

Development of Instant Food Mix for Diabetic Patients

Arati¹

¹Amity Institute of food technology, Amity university
Food science and nutrition

Guide Name: Dr. Renu Khedkar²

Publication Date: 2025/05/31

How to Cite: Arati; Dr. Renu Khedkar. (2025). Development of Instant Food Mix for Diabetic Patients. *International Journal of Innovative Science and Research Technology*, 10(5), 2537-2560. <https://doi.org/10.38124/ijisrt/25may1375>.

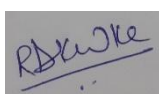
CERTIFICATE OF FACULTY GUIDE

I certify that the candidate **Ms. Arati, Enrollment No – A4345419028** of **M.Sc. (Foods & Nutrition) programme, Batch 2019-21** has planned and conducted the DISSERTATION entitled “**Development of Instant food mix for diabetic patients**” under my guidance and supervision and that the report submitted herewith is a bona-fide work done by the candidate.

This certificate has been generated online.

Date: 30.05.2021

Place: Noida



Signature

Faculty Guide : Dr.Renu Khedkar



Signature

Dr. V K Modi
Head of Institution, AIFT

TABLE OF CONTENTS

TITLE	2537
CERTIFICATE OF FACULTY GUIDE	2538
TABLE OF CONTENT	2539
ABSTRACT	2540
CHAPTER ONE: INTRODUCTION	2541
CHAPTER TWO: REVIEW OF LITERATURE	2542
CHAPTER THREE: METHODOLOGY	2547
CHAPTER FOUR: RESULTS	2554
CHAPTER FIVE: CONCLUSION	2558
REFERENCES	2559

ABSTRACT

In present times, instant foods are frequently defined as foods that supply convenience to consumers and helps in reducing the time of preparation/cooking, whereby the time it takes for the preparation and cooking of the food merely takes some minutes. Dosa is a food product from the southern part of India which resembles to a fermented pancake usually prepared from milled rice and black gram dal. Instant Dosa mix based on Ragi (finger millet flour), raw banana flour, Besan (gram flour) and Jowar (sorghum flour) and flavouring agents was developed using RSM (RESPONSE SURFACE METHODOLOGY). Proximate analysis of the product and shelf life study of the same were conducted in both accelerated (38 degrees) and ambient (27 degrees). Millets are known as quite possibly the main cereal grains. The objective of the present study was to develop a flour using the finger millet, chickpea flour sorghum and raw banana flour for people with diabetes. The flour in question is developed in order to sustain the palatability and also to bring forth a dietary change in the population having diabetes.

CHAPTER ONE

INTRODUCTION

In present times, instant foods are frequently defined as foods that supply convenience to consumers and helps in reducing the time of preparation/cooking, whereby the time it takes for the preparation and cooking of the food merely takes some minutes. The instant food is the food that gives comfort to purchasers and helps in lessening the human endeavours. It is the fundamental need of individuals. The word food alludes to any substance which is taken into the body to keep it in a solid condition. A food is a compound substance which is being burned-through to offer nourishment to the body. It contains fundamental supplements that are generally gotten from plants and animals, like carbs, fats, proteins, vitamins and minerals [16].

India is a country which is one of the world's main food producers. The changing demography and way of life of individuals has expanded the interest for the instant food. The interest for the moment food items is step by step expanding because of expansion in urbanization, separating of joint families to family units, want for quality time, expansion in the quantity of working ladies and changing food propensities for individuals living in social orders, every one of these progressions have changed the attitude of shopper towards their dietary patterns. Their conduct has likewise changed with the course of time. Instant-food implies basic, quick and advantageous which is not difficult to plan and liberated from microbial microorganisms. The new advancements coming up has diminish the endeavours of people by giving them great offices at less time and less expense. The instant food item administration is serving better with more prominent productivity and great taste. distinctive prepared food varieties, for example, bundle frozen food varieties , divide bunch of concentrated curries are currently a day quick turning into the ordinary weight control plans normally for youthful couples, additionally the pick pockets of chutney's, pickles , juices and paneer masala powders have made their entrance into the kitchens of many working class families.

In prior days, individuals used to eat food sumptuously and gradually yet now-days; the advanced pattern has changed the food propensities for individuals to eat good food which is straightforward and simple to process. the origination of these instant food was in japan with instant noodles and made way to India in the 80's. instant food isn't simply simple to cook yet in addition assumes a significant part at the hour of family social occasions .it benefits individuals by saving time, easy cooking , alleviation from work of cleaning and figuring the vegetables out. Expansion of urban cities because of the increase in population, blooming industries, diminishing time from people live; all have contributed for the popularity of instant foods. Since industrialisation, the working class is pulled in towards the industrial jobs for better remittances, in this way prompting deficiency of house keeper workers. Many women have engaged themselves in office work therefore, to keep oneself and the family satiated instant food have taken a great portion of the kitchen pantry. Nuclear families, prior there were huge families, in this way bigger amount of food was utilized to be readied because of rise of family unit, gradually and steadily every family begun utilizing instant food items to set aside time and cash. Costs of raw materials, the costs of crude materials likewise expanded, to set aside cash individuals utilized the moment food items to remain a sound eating regimen. Pay Working women now-a days, ladies' are particularly propelled towards their functioning interaction. Consequently, they don't have a lot of time to prepare food for extended periods of time; subsequently they select instant food varieties which can decreases their cooking endeavours. Standard of living in this day and age, the expectation for everyday comforts of individuals because of ascend in the pay level, has changed their outlook of dietary patterns [17].

CHAPTER TWO

REVIEW OF LITERATURE

A. *Diabetes Mellitus*

It is the condition of the body in which the insulin levels either are not sufficient enough to balance the blood sugar levels or the production of insulin in the body is near to null. Diabetes can be of various types, type 1 and type 2 ; depending upon the insulin productivity of the body. The major nutrients that are constituted in food are:

- Carbohydrates
- Proteins
- Fats

Where, carbohydrates are the major contributor of sugars, along with starch and fibre. Sugars can be classified as simple and complex table sugar is made of simple sugar known as glucose and fructose, whereas milk sugars are made of glucose and simple sugar known as galactose. Carbohydrates in starches, like bread, pasta, rice, and comparative food varieties, are long chains of various simple sugars. Sucrose, lactose, carbs, and other complex sugars should be separated into basic sugars by proteins in the stomach/ digestive system before the body can retain them. When the body ingests basic sugars, it generally changes over them all into glucose; which is a significant wellspring of fuel for the body. Glucose is the sugar that is shipped through the circulatory system and taken up by cells. The body can likewise make glucose from fats and proteins. Blood "sugar" truly implies blood glucose.

Diabetes mellitus, predominantly known as diabetes, is a metabolic condition of the human body which causes the blood sugar level to rise. In this condition either the amount of insulin produced by the body is not enough to move sugar from blood into the cells or the produced insulin is not used effectively. Untreated high blood sugar from diabetes can damage `nerves, eyes, kidneys, and other organs [9].

