starch content dropped as the sorghum flour substitute increased . (Samuel Ayofemi Olalekan Adeyeye ., 2016)).

B. **SORGHUM FLOUR NOODLES** : To improve its digestion, sorghum flour underwent fermentation using Lactobacillus plantarum, resulting in Modified Sorghum Flour (MOSOF). MOSOF cannot be used in place of wheat flour since it lacks gluten. The goal of this study was to determine the best MOSOF recipe to use in lieu of wheat flour for making dried noodles, as research on MOSOF substitution in dried noodle products is currently rare. The results showed that fermentation can raise the protein, starch, and moisture content of sorghum flour. Additionally, it was found that a 25% egg to 50% (wheat flour: MOSOF) ratio was the most effective treatment because it may enhance the elasticity (%), rehydration (%), ash (%), and moisture (%) of products made from dried noodles when compared to a 70:30 (wheat flour: MOSOF) ratio ($p<0.05$). (Anggreini et al., 2018)

C. **SORGHUM MALT-BASED WEANING FOOD** : Using sorghum malt, green gram malt, and sesame flour, an effort was made to create inexpensive, nutritious, but bulk-reduced weaning foods. The resulting formulations were assessed for their functional qualities, including colour, hot-paste and cold-paste viscosities, water absorption, particle size, and nutritive value in terms of calories, vitamin C, minerals, and lysine that were readily available. The components' particle sizes varied: sesame flour was significantly coarser and green gram malt was finer than sorghum malt. The particle size of the laboratory formulations was finer than that of the commercial sample. Compared to sorghum malt, green gram malt exhibited a reduced percentage of water dispersibility and a greater capacity for water absorption. Compared to the commercial sample, the experimental formulations exhibited larger percentages of dispersibility and lower capabilities for water absorption. (D. Kulkarni et al., 1991)

Chapter -5

METHOD AND METHODOLOGIES

5.1 INTRODUCTION

This chapter deals with materials and methodologies used for the development of moringa leaves powder and sorghum powder infused peda.

5.2 MATERIALS REQUIRED

1.Moringa Leaves Powder : Naturally dried and prepared from home

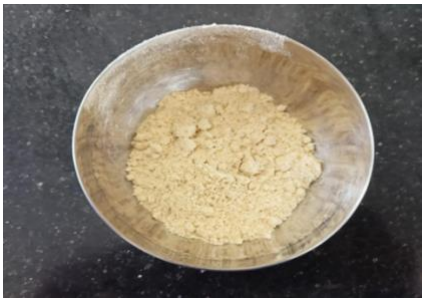
2.Sorghum Flour : Food Plus organics and millets

3.Ghee. : Purchased from Reliance Fresh

4.Jaggery. : Purchased from Reliance Fresh

5.Milk. : Purchased from Reliance Fresh

Ghee



Sorghum

Khoa

Jaggery syrup

Drumstick leaves Powder

5.3 EQUIPMENTS AND APPARATUS REQUIRED

1.Sauce Pan

2.Spatula

3.Moulds

4 weighing Machine

5 Grinders

6 Stove

Saucepan

Spatula

Mixer

Mould

Stove

Weighing Machine

5.4 PREPARATION OF PEDA

1.Selection of Raw Materials

Needed packets of milk was purchased from the local market having the required content of fat for the preparation of Khoa. Fresh moringa leaves were collected from the garden and was sundried appropriately and powdered. Sorghum flour was collected from the local market along with Ghee and Jaggery.

2.Preparation of Raw Materials

Moringa leaves: Moringa leaves were collected from the garden. They were sundried appropriately and ground into fine powders.

Sorghum Flour: Sorghum flour was bought from the market and ground to ensure that there is no lumps.

Jaggery syrup.: Required amount of jaggery powder is taken in sauce pan, mixed with water and brings to boil until it melts.

Khoa. : It is concentrated solid product obtained from milk. It is prepared by heating milk with 4.5% fat on a sauce pan in low flame until all the moisture is evaporated and it turns thick solid substance.

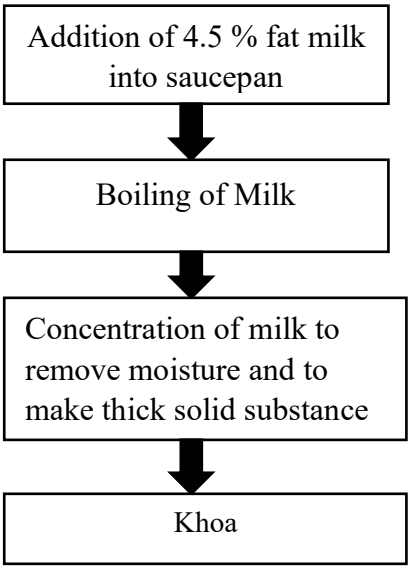
5.5 METHOD OF PREPARATION

Heat 1 tablespoon ghee in a sauce pan over medium heat. Add khoa and cook on medium flame for 3-4 minutes, while stirring continuously. Then add dried moringa powder ,sorghum powder and required amount of jaggery syrup to the khoa and mix it well. Cook for 3-4 minutes at medium heat, by stirring continuously. Remove from heat and let the mixture cool down for 2 minutes. Then make it into required shape using mould.