The use of complex carbohydrates in the diet of Indian population has deteriorated drastically. Diabetes is fast gaining the status of a potential epidemic in India with more than 62 million diabetic individuals currently diagnosed with the disease. It is predicted that by 2030 diabetes mellitus may afflict up to 79.4 million individuals in India. India has a high prevalence of diabetes mellitus and the numbers are increasing at an alarming rate. In India alone, diabetes is expected to increase from 40.6 million in 2006 to 79.4 million by 2030. Studies have shown that the prevalence of diabetes in urban Indian adults is about 12.1%, the onset of which is about a decade earlier than their western counterparts and the prevalence of Type 2 diabetes is 4–6 times higher in urban than in rural areas [12] . Type 1 diabetes

A. *Type 1 Diabetes*

(previously called insulin-subordinate diabetes or adolescent beginning diabetes), the insulin producing cells of the body is attacked by the immune system and damaging them as a result. The pancreas, consequently, delivers practically no insulin. Simply around 5 to 10% surprisingly with diabetes have type 1 infection [14]. A great many people who have type 1 diabetes build up the sickness before age 30, in spite of the fact that it can grow further down the road. Researchers accept that an ecological factor—potentially a viral contamination or a wholesome factor during adolescence or early adulthood—makes the resistant framework annihilate the insulin-delivering cells of the pancreas. A hereditary inclination makes a few group more powerless to an ecological factor.

Type-1 diabetes frequently grows out of nowhere and can create manifestations like polydipsia, polyuria, enuresis, absence of energy, outrageous sluggishness, polyphagia, abrupt weight reduction, moderate recuperating wounds, intermittent contaminations and obscured vision with serious lack of hydration and diabetic ketoacidosis in youngsters and teenagers. The indications are more extreme in youngsters contrasted with grown-ups. Type-1 diabetes patients are likewise inclined to other immune system issues, for example, Graves' infection, Hashimoto's thyroiditis, Addison's illness, vitiligo, celiac sprue, immune system hepatitis, myasthenia gravis, and vindictive pallor. The total reliance on insulin of type 1 diabetes patients might be hindered by a vacation stage which keeps going a long time to months or now and again 2-3 years. In certain kids, the necessity for insulin treatment may drop to a point where insulin treatment could be removed briefly without distinguishable hyperglycaemia [18].

B. *Type 2 Diabetes*

(once in the past called non–insulin-dependent diabetes), the pancreas frequently keeps on delivering insulin, some of the time even at higher-than-typical levels, particularly from the onset of the disease. The body creates protection from the impacts of insulin, so there isn't sufficient insulin to address the body's issues. As type 2 diabetes advances, the insulin-creating capacity of the pancreas diminishes [17].

Type-2 diabetes might not have symptoms for quite a long time or a very long time before they are analysed. Symptoms might be unpretentious. increase in the frequency of urination and mild thirst at the preliminary stages, which gradually deteriorate , In the long run, individuals feel incredibly exhausted, are probably going to create obscured vision, and may get dried out. There are many complications in diabetes; harms veins, making them thin and in this manner confining blood stream. Since veins all

through the body are influenced, individuals may have numerous inconveniences of diabetes [14]. Numerous organs can be influenced, especially brain, causing stroke, eyes (diabetic retinopathy), causing visual impairment, heart, causing respiratory failure, kidneys (diabetic nephropathy), causing constant kidney infection, nerves (diabetic neuropathy), creating diminished uproar in feet. High blood glucose levels likewise cause unsettling influences in the body's insusceptible framework, so individuals with diabetes mellitus are especially powerless to bacterial and contagious contaminations. Treatment of diabetes include diet, exercise, weight loss, education. In type-1 diabetes, insulin injections and in type 2 diabetes, often drugs by mouth and sometimes insulin or other drugs by injection. Diet, exercise, and training are the foundations of treatment of diabetes and regularly the primary proposals for individuals with mild diabetes. Weight reduction is significant for individuals who are overweight. Individuals who keep on having raised blood glucose levels notwithstanding way of life changes, or have exceptionally high blood glucose levels and individuals with type 1 diabetes (regardless of their blood glucose levels) likewise require drugs. Since confusions are more averse to create if individuals with diabetes stringently control their blood glucose levels, the objective of diabetes treatment is to keep blood glucose levels as near the ordinary reach as could really be expected [17].

C. *Diabetes and Metabolism*

Since diabetes is an illness of impeded glucose digestion, and glucose is a central unit of starches, the significance of food sources and drinks in dealing with the sickness can't be downplayed. Unchecked, diabetes unleashes devastation on the whole body. However, even all around controlled diabetes actually conveys higher dangers for bleak conditions. Metabolic results known to happen in diabetes go a long ways past raised glucose. They remember overabundance free unsaturated fats for the blood, changed utilitarian properties of endothelial cells inside conduits and veins, and different debilitations. What's more, as has as of late been perceived, fundamental aggravation is firmly corresponded with diabetes.

Diabetes is connected to various illnesses and conditions, including those that influence the eyes, kidneys, nerves, and circulatory framework. For instance, one illness condition causes unusual development of veins in the retina, another harms the sifting elements of the kidneys, but then another causes tangible nerve harm, especially in the feet. What's more, cardiovascular doctors oversee numerous diabetic patients in light of the fact that vascular sicknesses are the chief reasons for death and inability among these patients. These doctors frequently notice people with atherosclerosis just as eye and kidney infections. These last conditions are significant reasons for visual deficiency and end-stage renal disappointment.

D. *Why is Diet Important*

Diet the board is vital in individuals with the two kinds of diabetes mellitus. Specialists suggest a sound, adjusted eating regimen and endeavours to keep a solid weight. Individuals with diabetes can profit by meeting with a dietician to build up an ideal eating plan. Such an arrangement incorporates keeping away from basic sugars and handled food varieties, expanding dietary fibre, restricting segments of starch rich, and greasy food varieties (particularly soaked fats). Individuals who are taking insulin ought to stay away from extensive stretches between dinners to forestall hypoglycaemia. Despite the fact that protein and fat in the eating routine add to the quantity of calories an individual eats, just the quantity of sugars directly affects blood glucose levels. The American Diabetes Association has numerous accommodating tips on diet, including plans. In any event, when individuals follow a legitimate eating routine, cholesterol-bringing drugs are required down to diminish the danger of coronary illness. Numerous more seasoned individuals experience issues following a solid, adjusted eating routine that can handle blood glucose levels and weight. Evolving since quite a while ago held food inclinations and dietary propensities might be hard. Some more established individuals have different problems that can be influenced by diet and may not see how to coordinate the dietary suggestions for their different issues. Some more established individuals can't handle what they eat on the grounds that another person is cooking for them—at home or in a nursing home or other organization. At the point when individuals with diabetes don't do their own cooking, individuals who shop and get ready dinners for them should likewise comprehend the eating routine that is required. More established individuals and their parental figures generally advantage from meeting with a dietician to build up a solid, attainable eating plan.

Individuals with type 1 diabetes and certain individuals with type 2 diabetes may utilize sugar checking or the carb trade framework to coordinate with their insulin portion to the carb substance of their feast. "Checking" the measure of starch in a supper is utilized to compute the measure of insulin the individual takes prior to eating. Be that as it may, the starch to-insulin proportion (the measure of insulin taken for every gram of sugar in the feast) shifts for every individual, and individuals with diabetes need to work intimately with a dietician who has insight in working with individuals with diabetes to dominate the strategy. A few specialists have informed use regarding the glycaemic record (a proportion of the effect of an ingested carb containing food on the blood glucose level) to outline among quick and gradually utilized sugars, despite the fact that there is little proof to help this methodology.

E. *Complex Carbohydrates in Diabetes*

Diabetic's dietary practices are basically affected by social foundations. Concerning every one of the components of dietary practices, there were huge positive connections between information in regards to diabetic eating routine and dietary practices. Information was a remarkable factor identified with dietary practices control [19]. Instant food mixes have quite significantly proven to be of great use when it comes to saving time. However, the variety in food mixes should not be constricted to the normal delicacies, but also different delicacies from different part of the country. Moreover, an instant food with millets as the basic ingredients is not a common occurrence.

Dietary fibre addresses an order of complex starches that have solid support for the executives of such metabolic perspectives as satiety, weight the board, glucose digestion, and glucose control. Non-absorbable dissolvable and insoluble starches are fundamentally gotten from plant sources, like natural product, vegetables, vegetables and grains. Regular types of sugar acknowledged as dietary fibre incorporate lignin, chitin (from growths), gelatin, beta-glucan, safe starch, inulin, oligosaccharides, and an assortment of gums. Each of these has special underlying qualities and organic capacities.

Carbohydrate food varieties are delegated low or high glycaemic record (GI) contingent on the pace of their assimilation and retention and their relative effect on raising blood glucose fixation [25]. GI of a food is estimated by contrasting the ascent in blood glucose with that of a reference food (glucose or white bread) containing a similar sum (25 g or 50 g) of sugar devoured by similar individual on two unique days. This attribute of carb food varieties is dictated by the sub-atomic construction of their starch. Starches with high amylose are gradually processed and retained [18]. Retro-gradation, which is quicker in amylose, further lessens edibility of the starch, delivering some starch into safe starch. Safe starch doesn't hydrolyse to deliver glucose. Consequently sugar food varieties with high amylose and safe starch content forestall unexpected increment of blood glucose after utilization and are named having a low GI [25].

Millets are devoured by more than 1/3rd of the total populace. It is the sixth cereal harvest as far as world's horticultural creation. Millets are Jowar (Sorghum), Sama (Little millet), Ragi (Finger millet). Millets like pearl and samo have high amount of fat in them as compared to finger millet, which has the most minimal fat. Millets are utilized as food and are broadly utilized in rustic zones. They have been utilized all around the world and are quite a history in itself. The Romans and the Greeks made many dishes out of millets and enjoyed it. A major share of millets is delivered to the whole world by China, India, Greece, Africa and Egypt. However, even in provincial regions a few millets are utilized for burning-through like Finger millet, Sorghum, and so forth and the excess are utilized as creature feed. Millet are having stunning qualities in their nourishment content. Millets assume a critical part in conventional weight control plans in numerous districts [15]. In numerous provinces of India they are utilizing various assortments of millets separately. Every one of the millets are three to multiple times higher in their sustenance content when contrasted with wholesome substance of generally utilized rice and wheat. Wheat and rice furnish with security of food while millets give numerous protections like food, wellbeing, nourishment, business, creature feed and so on, making millets as yield of farming security.

Millets have a huge job in the diets of numerous locales all through the country. Millets have different beneficial properties like dry season safe, great yielding in zones where water is restricted and they have great nutritive qualities. Millet are rich with phytochemicals, in any case, the sorts and sum present change significantly between and inside various species. The handling strategies utilized for the grains, such as dehulling and decortication, malting, maturation and warm preparing, and so on, have influence on the amount of phenolics present, generally helps in diminishing them. Hence the phytochemical levels in millet food sources and refreshments are impressively lower than in the other oat grains. There are confirmations appearing, millet food varieties and drinks have useful and health-promoting impacts, explicitly hostile to diabetic, against stoutness, cardiovascular illness, because of the activities of these phytochemicals and assume a part in body invulnerable frame-work [15].

Starch is a carbohydrate that gives truly necessary energy to everyday exercises. It is basically made out of direct amylose including α -1,4 connected D-gluco-pyranosyl units and extended amylopectin which is additionally interconnected by α -1,6 glycosidic linkages [20]. According to their digestibility, starches are divided into three types; rapidly digestible starch, slowly digestible starch and resistant starch [21].

➤ *Finger Millet*

Finger millet (*Eleusine coracana*), one of the millets which is known for a few medical advantages and a portion of the medical advantages are credited to its polyphenol and dietary fibre substance. Finger millet (Ragi) is a crop which has a very potent role in providing nutrients to the body, however it is lowly consumed as compared to the often consumed cereals [2]. Finger millet is an arsenal of beneficial properties which includes carbohydrates, proteins, dietary fibres, minor and major nutrients, and phytochemicals essential for human health [2]. Finger millet has a humongous source of nutrients and plays a vital role in lowering diabetes and obesity [1]. It is a significant staple food in India for individuals of low pay gatherings. They are likewise perceived for their wellbeing valuable impacts, for example, hostile to diabetic, against tumorigenic, atherosclerogenic impacts, cell reinforcement and antimicrobial properties. This survey manages the idea of polyphenols and dietary fibre of finger millet and their job concerning the medical advantages related with millet. Late reports show that hyperglycaemia could incite non-enzymatic glycosylation of different proteins, bringing about the advancement of on-going inconveniences in diabetes [22]. Subsequently, control of postprandial blood glucose flood is basic for therapy of diabetes and for decreasing on-going vascular intricacies which can be constrained by admission of high complex starch and high fibre diet. The millet diet is known for high supporting force and is generally suggested for diabetics. Exploration has shown that the starches present in finger millet are gradually processed and absorbed than those present in different grains [23].

➤ *Raw Banana Flour*

Crude banana, a few examinations have recommended that utilization of unripe bananas applies a helpful impact on human wellbeing, related with un-digestible parts [6]. Raw Banana flour is a starchy food that encloses a high proportions of indigestible mixtures like resistant starch (RS 17.5%), and non-starch polysaccharides, remembered for its dietary fibre content [7]. Low natural

product utilization is one of the primary danger factors for expanded mortality additionally builds the danger of persistent illnesses and chronic weakness. Along these lines, the normal utilization of natural products can diminish the occurrence of certain sicknesses like diabetes, cardiovascular and gastrointestinal illnesses, and a few variations of cancer [8].

➤ *Gram Flour*

Rich in fibre and other supplements, Besan is gram flour or chickpea powder. LOW GLYCEMIC INDEX (GI) food varieties have been appeared to improve glycemic control in patients with type 2 diabetes mellitus. Legumes, otherwise called pulses (dried beans, chick peas, and lentils), were the food sources perceived as having low GI values and have been suggested in numerous public DM rules [10]. The supplementation of wheat flour with chickpea flour would enormously improve the protein dietary nature of bread. This high protein content in the chickpea enhanced breads would be of wholesome significance in most non-industrial nations, like Africa and Asia, where numerous individuals can barely manage the cost of high foreboding food sources in view of their costly expenses. Kabuli seeds are huge and light shaded beans, and are described by their bigger size, slam head shape and low fibre content. The seeds of cultivars are little, wrinkled at mouth, with earthy coloured, dark or green tone [24]. Chickpeas are a good source of dietary fibre, and of the vitamins, minerals and essential amino acids [25]. The starch content of chickpea and wheat flours are 51 % and 64 %, respectively [26]. Chickpea flour consists of 58% total starches, 21% protein, dietary fibre (12.4%), and minerals (3.2%). Contingent upon chickpea assortment, it can have 40% of safe starch and up to 60% of Slowly Digestible Starch (SDS) [10], bringing about a low glycaemic file. Consequently, it is a fascinating choice for customers with diabetes mellitus, cardiovascular illnesses, and metabolic disorder [44].