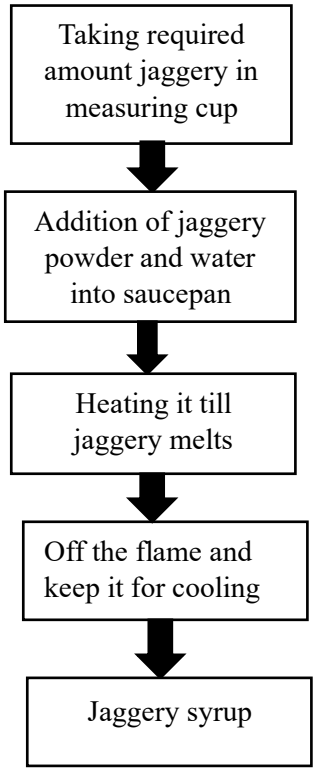
TREATMENT METHOD

SAMPLE	KHOA (g)	MURINGA POWDER (g)	SORGUM (g)	JAGGERY (g)	GHEE (g)
SAMPLE 1	50	6.25	6.25	8	4
SAMPLE 2	50	12.5	6.25	8	4
SAMPLE 3	50	6.25	12.5	8	4

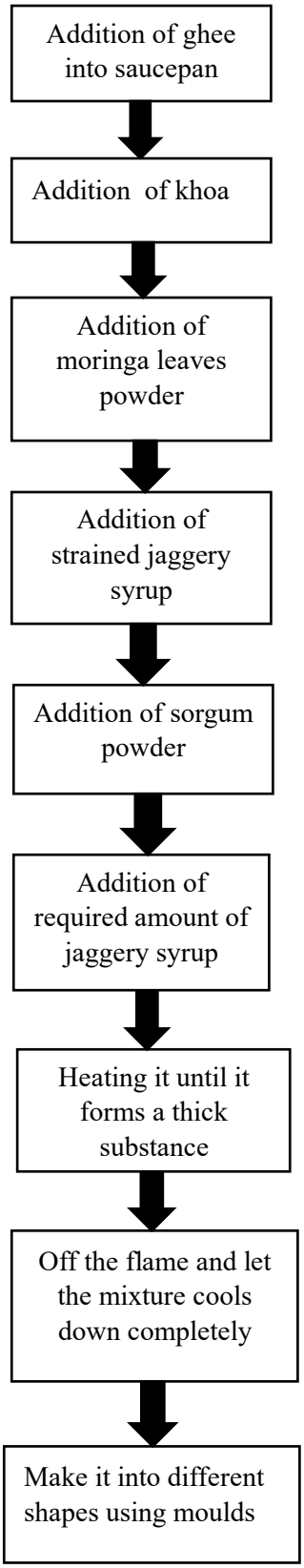
FLOW CHART OF KHOA

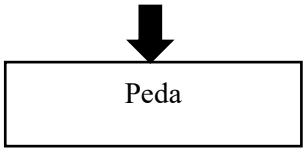


FLOW CHART OF JAGGERY SYRUP



FLOW CHART OF PEDA





5.6 SENSORY EVALUATION

Sensory evaluation of the peda were carried out by 11 panel members the sensory panel involved semi trained panellists . The evaluation was done for accessing various quality attributes such as aroma, appearance ,taste ,texture and overall acceptability .A separate score of 9 points was given to each attributes and end of the evaluation they will give comments for the product .

9 – point	Hedonic Scale
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

5.7 CHEMICAL AND MICROBIAL ANALYSIS

Methods for analysing various parameters of peda

5.7.1 DETERMINATION OF PROTEIN CONTENT

The determination of protein content in peda was done using AOAC method. In order to conduct this test 0.70 to 2.20g sample was weighed into a digestion flask. Then 0.7g HgO and 15g Na_2SO_4 were added. To this, 25 ml of sulphuric acid was poured .The flask was placed in an inclined position on a heater and heated gently until frothing ceased . The sample was boiled until it became clear. After this step, the sample was cooled and about 200 ml distilled water was added and again cooled to room temperature .To this, 25 ml Thiosulphate solution (8% in water) was added and mixed to precipitate mercury. To make a strong alkaline solution, sodium hydroxide was carefully added through the sides of the flask. The apparatus was assembled taking care that the tip of the

condenser extends below the surface of a known quantity of standard sulphuric acid. To this, 5-7 drops of methyl red indicator were added. After all these steps, the solution was heated immediately until all the ammonia had been distilled (150 ml). The receiver was lowered before stopping distillation and the tip of the condenser was washed with distilled water. It is titrated against standard sodium hydroxide solution. Finally, it was corrected for blank determination on reagents.

CALCULATION

$$\text{Nitrogen Content (N) in \%} = \frac{[(M\ \text{acid})(\text{ml acid}) - (\text{ml NaOH})(M\ \text{NaOH})] * 1400.67}{\text{Mg test portion wt}}$$

Where,

M acid = molarity of standard acid,

ml acid = volume in ml of acid used as trapping solution

M NaOH = molarity of standard base

ml NaOH =volume in ml of standard base used for titrating

5.7.2 DETERMINATION OF MOISTURE CONTENT

The determination of moisture content in peda was done using AOAC method. In order to determine moisture content weigh accurately about 5g of sample in a previously dried and weighed moisture dish. Dry in an oven at 105±2˚C, for 4hours. Cool the moisture dish in a desiccator and weigh with the lid on. Repeat the process of drying, cooling and weighing at half-hour intervals until the loss in weight between two successive weighing is less than one milligram. Record the lowest mass obtained.