➤ *Sorghum Flour*

Sorghum also known as Jowar in India is used as a decoction and is utilized as a demulcent and diuretic for treating kidney and urinary objections. Sorghum is one of the old cereal grain and it is a staple harvest in India likewise in Africa. It is considered as a protected food grain elective for individuals with celiac illness and gluten lack of care. Atomic proof shows that sorghum grain is totally sans gluten, and gives medical advantages that make it a decent expansion to any eating regimen. Gluten, is a protein which is available ordinarily in grains like wheat, grain and rye that gives them the chewy, springy quality when prepared into breads or pastas. Sorghum utilized as Wheat trade for Breads, Pastas, and so on It is additionally showed that Sorghum or jowar helps in weight reduction. Contrasted with significant cereals like rice and wheat, jowar has a high extent of calcium. It is additionally loaded with iron, protein and fibre. Specialists have tracked down that an ordinary sorghum wax is rich in policosanols which helps in decreasing the degrees of cholesterol. Being a without gluten grain, it is likewise very much wanted by the individuals who can't endure wheat-based items [16]. Of late, in occidental nations, the utilization of sorghum in human utilization has expanded because of its potential role in decreasing the danger of creating persistent sicknesses (stoutness, cardiovascular infections, hypertension, diabetes, and cancers.) [13].

Sorghum grain has been accounted for to have the most minimal crude starch absorbability due to restrictions in openness to starch brought about by endosperm proteins. The edibility of the starch, subject to hydrolysis by pancreatic compounds, decides the available energy substance of oat grain. The compound idea of the starch, especially the amylose and amylopectin content, is one more factor that influences its edibility. The starch absorbability was accounted for to be higher in low-amylose, i.e., waxy, sorghum than in ordinary sorghum [28].

➤ *Fenugreek*

Fenugreek (*Trigonella foenum-graecum*) is a vegetable and it has been utilized as a zest all through the world to upgrade the tactile nature of food sources. It is known for its restorative characteristics like antidiabetic, anticarcinogenic, hypocholesterolemic, cancer prevention agent, immunological activity and so on. Adjacent to its therapeutic ability, it is additionally utilized as a piece of different food item improvement as food stabilizer, cement, and emulsifying specialist. All the more critically it is utilized for the advancement of solid and nutritious expelled and pastry shop item [39]. Fenugreek is a conspicuous spice in the acts of Ayurvedic medication. Fenugreek, with a variety in its structures and methods of utilization, has inspired its potential medical advantages as a useful food as of late, which as of not long ago has been a piece of the customary arrangement of restoring skin conditions and numerous different sicknesses [40]. In India, fenugreek has been taken as a restorative plant since old occasions and is viewed as a guard to human wellbeing. In food, fenugreek seeds are added as additives in pickles as they are plentiful in nutrient E. Likewise, dried leaves of fenugreek are utilized for seasoning vegetable dishes, fish, and meat [41]. A customary solution to fix fever is a home grown tea made with fenugreek, nectar and lemon. Fenugreek fibre could be compelling for relieving clogging and stops the development of diverticulosis. Fenugreek has been generally utilized as a solution for consumes, skin inflammation, abscesses, and gout. It prompts labour as it animates uterine withdrawal. Grown seeds of fenugreek and micro-greens are utilized in plates of mixed greens. Fenugreek seeds are wealthy in lysine, 1-tryptophan, and trigonelline, though fenugreek leaves are a rich wellspring of vit-K [42].

Fenugreek beneficially affects purifying the blood and as a diaphoretic it can bring about perspiration and helps in detoxing the body. Because of sharp smell of fenugreek, that is smelt on the skin and in under-arm sweat. Fenugreek is likewise known for its lymphatic purifying movement through its crucial job is to inundate the cells with supplements and to eliminate harmful materials, dead cells and protein waste from the body. a block in any part of the human body can subject the body towards poor circulation of fluids and blood, oedema, pin, loss of energy and ailments. Fenugreek keeps up bodily fluid states of the body, generally the lungs, by assisting with clearing blockage. It additionally goes about as a throat cleaning agent and bodily fluid dissolvable that likewise

facilitates the inclination to hack. Water in which seeds of fenugreek are soaked in, aides in relaxing and dissolving, collecting and solidifying the majority of cell flotsam and jetsam. Fenugreek has been utilized to assuage colds, bronchial grumblings, flu, asthma, catarrh, clogging, sinusitis, pleurisy, pneumonia, sore throat, laryngitis, roughage fever tuberculosis and emphysema [39]. Dietary fibre from fenugreek blunts glucose after a supper. The instruments for these impacts have not been completely explained. Fenugreek seeds contain 45.4% dietary fibre (32% insoluble and 13.3% soluble), and the gum is made out of galactose and mannose. The last mixtures are related with diminished glycaemic impact. The hypoglycaemic impact of fenugreek has been particularly recorded in people and creatures with type 1 and type 2 diabetes mellitus [43].

F. Reasons for Popularity of Instant Food Products

Expansion of urban cities because of the increase in population, blooming industries, diminishing time from people live; all have contributed for the popularity of instant foods. Since industrialisation, the working class is pulled in towards the industrial jobs for better remittances, in this way prompting deficiency of house keeper workers. Many women have engaged themselves in office work therefore, to keep one-self and the family satiated instant food have taken a great portion of the kitchen pantry. Nuclear families, prior there were huge families, in this way bigger amount of food was utilized to be readied because of rise of family unit, gradually and steadily every family begun utilizing instant food items to set aside time and cash. Costs of raw materials, the costs of crude materials likewise expanded, to set aside cash individuals utilized the moment food items to remain a sound eating regimen. Pay Working women now-a days, ladies' are particularly propelled towards their functioning interaction. Consequently, they don't have a lot of time to prepare food for extended periods of time; subsequently they select instant food varieties which can decrease their cooking endeavours. Standard of living in this day and age, the expectation for everyday comforts of individuals because of ascend in the pay level, has changed their outlook of dietary patterns. Significant changes popular for rural and food items are being filled by developing populaces, rising wages, and evolving ways of life. These change where and how food items are developed, handled and disseminated; moreover, new friendly and natural concerns are bringing pressure for more change. Request, not stockpile, drives item contributions with innovation fitting items to address buyer issues and complex plans of action conveying them to the client in a safe way [16].

G. Shelf Life of a Product

Shelf life of a food product as defined as the time under characterised storage conditions during which; food stays safe, holds preferred synthetic, physical and biological attributes. Oxidative responses are the most incessant occasion prompting the finish of the shelf life of microbiologically stable food varieties, like encompassing steady and frozen food sources. Since quality is a unique condition, constantly moving to bring down levels, the life of these items relies upon the oxidation rate and the acceptability of the same. The last is the oxidation level above which the item becomes inadmissible for utilization [38]. Time span of usability in this way, regularly says nothing regarding the wellbeing of the given food item.