CALCULATION

$$\text{Moisture , percent by mass} = \frac{100\ (M_1 - M_2)}{M_1 - M}$$

Where,

M 1 = mass, in g of dish with material before drying

M 2 = mass in g of dish with material after drying to constant mass

M = mass in g of the empty dish.

5.7.3 DETERMINATION OF TOTAL ASH CONTENT

Determination of total ash content in peda was done using IS IS:12711:1989;R-2015. In order to determine the ash content ,5g of material was weighed accurately in a crucible. For an hour, ignite the sample in the crucible with an appropriate burner's flame. Place the crucible in a muffle furnace at 500 ± 10˚C until it produces grey ash. Use a desiccator to cool the crucible before weighing it. For every thirty minutes, repeat the igniting, cooling, and weighing procedures until the mass difference between two subsequent weighings is less than one milligramme. Identify the lowest mass obtained.

CALCULATION

Total ash(on dry basis), percent by mass = $\frac{100(M_2 - M) \times 100}{M_1 - M \times (100 - W)}$

Where

M 1 = mass, in g of dish with the material taken for test

M 2 = mass in g of dish with ash

M = mass in g of the empty dish

W = moisture % of the sample

5.7.4 DETERMINATION OF CARBOHYDRATE CONTENT

The determination of carbohydrate content in peda was done using AOAC method . Once the percentages of moisture, total protein, fat, and total ash have been determined, the total carbs are computed as follows.

CALCULATION

Total carbohydrates = 100 - (A+B+C+D)

Where

A = percent by mass of moisture

B = percent by mass of total protein

C = percent by mass of fat and

D = percent by mass of total ash

5.7.5 DETERMINATION OF VITAMIN CONTENT

The determination of the vitamin content in peda was done using AOAC method. In order to conduct this test first sample is prepared . The initial procedure in conducting this test is to prepare a sample. To prepare the sample, weigh enough test samples (≤5 g) to yield 50 micrograms of vitamin A and transfer to a 125ml low actinic Erlenmeyer flask. For high-sugar test samples, add 3ml water and mix to form a slurry. Add 40 mL of 95% ethanol. In each test flask, add a pea-sized piece of 50mg pyrogallic acid (antioxidant). Add glass beads or boiling stones to help the water boil faster. Swirl each flask to ensure that all components are fully mixed into the solution. Pipette 10ml of 50% KOH solution into each flask, and immediately place flask on hot plate under reflux condenser and swirl . Reflux for 45 minutes and swirl flask every 10 minutes. Remove the reflux flask from the hot plate, cover with a cork, and quickly cool it to room temperature with cold water (ice water).

To neutralise the KOH, pipette 10 ml of glacial acetic acid into each flask. After mixing, let the flask drop to room temperature. Transfer the solution quantitatively into each flask using Tetrahydrofuran - 95% Ethanol: 1:1v/v . Dilute to volume using the same solvent mixture, up to 100 mL. Secure the stopper and invert the volumetric flask for 10 minutes. . Refrigerate the flask for at least 1 hour or overnight to precipitate the fatty acid salts produced during saponification known concentration vitamin A standards also should be treated using the same technique as above.. Inject both (treated standards and samples) to the HPLC system and calculate the concentration .

CALCULATION

$$\textbf{Vitamin A (mg/kg)} = \frac{\textbf{Area of sample X Std concentration X Volume made up}}{\textbf{Area of standard X Weight of sample}}$$

5.7.6 DETERMINATION OF SUGAR

The determination of the sugar content in peda was done using AOAC method. In order to conduct this test prepare standard dextrose solution in a 50ml burette . Estimate the titre (volume of dextrose solution needed to remove all copper in 10 ml Fehling solution) using the standard dextrose solution. To finish the titration, pipette 10 ml of Fehling's solution into a 300 ml conical flask and add nearly all of the standard dextrose solution needed to reduce the copper. More than one millilitre will be needed later. Heat the flask containing mixture over wire gauze. Gently boil the contents of the flask for 2 minutes. At the end of two minutes of boiling add one ml. of methylene blue indicator solution. Without interrupting boiling, While the contents of the flask begins to boil, start to add standard dextrose solution (one or two drops at a time) from the burette till blue colour of indicator disappears [The titration should be completed within one minute so that the contents of the flask boil together for 3 minutes without interpretation. Note the titre (that is total volume in ml. of std. dextrose solution used for the reduction of all the copper in 10 ml. of Fehling's solution).Multiply the titre (obtd. by direct titration) by the number of milligrams of anhydrous dextrose in one millilitre of standard dextrose solution to obtain the dextrose factor. Compare this factor with the dextrose factor and determine correction. Transfer test sample representing about 2- 2.5 gm sugar to 200 ml volumetric flask, dilute to about 100 ml and add excess of saturated neutral Lead acetate solution (about 2 ml is usually enough). Mix, dilute to volume and filter, discarding the first few ml filterate. Add dry Pot. Or Sodium . Oxalate to precipitate excess lead used in clarification, mix and filter, discarding the first few ml filterate. Take 25 ml filterate or aliquot containing (if possible) 50 – 200 mg reducing sugars and titrate with mixed Fehling A and B solution using Lane and Eynon Volumetric method. For inversion at room temperature, transfer 50 ml aliquot clarified and de-leaded solution to a 100 ml volumetric flask, add 10 ml HCl (1+ 1) and let stand at room temperature for 24 hours. (For inversion, the sample with HCl can be heated at 700 C for 1 hr. This saves time and makes the whole process shorter). Neutralise exactly with conc. NaOH solution using phenolphthalein and dilute to 100 ml. Titrate against mixed Fehling A and B solution (25 ml of Fehlings Solution can be considered for the purpose) and determine total sugar as invert sugar (Calculate added sugar by deducting reducing sugars from total sugars).