An item that passes its timeframe of realistic usability date doesn't quickly get risky for human utilization, but instead no longer adjusts to a bunch of given quality boundaries. There are food items that can, whenever kept well, stay new for quite a long time after their time span of usability date subject to no bacterial pollution purified milk, for model. Yet, for certain items, especially where improvement of microorganisms can occur, leaving food varieties past their time span of usability date can bring about the food being hazardous to eat and lead to food contamination. These items regularly have their timeframe of realistic usability and expiry dates to relate [45].

Evaluation of shelf life in ambient conditions; When there is no need to accelerate timeframe of realistic usability testing, the last can be conveyed out under conditions re-enacting as intently as conceivable those really experienced by the item on the racks. The essential prerequisite is that capacity conditions (e.g., temperature, dampness, oxygen focus, light) during timeframe of realistic usability testing are held consistent and equivalent to the traditional stockpiling temperature of the item [38].

Oxidation regularly continues piecemeal gradually under genuine capacity conditions. Consequently, it is helpful to speed up time span of usability tests by testing food under natural conditions that accelerate food quality disintegration and afterward extrapolating the outcomes to milder conditions normally experienced by the item. This sort of test is by and large called sped up timeframe of realistic usability test (ASLT) [46]. Albeit the investigation of food oxidative security as a component of various ecological elements is broad, results are hard to decipher as far as time span of usability information in light of varieties in test conditions and worthiness limit definitions. It ought to be brought up that by and large the lipid solidness tests directed under outrageous natural conditions (i.e., high temperatures, high oxygen focus) have an alternate certainty as for a time span of usability study. The previous are by and large set up to assess the weakness of a sample to oxidation and the point is to anticipate its soundness as a component of various factors. Nonetheless, a time span of usability prescient investigation has the goal to accurately gauge the item timeframe of realistic usability under genuine capacity conditions.

CHAPTER THREE METHODOLOGY

A. Preparation of Flour

The materials (finger millet, besan, raw banana flour, jowar) for the preparation of the mix were brought and the amount to be used was analysed using RSM. Reaction surface approach (RSM) is a compelling test plan system, which can investigate the associations between free factors and at least one ward factors and foresee their reactions under indicated sets of conditions [35]. RSM is an assortment of factual and numerical methods established on the attack of a polynomial model to the information that must portray the conduct of an informational index with the reason of making measurable expectations. The methodology is helpful for optimizing, planning, creating, and improving processes where a reaction or reactions are influenced by several variables [36]. All the raw materials were collected as flours. According to response surface methodology, the optimized values for the ingredients was followed to formulate the flour mixture. Formulated sample was packed in poly-ethene pouches for analysis. Proximate analysis and shelf life study of the product was done according to standard procedures.

B. Determination of Moisture Content

Moisture content alludes to the quantity of water particles that become consolidated into a food item. Moisture content impacts the taste, surface, weight, appearance, and timeframe of realistic usability of staples. Indeed, even a slight deviation from a characterized standard can unfavourably affect the actual properties of a food material. For instance, substances which are too dry could influence the consistency of the final result. Then again, overabundance dampness may make food material agglomerate or become caught in the channelling frameworks during creation. Additionally, the pace of microbial development increments with complete water content, conceivably bringing about ruined clusters that should be discarded. Be that as it may, water is likewise a reasonable fixing adding to the heaviness of the eventual outcome. Subsequently, getting an ideal scientific incentive for dampness is of incredible financial significance to a food maker. Therefore, food investigators take part in the sensitive adjusting of dampness and all out solids to guarantee reliable item quality, wellbeing, moisture can go into an item in various ways. moisture content of the food material is imperative to consider the food is reasonable before the utilization, since dampness content influences the physical and chemical aspects of food which relates with the newness and strength for the capacity of the food for an extensive stretch of time and the moisture content decides the real nature of the food before utilization and to the resulting preparing in the food area by the food makers.

➤ Materials Required:

- Petri dishes, hot air oven, sample, weighing balance, spatula.

➤ Procedure:

- A petri dish was weighed and weight noted.
- 5g of sample was reweighed accurately and mentioned w1.
- The sample was kept in a hot air oven for 8 hours at 110 degrees.
- The dish was removed and cooled, weight was noted and mentioned w2.
- This procedure was repeated until a constant weight was obtained.

➤ Calculation:

- Moisture content of the sample was obtained using the following formula [11].
- **% of moisture = $(w2-w1/\text{weight of the sample used}) \times 100$**
- Where, W1 = initial weight (weight of the sample before losing moisture)
- W2 = final weight (weight of the sample after losing moisture)

C. Determination of Ash Content

Deciding the ash substance of a food is essential for general investigation for nourishing assessment and it is a significant quality characteristic for some food fixings. Additionally, ashing is the initial phase in the readiness of an example for explicit natural investigation. This lab practice utilizes the dry ashing strategy with a stiffler heater to decide the debris substance of an assortment of food items. Dampness content assurance is additionally included so debris content information can be communicated on both a wet weight premise and a dry weight premise [27]. Ash content addresses the absolute mineral substance in food sources. Deciding the debris substance might be significant for a few reasons. It is a piece of general examination for wholesome assessment. Ashing is the initial phase in setting up a food test for explicit basic investigation. Since specific food sources are high specifically minerals, debris content gets significant. One can typically anticipate a consistent essential substance from the debris of creature items, yet that from plant sources is variable.

➤ *Materials Required:*

- Petri dishes, weighing balance, flour sample, crucibles, muffle furnace, weighing balance, spatula.

➤ *Procedure:*

- A crucible was weighed and weight noted down.
- 10g of sample was added into the crucible and was mentioned w1.
- The crucible with the sample was charred and then transferred into a muffle furnace and the temperature of the muffle furnace was set to 550 degrees.
- The sample was heated for 8 hours.
- The crucible was removed and set aside to cool down.
- The weight of the crucible was noted down and mentioned w2 [11].

➤ *Calculation:*

- Ash content of the sample was obtained using the following formula:
- **% ash = (w2 – w1/ weight of the sample)*100**
- Where, W1 = initial weight (weight of the sample before ashing)
- W2 = final weight (weight of the sample after ashing)

D. Determination of Crude Fibre

Fat-free organic substances in food items which are insoluble in acid and alkaline media are called crude fibre. Crude fibre is a measure of the quantity of indigestible cellulose, pentosans, lignin, and other components of this type in present foods. It is the residue of plant materials remaining after solvent extraction followed by digestion with dilute acid and alkali. These components have little food value but provide the bulk necessary for proper peristaltic action in the intestinal tract [26]. Dietary fibre is that piece of plant material in the eating routine which is impervious to enzymatic assimilation which incorporates cellulose, non-cellulosic polysaccharides, for example, hemicellulose, pectic substances, gums, adhesives and a non-carb part lignin. The eating regimens wealthy in fibre like grains, nuts, foods grown from the ground positively affect wellbeing since their utilization has been identified with diminished rate of a few illnesses [29]. A fibre rich eating routine is lower in energy thickness, regularly has a lower fat substance, is bigger in volume and is more extravagant in micronutrients. This bigger mass of food takes more time to eat and its quality in the stomach may bring a sensation of satiety sooner, albeit this sensation of totality is present moment [30]. It is also said to have the ability to control diabetes, both mild and severe.

➤ *Materials Required:*

Sulphuric acid, flour sample, filter paper, hot air oven, crucible, muffle furnace.

➤ *Reagents*

- Dilute Sulphuric acid – 1.25% (w/v) accurately prepared
- Sodium Hydroxide solution - 1.25% (w/v) accurately prepared
- Ethyl alcohol – 95% by volume
- Petroleum ether

➤ *Procedure:*

- Mix 200ml of sulphuric acid of 1.25% concentration with 2 g of flour sample and boil for 30 min.
- Filter out the solution using a filter paper and wash with hot water to decline the level of acidity.
- Test the acidity using a pH paper.
- Mix the residue from the filter paper with 1.25% of sulphuric acid.
- Boil for 30 minutes filter and wash with hot water.
- Dry the remaining mixture in a hot air oven for 1 hour.
- Weigh the sample and transfer into a crucible.
- Note down the weight as w1.
- Shit the sample (crucible) into a muffle furnace to be heated at a set temperature of 550 degree Celsius for 6 hours.
- Cool off the sample and note down the weight as W2 [3].

➤ *Calculation:*

- Percentage of crude fibre was obtained using the formula:
- % of crude fibre = $(w_1 - w_2 / \text{weight of the sample used}) * 100$**

E. Determination of Fat

Unsaturated fats are the essential segment of lipids and play a crucial job in organic frameworks. Unsaturated fats can exist as free forms and bound structures, like cholesterol and phospholipids [34]. Petroleum and ethyl ether are the most commonly used solvents however, pentane and hexane are also used in cold extraction of fat in some food products [5]. For the investigation of unsaturated fats organization, test arrangement is a significant task. It can be done by changing over the unsaturated fats into the methyl esters followed by gas chromatography (GC) [34].

Therefore, the sample was subjected to cold extraction process for the analysis of fat. 10g of sample was weighed into a conical flask.

➤ *Materials Required:*

- n-hexane, flour sample, hot plate, filter paper, beakers, desiccator.

➤ *Procedure:*

- Add 50 ml of n-hexane solution to the sample into a beaker.
- Cover the solution and leave it for 24 hours for the separation of fat from the flour sample.
- Weigh a beaker accurately and record the weight as W₁.
- Filter out the sample into the beaker.
- Heat the beaker till all the n-hexane solution dries off and cool off in a desiccator.
- Weigh the beaker again and note down the weight as W₂.

➤ *Calculation:*

- Percentage of fat was obtained using the following formula: [4]
- % of fat = $(w_1 - w_2 / \text{weight of the sample}) * 100$**

F. Determination of Carbohydrate

Carbohydrates are quite possibly the main fixings in food sources and raw materials. They may happen normally or be added to food items to provide nutrients and, much of the time, to improve the surface and by and large nature of a food item [31]. On the off chance that starch isn't required for endurance, it brings up issues about the sum and kind of this macronutrient required for ideal wellbeing, life span, and maintainability. This audit centres around these flow debates, with uncommon spotlight on stoutness, diabetes, cardiovascular illness, disease, and early passing [32]. Food carbohydrates incorporate a wide scope of macromolecules that can be arranged as per their compound design into three significant gatherings: low atomic weight mono and disaccharides, middle sub-atomic weight oligosaccharides and high sub-atomic weight polysaccharides. They can likewise be named basic or complex starches. Basic carbs are mono-saccharides and disaccharides while complex starches are made up of numerous mono-saccharides like starches and fibre (polysaccharides) [33].

➤ *Procedure:*

- Carbohydrate content in sample is estimated by subtractions method. [11]

➤ *Calculation:*

- Carbohydrate = Total Solids - (Fat + Protein + Ash)**

G. Determination of Protein➤ *Principle:*

The protein content of the food sample is analysed from the organic nitrogen by following kjeldhal method. Different nitrogenous compounds are converted into ammonium sulphate by boiling with concentrated sulphuric acid. The ammonium sulphate shaped is disintegrated with a soluble base (NaOH) and the alkali freed is caught up in overabundance of standard solution of corrosive and afterward back titrated with standard alkali.

➤ *Materials Required:*

Kjeldahl digestion flask - 500 or 800 mL , Kjeldahl distillation apparatus, - same digestion flask fitted with rubber stopper through which passes lower end of efficient rubber bulb or trap to prevent mechanical carryover of NaOH during distillation or apparatus as shown below, Conical flask, 250 mL d. Burette 50 ml.

➤ *Reagents:*

- Concentrated Sulphuric acid
- b.45% Sodium Hydroxide - Dissolve 450 g of Sodium hydroxide pellets in 1000 mL water
- Standard Sulphuric acid solution – 0.1 N
- Standard Sodium Hydroxide solution – 0.1 N
- Methyl red indicator solution - Dissolve 0.5 g methyl red in 100 mL of alcohol

➤ *Procedure:*

The protein content is resolved from the natural Nitrogen content by Kjeldah method. The protein content of the flour was obtained by using the following formula [11]:

- Weigh rapidly around 1-2 g of the example and move to a 500 or 800 mL Kjeldahl flask taking consideration to see that no segment of the example sticks to the neck of the flask.
- Add 0.7 g of Mercuric oxide, 15 g of Potassium Sulphate and 40 mL of concentrated sulphuric corrosive (Mercuric oxide is added to expand the pace of natural breakdown during acid processing. Due to ecological/security worries over taking care of and removal of mercury, copper sulphate can be utilized. This is significant from wellbeing perspective as mercury fumes may escape into the climate during the refining measure.
- Add a few glass dabs. Spot the jar in a slanted position on the substitute the processing chamber and overview.
- Warm the cup delicately at low fire until the underlying foaming stops and the blend bubbles consistently at a moderate rate. During warming pivot the cup a few times.
- Keep warming for about an hour or more until the shade of the overview is light blue.
- In the event that dark specs are available after 30 minutes of assimilation, wrap the vessel with aluminium foil and save for 2-3 minutes. By doing this dark specs would drop down from the dividers in the absorption combination.
- In the event that the specs are as yet present, eliminate the vessel from warmth and permit to cool for 10 minutes.
- Don't change the warmth force in the entire cycle.
- Then again, hardly any drops of water may likewise be pour down across the side of the jar.
- Cool the overview and add gradually 200 ml of water.
- Cool, add a piece of granulated Zinc or hostile to knock granules and cautiously pour down the side of the jar adequate Sodium Hydroxide arrangement (450gm/L) to make the substance unequivocally soluble (around 110 mL) prior to blending the corrosive and antacid layer.
- Associate the jar to a refining contraption joining a proficient glimmer head furthermore, condenser.
- To the condenser fit a conveyance tube which plunges just beneath the outside of the pipetted volume of standard corrosive contained in a tapered cup beneficiary.
- Blend the substance of the absorption jar and bubble until 150 mL have refined into the recipient.
- Add 5 drops of methyl red marker and titrate with normalized 0.1 N Sodium Hydroxide solution.