CALCULATION:

Reducing and Total Reducing Sugar can be calculated as,

$$\textbf{Reducing Sugar (\%)} = \frac{\text{mg. of invert sugar x vol. made up x 100}}{\text{TR x Wt. of sample x 1000}}$$

$$\textbf{Total Reducing Sugar (\%)} = \frac{\text{mg. of invert sugar x final vol. made up x original volume x 100}}{}$$

TR x Wt. of sample x aliquot taken for inversion x1000

Sugar % = **(Total Reducing Sugar – Reducing sugar) x 0.95 + Reducing Sugar**

Added Sugar = **Total Sugars – Reducing Sugar**

5.7.7 DETERMINATION OF IRON CONTENT

The determination of the iron content in peda was done using AOAC method. In order to conduct this test . Ash 5.00 g test portion in Pt, SiO2 or porcelain dish . Cool and weigh if percent ash is desired. Continue ashing until practically C- free, To diminish ashing time, or products that do not burn practically C- free, use one of the Following ash aids. Moisten ash with 0.5 – 1.0 ml Mg(NO3)2 solution or with redistilled HNO3 . Dry and carefully ignite in furnace, avoiding spattering. (Do not add these ash aids to self rising flour (products containing NaCl) in Pt Dish because there is a chance of vigorous action on dish.) Cool, add 5 ml HCl, letting acid rinse upper portion of dish, and evaporate to dryness on steam bath. Dissolve residue by adding 2.0 ml HCl, accurately measured, and heat 5 min on steam bath with watch glass on dish. Rinse watch glass and dilute residue solution to 100 ml with H2O. If necessary, filter diluted residue solution through ash less paper and discard first 15 – 20 ml filtrate . Pipette 25 ml aliquot into 50 ml volumetric flask and add 1 ml H2NOH.HCl solution and transfer to conical flask and reduce the half of the volume by heating. Then cool the solution and add 10 ml acetate buffer + 4 ml Phenanthroline and dilute to volume. Determine absorbance in spectrophotometer at ca 510 nm. From reading ,determine Fe concentration from equation of line representing standard points or by reference to standard curve for Known Fe concentration .Calculate Fe in flour as mg/Ib.

CALCULATION

Iron mg/kg = $\frac{\textbf{Standard concentration X Sample absorbance X made up volume}}{\textbf{Standard absorbance X Sample weight}}$

5.7.7 DETERMINATION OF TOTAL PLATE COUNT

The determination of the tpc in peda was done using AOAC method. In order to conduct this test Aseptically transfer 10 gms of the sample into 90 ml of Butterfiled's Phosphate buffer. This becomes 10 -1 dilution. Dispense 1 ml each of the sample homogenate into duplicates of appropriately labelled petrifilms within 3 minutes of shaking. Re shake the sample homogenate if 3 minutes has elapsed, before dispensing into petrifilms. Prepare appropriate decimal dilutions of sample homogenate , using separate sterile micropipette tips for each dilutions, by transferring 1 ml of the sample homogenate and previous dilutions to 9 ml of Butterfield's phosphate buffer solution within 3 minutes of shaking them. At each stage of selected dilution, within 3 minutes of shaking , dispense 1 ml of each dilutions into duplicates of appropriately labelled petrifilms. Re-shake the dilution tubes if 3 minutes has elapsed before dispensing into petrifilms. Place petrifilms on flat surface. Lift the top film and inoculate 1 ml of the test suspension on to the centre of the film plates. Carefully roll the top film down into the inoculum. Distribute test suspension over 20 cm square area with downward pressure on centre of plastic spreader device (recessed side down). Leave petrifilms undisturbed for 1 min to permit gel to solidify .Incubate petrifilms 48 hrs + 3 hrs at 35 o + 1o C .Colonies appear in various shades of red . Count all colonies in countable range (30 – 300 colonies per plate).In incubator, place plates in horizontal position, clear side up , in stacks not exceeding 20 units. Count plates promptly after incubation period**.**

CALCULATION

1. Count all the colonies in the countable range 30 to 300.

2. Multiply average number of colonies in the plates in countable range with the dilution factor and report in cfu/g.
3. Estimated counts can be made on plates with > 300 colonies and should be reported as estimated counts. In making such counts, circular area can be considered to contain 20 one centimeter squares.