➤ *Calculation:*

- $\text{Nitrogen (\%)} = 100 \times 0.0014 \square W (A - B)$
- Where, A = Volume in ml N/10 NaOH in blank determination
- B = Volume in ml of N/10 NaOH in the rest
- W = Weight in mg of sample taken
- **The protein per cent was calculated by multiplying nitrogen percentage with factor 6.25.**
- **Protein (%) = Percent total nitrogen \times 6.25**

H. Evaluation of Acidity and Peroxide Value of the Product.

The time span of usability of food items is a significant element for the two producers and buyers. The main factor for time span of usability assessment of food is wellbeing, trailed by quality including physical, synthetic, and sensorial properties. Time span of usability studies can give significant data to makers and shoppers to guarantee an excellent item during the capacity time frame. By and large, long-timeframe of realistic usability considers do not fit with the speed necessity. On the other hand, sped up examinations have been applied [35]. Shelf life of a food product as defined as the time under characterised storage conditions during which; food stays safe, holds preferred synthetic, physical and biological attributes Oxidative responses are the most incessant occasion prompting the finish of the rack life of microbiologically stable food varieties, like encompassing steady and frozen food sources. Since quality is a unique condition, constantly moving to bring down levels, the life of these items relies upon the oxidation

rate and the acceptability of the same. The last is the oxidation level above which the item becomes inadmissible for utilization [38]. In this article, the essential ideas and dynamic responses are talked about alongside sped up time span of usability re-enactment. The product was kept to be analysed for its shelf life under ambient and accelerated conditions (Table.2, 3 and 4). Titration was carried out on the flour samples to analyse the change in acidity and rancidity levels.

➤ *Ambient Condition:*

The prepared flour sample was kept in a desiccator for 45 days at 27 degree Celsius.

➤ *Accelerated Condition:*

The prepared flour sample was kept in a desiccator with 90% RH inside an incubator maintaining a temperature of 38 degree Celsius for 35 days.

➤ *Acidity Test*

The acid value of any food article is defined as the number of milligrams of potassium hydroxide needed to neutralize the free fatty acid present in one gram of fat. It is a relative proportion of rancidity as free fatty acids are regularly formed during deterioration of oil glycerides. The acid is likewise communicated according to penny of free greasy acids determined as oleic acid [37].

➤ *Materials Required:*

Phenolphthalein, conical flasks, beakers, heating plate, filter paper, sodium hydroxide, ethanol, burette, burette stand, funnel, dropper, weighing balance.

➤ *Reagents:*

- Standardisation of sodium hydroxide: Sodium hydroxide was standardised by adding 1g of NaOH (sodium hydroxide) into 250 ml distilled water.
- Standardisation of phenolphthalein: 50 ml ethanol+ 5-6 drops of phenolphthalein

➤ *Procedure:*

- Sodium hydroxide was standardised by adding 1g of NaOH (sodium hydroxide) into 250 ml distilled water.
- Weigh 10g of sample 250 ml conical flask using weighing balance.
- Add ethanol and standardised phenolphthalein indicator (50 ml ethanol+ 5-6 drops of phenolphthalein) in a conical flask.
- Heat the conical flask on a heating plate for 10 minutes.
- After 10 minutes, remove the conical flask from the heating plate and filter the solution using a funnel and a filter paper.
- Add 2-3 of phenolphthalein to the filtered solution.
- Use 0.1 N NaOH (sodium hydroxide) solution for titration.
- Note down the initial value from the burette.
- Titrate the solution until the appearance of light pink colour.
- Note down the final value on the burette.
- Titrate till common values are acquired.

➤ *Precautions:*

- Burette should be clamped erect on the burette stand on a flat surface.
- Note down the reading instantly at the moment of colour change.
- The sample should be weighed properly.
- Do not leave the ethanol bottle open.

➤ *Peroxide Test*

- Peroxide value can be defined as the degree of oxidation subjected in a sample of oil [37].

➤ *Materials Required:*

- Burette, burette stand, conical flasks, measuring flasks, beakers, weighing balance, measuring cylinder (10ml), dropper.

➤ *Reagents:*

- Indicator used- potassium iodide
- Chemical used- concentrated hydrochloric acid, sodium thiosulphate, potassium iodide, starch solution.

➤ *Chemical Preparation:*

• *Preparation of 1% Starch Solution:*

- ✓ Take 50ml of distilled water.
- ✓ Take 0.5g starch and add it into hot water.
- ✓ Stir the solution till the starch molecules have dissolved.

• *Preparation of Potassium Iodide Solution:*

- ✓ In a beaker, take 100 ml of distilled water and add 15 g of potassium iodide and mix well.

• *Preparation of Sodium Thiosulphate Solution:*

- ✓ Dissolve 2.5 g of sodium thiosulphate crystals in 100 ml distilled water.

• *Preparation of Potassium Dichromate Solution:*

- ✓ Take a part of potassium dichromate in a petri dish.
- ✓ Keep it inside a hot air oven set at 110 degree Celsius for 30 min.
- ✓ Retrieve the sample from the oven and keep it aside in a desiccator to cool off.
- ✓ In a conical flask, weigh the dried potassium dichromate powder anywhere between 0.16g to 0.22 g.
- ✓ Into the conical flask add 25 ml of distilled water and stir till the powder dissolves completely.
- ✓ Add 5ml of concentrated hydrochloric acid into the conical flask contained the dried potassium dichromate solution.
- ✓ Add 20 ml of potassium iodide solution into the conical flask and mix for 5 minutes continuously.

• *Preparation of Acetic Acid and Chloroform Solution*

- ✓ In a measuring flask, take 90 ml of acetic acid and 60 ml of chloroform.
- ✓ Mix well for 5 minutes.
- ✓ Cover the solution.

• *Standardisation of Sodium Thiosulphate*

- ✓ Titrate sodium thiosulphate with the above prepared solution (potassium dichromate and potassium iodide).
- ✓ Add 1 ml of 1% starch solution in a conical flask till blue colour.

➤ *Procedure:*

- Take 10 g of sample in a conical flask.
- Measure 30 ml of acetic acid and chloroform mixture in a measuring flask.
- Pour the mixture into the conical flask and shake well.
- Add 1 ml of saturated potassium iodide solution (2ml water + potassium iodide) into the conical flask and shake well.
- Add 30 ml of distilled water into the conical flask and shake for 1 minute until it is mixed well.

➤ *Titration:*

- Take 0.1N sodium thiosulphate in a burette.
- Note the initial weight.
- From the prepared sample solution, take 20 ml of sample into another conical flask.
- Add 0.5 ml of starch solution and keep it under the burette.
- Start titration, continue until the black colour is removed from the solution.
- Stop titrating when the solution loses black colour, note the final value in the burette.

➤ *Calculation:*

- Peroxide value expressed as milli equivalent of peroxide oxygen per kg sample (meq/kg):
- **PEROXIDE VALUE = $V * N * 100 / WS$**
- Where, V = volume of potassium thiosulphate used.
- N= normality of the solution (potassium thiosulphate)

- WS= weight of the sample

➤ *Precautions:*

- Burette should be clamped erect on the burette stand on a flat surface.
- Note down the reading instantly at the moment of colour change.
- The sample should be weighed properly.
- Store the potassium iodide solution in a dark place.
- Prepare fresh potassium iodide solution for each experiment, do not store and use.
- Wash the burette before use.