5.7.8 DETERMINATION OF YEAST AND MOULD

The determination of the yeast and mould count in peda was done using AOAC method. In order to conduct this test aseptically transfer 10gms of the sample into 90ml of Butterfiled's Phosphate buffer. This becomes 10 -1 dilution. Dispense 1 ml each of the sample homogenate into triplicates of appropriately labelled petrifilms within 3 minutes of shaking. Re shake the sample homogenate if 3 minutes has elapsed, before dispensing into petrifilms. Prepare appropriate decimal dilutions of

sample homogenate , using separate sterile micropipette tips for each dilutions, by transferring 1 ml of the sample homogenate from previous dilutions to 9 ml of Butterfield's phosphate buffer solution within 3 minutes of shaking them. At each stage of selected dilution, within 3 minutes of shaking , dispense 1 ml of each dilutions into triplicates of appropriately labelled petrifilms. Re-shake the dilution tubes if 3 minutes has elapsed before dispensing into petrifilms. Place petrifilms on flat surface. Lift the top film and inoculate 1 ml of the test suspension on to the centre of the film plates. Carefully roll the top film down into the inoculum. Distribute test suspension over 30 cm square area with downward pressure on centre of plastic spreader device. Leave petrifilms undisturbed for 1 min to permit gel to solidify . Incubate petrifilms 5 days at 20ºC - 25 o C .Yeast colonies appear as blue green or off white in colour and form small defined colonies. Mould colonies are usually blue in colour but may also take on their natural pigmentation.(ie, black , yellow, green etc). They tend to be larger and more diffused than the yeast colonies. High number of yeast colonies may cause the entire growth area to turn blue, black, yellow etc .When this occurs, do not make estimated counts, but further dilute and plate test suspensions to get more accurate counts. In incubator, stack plates horizontally, clear side up , in stacks of not exceeding 20 units. Count plates promptly after incubation period.

CALCULATION

1. Count all the colonies in the countable range 10 to 150.
2. Multiply average number of colonies in the plates in the countable dilution with the dilution factor and report in cfu/g.
3. Estimated counts can be made on plates with > 150 colonies and should be reported as estimated counts. In making such counts, circular area can be considered to contain 30 one centimeter squares.

5.7.9 DETERMINATION OF COLIFORM

The determination of the coliform count in peda was done using AOAC method. In order to conduct this test aseptically transfer 10 gms of the sample into 90 ml of Butterfiled's Phosphate buffer. This becomes 10 -1 dilution. Dispense 1 ml each of the sample homogenate into duplicates of appropriately labelled petrifilms within 3 minutes of shaking. Re shake the sample homogenate if minutes has elapsed, before dispensing into petrifilms. Prepare appropriate decimal dilutions of sample homogenate , using separate sterile micropipette tips for each dilutions, by transferring 1 ml of the sample homogenate and previous dilutions to 9 ml of Butterfield's phosphate buffer solution within 3 minutes of shaking them. At each stage of selected dilution, within 3 minutes of shaking ,

dispense 1 ml of each dilutions into duplicates of appropriately labelled petrifilms. Re-shake the dilution tubes if 3 minutes has elapsed before dispensing into petrifilms. Place petrifilms on flat surface. Lift the top film and inoculate 1 ml of the test suspension on to the centre of the film plates. Carefully roll the top film down into the inoculum. Distribute test suspension over 20 cm square area with downward pressure on centre of plastic spreader device (recessed side down). Leave petrifilms undisturbed for 1 min to permit gel to solidify . Incubate petrifilms 24 hrs + 2 hrs at 35 o + 1o C .Colonies appear as red colonies that have one or more gas bubbles associated with them . Count all colonies in countable range (15 – 150 colonies per plate). Red colonies without gas bubbles are not considered as coliform organisms. In incubator, stack plates horizontally, clear side up , in stacks of not exceeding 20 units.. Count plates promptly after incubation period.

CALCULATION

1. Count all the colonies in the countable range 15 to 150.

2. Multiply average number of colonies in the plates in countable range with the dilution factor and report in cfu/g.

3. Estimated counts can be made on plates with > 150 colonies and should be reported as estimated counts. In making such counts, circular area can be considered to contain 21 centimeter squares.

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Chapter- 6

RESULT AND DISCUSSION

The present investigation was undertaken to develop nutritious peda by using dry moringa leaves powder and sorghum powder .In total 3 different formulation were prepared during the study. Those were S1,S2,S3.

6.1 DEVELOPMENT OF NUTRIENT RICH PEDA USING MORINGA LEAVES AND SORGHUM PEDA

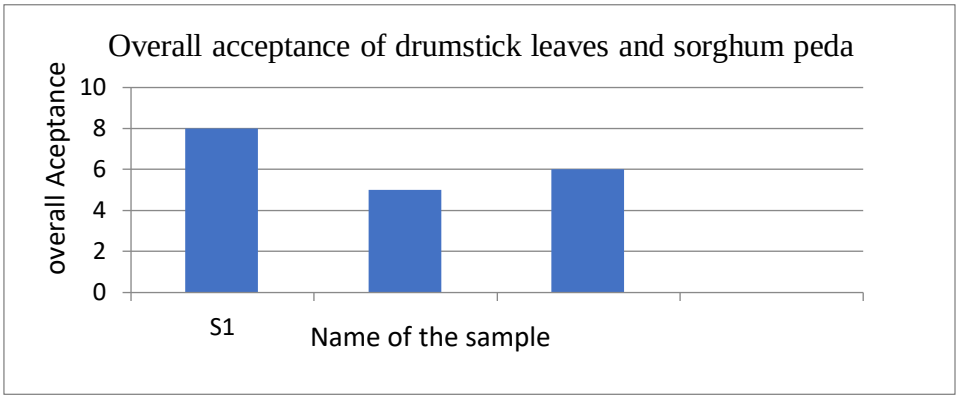
In the present study 3 different formulations of peda were made by making small alterations in the composition of moringa leaves powder , sorghum powder and jaggery syrup and were subjected to sensory evaluation for selecting the best formulation .

6.2 SELECTION OF THE BEST FORMULATION OF PEDA

The acceptability of the three sample were found by a panel of 10 semi trained members using a nine-point hedonic scale .It was found that sample S1 with 50% moringa leaves powder and 50% sorghum powder has got more acceptance where the sample S2 with 60% moringa and 40 sorghum got least acceptance .This may due to the fact that when the composition of moringa leaves powder is more the taste ,smell and appearance of the product is not achieved .

Mean sensory score of 3 different formulation of peda

SL No	QUALITY PARAMETERS	S1	S2	S3
1	Appearance	8	5	5
2	Aroma	8	5	6
3	Taste	8	5	6
4	Texture	8	6	6
5	Overall Acceptability	8	5	6



Graph : Comparitive study of Three sample based on sensory analysis using Hedonic scale

HEDONIC RATING PROVIDED BY DIFFERENT FOOD ANALYSTS

Sl No	Food Analyst	Sample	Aroma	Appearence	Taste	Texture	Overall Acceptability
1	Analyst 1	S1	8	7	8	8	8
		S2	5	6	6	6	6
		S3	5	6	6	6	6
2	Analyst 2	S1	8	8	9	8	8
		S2	7	6	7	6	7
		S3	7	6	8	6	7
3	Analyst 3	S1	8	8	8	8	8
		S2	6	6	6	6	6
		S3	7	7	6	6	7
4	Analyst 4	S1	9	8	8	9	9
		S2	2	2	1	4	2
		S3	7	4	6	8	6
5	Analyst 5	S1	9	9	9	9	9
		S2	7	6	6	8	7
		S3	8	8	7	8	8
6	Analyst 6	S1	9	8	8	6	8
		S2	7	6	6	8	7

		S3	7	6	7	7	7
7	Analyst 7	S1	8	7	8	8	8
		S2	4	3	3	3	3
		S3	4	3	5	4	4
8	Analyst 8	S1	7	6	7	8	7
		S2	5	5	6	7	6
		S3	7	6	7	8	7
9	Analyst 9	S1	9	8	7	8	8
		S2	8	7	6	7	7
		S3	7	7	6	6	7
10	Analyst 10	S1	9	8	7	8	8
		S2	3	2	1	5	3
		S3	2	1	4	3	3
11	Analyst 11	S1	8	7	8	7	8
		S2	3	4	3	4	4
		S3	4	5	3	4	4

6.3 NUTRIENT PROFILE OF THE DEVELOPED SAMPLE

The peda which is rich in moringa leaves and sorghum has got much nutritious properties and have a remarkable health benefits so it is accepted by every age group .

NUTRIENT PROFILE OF THE SAMPLE

SI No	PARAMETER	UNIT	RESULT
1	VITAMIN A	IU	781.26
2	CARBOHYDRATE	%	47.4
3	TOTAL SUGAR	%	11.69
4	PROTEIN	%	10.13
5	IRON	mg/100g	1.69
6	TOTAL ASH	%	3.3

The above table showcase the different parameter present in the moringa leaves sorghum peda .The sample was tested for its protein content, total sugar, iron vitamin A and carbohydrate . The result obtained shows that it contain protein 10.13%, total sugar 11.69 %, carbohydrate 47.4% , iron 1.96 mg/100g , vitamin A 781.26 IU (27.10 mg)

Chapter -7

SUMMARY AND CONCLUSION

The present study, entitled "Development of Moringa Leaves Powder and Sorghum-Based Peda," was aimed at standardising peda and evaluating their nutritional, chemical and microbial qualities. Three different combinations of peda's were made using various constituent compositions. A variety of organoleptic characteristics were assessed for the product, including appearance, taste, texture, aroma, and overall acceptance. The highest mean score for various qualitative parameters was acquired for the creation of peda, and sample S1, which had a 50/50 equal percentage of sorghum and moringa, was chosen for further investigation based on this best score. The selected product was prepared, packaged, and refrigerated for a period of one week. The peda's chemical and nutritional contents, including its protein, vitamin, and iron content, were measured. By analysing the proximate composition of peda, it was clear that it has a high nutritive value in terms of protein, vitamin A, and iron. For a period of one week, the refrigerated product maintained the same quality as the original one. There was an insignificant change in its quality after one week. The shelf life of the

product can be extended for a month by utilising suitable packaging materials such as polythene bags or parchment paper-lined paper board boxes and keeping it at a refrigeration temperature of 8 oC or below. The final result was positive and showed that a peda with nutritional benefits could be developed. Based on this investigation, we are able to conclude that jaggery powder can be used to replace sugar and give it a similar taste.

Chapter-8

REFERENCE

1. Anil Kumar, Shreya Tripathi, Nidhi Hans, Falguni Pattnaik, Satya Narayan Naik (2018): Ghee : Its Properties, Importance and Health Benefits . LIPID UNIVERSE

2. B Harshith Reddy, P Pradeep and TVN Padmavathi (2020) :Development and evaluation of value-added products from Moringa leaves ; Journal of Pharmacognosy and Phytochemistry 2020; 9(5): 660-663 https://doi.org/10.22271/phyto.2020.v9.i5j.12304

3. Chetan Dharaiya , Rekha Rani and Bhopal Singh (2019): RECENT ADVANCES AND APPLICATION OF MEMBRANE PROCESSING IN DAIRY INDUSTRY: Recent Technologies in Dairy Science (2019): 153-181

4. John Lindsay (2010) ; Sorghum: An Ancient, Healthy and Nutritious Old World Cereal

United Sorghum Checkoff Program , International Sorghum and Millet Collaborative Research Support Program (INTSORMIL CRSP) ,INTSORMIL Scientific Publications. https://digitalcommons.unl.edu/intsormilpubs

5. Joshi, P., & Mehta, D. (2010). Effect of dehydration on the nutritive value of drumstick leaves. Journal of metabolomics and systems biology, 1(1), 5-9

6. Karuna D. Kulkarni, D. N. Kulkarni, and U. M. Ingle (1991): Sorghum malt-based weaning food formulations: Preparation, functional properties, and nutritive value : Food and Nutrition Bulletin, vol. 13, no. 4 © 1991, The United Nations University.

7. Kourkouta Lambrini ,Frantzana Aikaterini , Koukourikos Konstantinos ,Iliadis Christos , Papathanasiou V. ,Ioanna and Tsaloglidou Aret (2021) Milk Nutritional Composition and Its Role in Human Health . Journal of Pharmacy and Pharmacology 9 (2021) 10-15

8. Lassana Sissoko , Nouhoum Diarra ,Ibrahim Nientao ,Beth Stuart (2020) Moringa oleifera leaf powder for type 2 diabetes: a pilot clinical trial ;African Journal of Traditional, Complementary and Alternative Medicines 17(2)DOI:10.21010/ajtcam.v17i2.3

9. Lloyd Mbulwe ,Mukachikwikwi Hamakoko ,George Mhango ,Mathew Moonga (2020) ; Effect of Substituting Maize Based Stock-feed Diets with Sorghum on the Performance of Quails; European Journal of Agriculture and Food Sciences 2(5); https://www.ejfood.org/index.php/ejfood/article/view/115#:~:text=https%3A//doi.org/10.24018/ejfood.2020.2.5.115

10. Mansoor Abdul Hamida , Jason Siew Kin Minga, Mayrana Md. Norb, Hasmadi Mamata,Jahurul Haque Akanda (2021) :Effect of Moringa Leaves Powder Incorporated into Chocolate on the Quality and Stability Properties :Bulletin of Culinary Art and Hospitality Vol 1, No 2, December2021, pp. 42-49ISSN 2797-8249.

11. Mohammed L. Sserunjogi, Roger K. Abrahamsen, Judith Narvhus,(1998) :A Review Paper: Current Knowledge of Ghee and Related Products, International Dairy Journal, Volume 8, Issue 8,

12. Morton, J. F. (1991). The Horse radish tree, Moringa pterygosperma. A boon to arid lands? Economic Botany, 45, 318–333.

13. N.C. Ganguli, M.K. Jain (1973) : Ghee: Its Chemistry, Processing and Technology. Journal of Dairy Science ,Volume 56, Issue 1, January, Pages 19-25 https://doi.org/10.3168/jds.S0022-0302(73)85109-4

14. Parth Hirpara, Nitin Thakare, VD Kele and Dhruvin Patel (2020); Jaggery: A natural sweetener , Journal of Pharmacognosy and Phytochemistry 2020; 9(5): 3145-3148

15. Piyush Kashyap, Shiv Kumar, Charanjit Singh Riar, Navdeep Jindal, Poonam Baniwal, Raquel P. F. Guiné, Paula M. R. Correia, Rahul Mehra, and Harish Kumar (2022) "Recent advances in Drumstick (Moringa oleifera) leaves bioactive compounds: Composition, health benefits, bio-accessibility, and dietary applications." Antioxidants" 11.2: 402.

16. .Odee, D. (1998): Forest biotechnology research in dry lands of Kenya: the development of Moringa species. Dry land Biodiversity 2, 7-9

17. Ramachandran, C. A., Peter, K. V., Gopalakrishnan, P. K. (1980). Drumstick (Moringa oleifera): a multipurpose Indian vegetable. Economic Botany 34 (3): 276-83.

18. Riski Ayu Anggreini ,Ulya Sarofa, Rosida (2018) Characteristics of Dried Noodles from Modified Sorghum Flour (MOSOF) (Sorghum bicolour) :Atlantis Highlights in Engineering (AHE), volume 1International Conference on Science and Technology (ICST 2018) license (http://creativecommons.org/licenses/by-nc/4.0/).

19. Samuel Ayofemi Olalekan Adeyeye (2016)Assessment of quality and sensory properties of sorghum–wheat flour cookies :FOOD SCIENCE & TECHNOLOGY | RESEARCH ARTICLE Adeyeye, Cogent Food & Agriculture (2016), 2: 1245059 http://dx.doi.org/10.1080/23311932.2016.124505

20. Serere Harusekwi Julien , Nemapare Patience : Development of Moringa Olefeira Enriched Muffins : International Journal of Nutrition and Food Sciences .2015; 4(2): 178-183 (http://www.sciencepublishinggroup.com/j/ijnfs)

21. Thanaa A. M , Amer, Hala S. Sayed ,Fatma M. I. Shahine ((2015), Production of functional bakery products supplemented with moringa leaves powder ; Annals of Agric. Sci., Moshtohor ISSN 1110-0419 Vol. 53(4) (2015), 625–642 http://annagricmoshj.com

22. Y.G. Moharram, A.M.A. Youssef (1995) :Sorghum grain and quality of its edible products Developments in Food Science ,Volume 37, 1995, Pages 111-146 https://doi.org/10.1016/S0167-4501(06)80156-1

23. Yun Xiong, Pangzhen Zhang , Robyn Dorothy Warner, and Zhongxiang Fang (2019) Sorghum Grain: From Genotype, Nutrition, and Phenolic Profile to Its Health Benefits and Food Applications Comprehensive Reviews in Food Science and Food C 2019 Institute of Food Technologists doi: 10.1111/1541-4337.12506 Vol.18,2019 Safety)

24. Zahidul Islam, S. M. Rashadul Islam, Faruk Hossen, Kazi Mahtab-ul-Islam, Md. Rakibul Hasan, and Rezaul Karim (2021) ;Moringa oleifera is a Prominent Source of Nutrients with Potential Health Benefits, " International Journal of Food Science”

MORINGA LEAVES SORGHUM PEADA

SAMPLE S1

SAMPLE S2

SAMPLE S3

SCORE CARD

HEDONIC RATING SCALE

Name :

Product:

Date:

F Q LAB
AND RESEARCH CENTRE
(P) LIMITED
FQLAB
Food Testing • Training • Food Safety Systems

♦ ISO 9001 QMS CERTIFIED ♦ APPROVED BY KERALA STATE POLLUTION CONTROL BOARD ("A" GRADE LAB) ♦
♦ MEMBER : AFI (USA), IFOAM (GERMANY), NIQR (INDIA) ♦ RECOGNISED BY BUYERS IN USA, EU, JAPAN & OTHER COUNTRIES ♦

Doc.No: FQLAB/F/7801A

TEST CERTIFICATE

B 7514

Date of Issue : 13.03.2024

Issued To:
Ms. Saumya Saj
Nediyadathu (H)
Puthupaddy P.O.
Muvattupuzha-686 673

Sample Code	: FQLAB/23-24/1309/C2453
Sample Receipt	: 29.02.2024
Date of Analysis	: 01.03.2024 - 13.03.2024
Reported Date	: 13.03.2024

Particulars of sample	: Moringa Leaves Sorghum Peda
Condition of Sample	: Received in good condition
Customer Sample ID	: Nil
Sample Quantity	: 350g
Sample Drawn by	: Customer
Sample Description	: Light green colour peda

TEST RESULTS

SL NO.	PARAMETERS	UNIT	TEST METHOD	RESULT
1	Moisture	%	AOAC 22nd Edn. 2023; 934.06, Ch.37.1.10	38.97
2	Total Ash	%	SOP No. FQLAB/SOP/C/F&V/7203	3.03
3	Iron	mg/100g	AOAC 22nd Edn. 2023; 944.02, Ch.32.1.09	1.96
4	Vitamin A	IU	AOAC 22nd Edn. 2023; 2001.13, Ch.45.1.34	781.26
5	Carbohydrate	%	AOAC 22nd Edn. 2023; 986.25, Ch.50.1.16	47.4
6	Total Sugar	%	AOAC 22nd Edn. 2023; 930.36, Ch.44.1.13	11.69
7	Protein	%	AOAC 22nd Edn. 2023; 920.152, Ch.37.1.35	10.13

No.of parameters tested: 7

********** End of the Report **********

For FQLAB AND RESEARCH CENTRE (P) LIMITED

MANOJ P
Sr. Technologist
(Chemistry)
FQL & RC

MUKIL MANOJ
Authorised Signatory
Sr. Technologist
(Chemistry)
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Doc.No: FQLAB/F/7801A

TEST CERTIFICATE

B 7493

Date of Issue : 06.03.2024

Issued To:
Ms. Saumya Saj
Nediyadathu (H)
Puthupaddy P.O.
Muvattupuzha-686 673

Sample Code	: FQLAB/23-24/1309/M3079
Sample Receipt	: 29.02.2024
Date of Analysis	: 29.02.2024 - 05.03.2024
Reported Date	: 05.03.2024

Particulars of sample	: Moringa Leaves Sorghum Peda
Condition of Sample	: Received in good condition
Customer Sample ID	: Nil
Temperature at the time of receipt in lab	: 28.6°C
Sample Quantity	: 350g
Sample Drawn by	: Customer
Sample Description	: Light green colour peda

TEST RESULTS

SL NO.	PARAMETERS	UNIT	TEST METHOD	RESULT
1	Aerobic Plate Count	cfu/g	AOAC 22nd Edn. 2023; 990.12, Ch.17.2.07	32,000
2	Yeast and Mould	cfu/g	AOAC 22nd Edn. 2023; 997.02, Ch.17.2.09	10
3	Coliforms	cfu/g	AOAC 22nd Edn. 2023; 991.14, Ch.17.3.04	2,000

Remarks: The above tested parameters are as per customer requirement

No.of parameters tested: 3

********** End of the Report **********

For FQLAB AND RESEARCH CENTRE (P) LIMITED

Authorised Signatory
SONIA BIJU
Quality Manager
(Microbiology)
FQL & RC

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