CHAPTER FOUR RESULTS

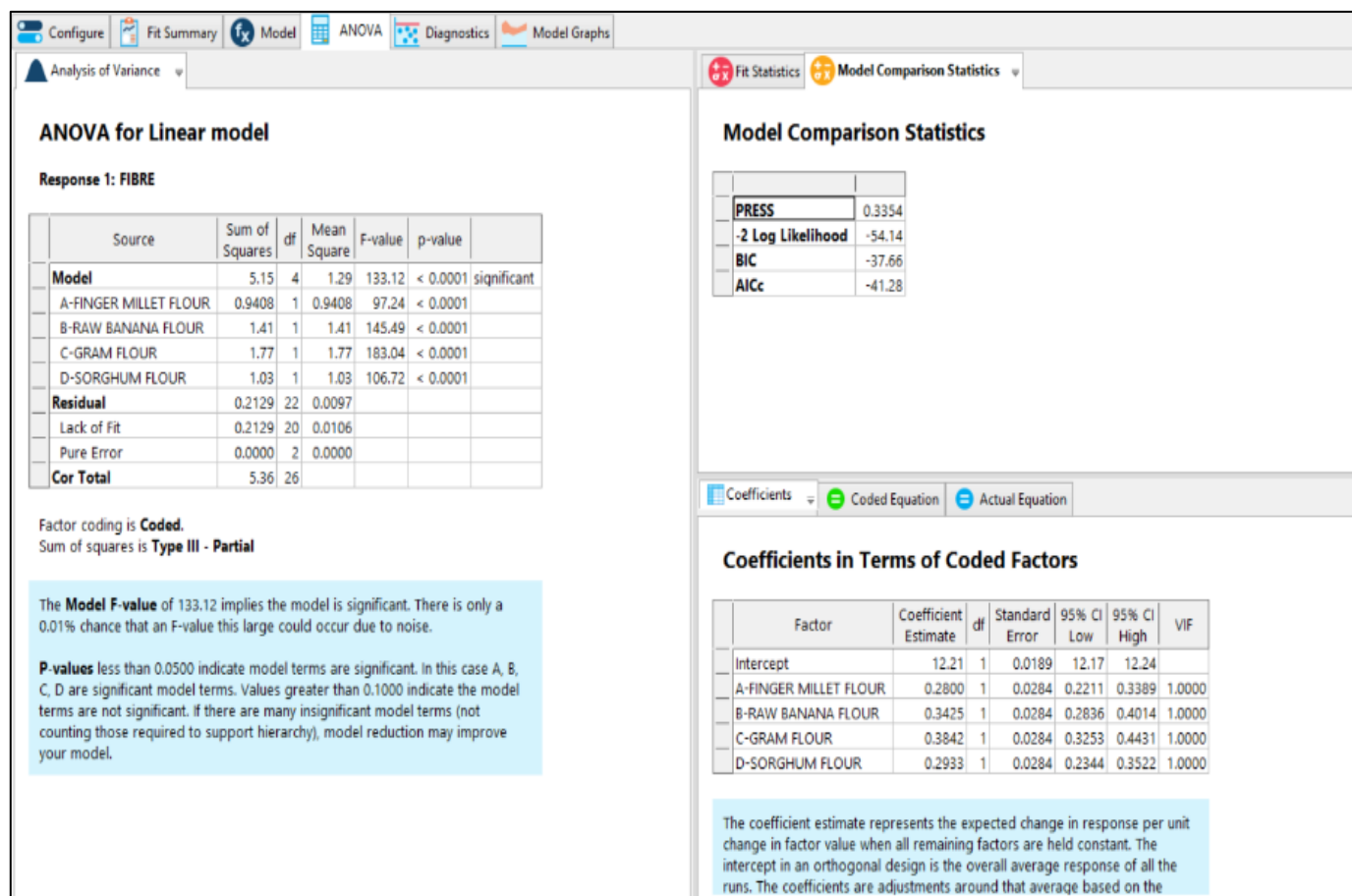


Fig 1: Results of Optimized Combination using Response Surface Methodology

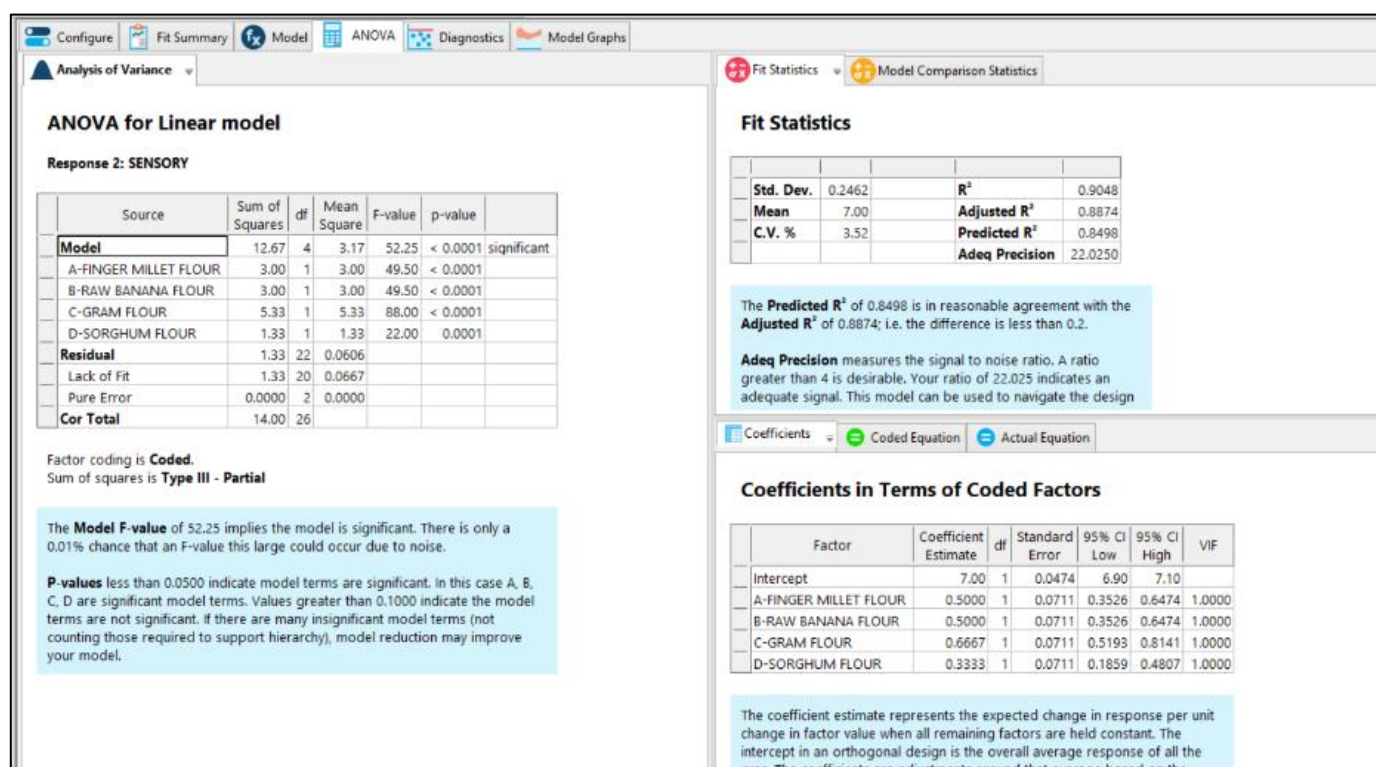


Fig 2: Results of Optimized Combination using Response Surface Methodology

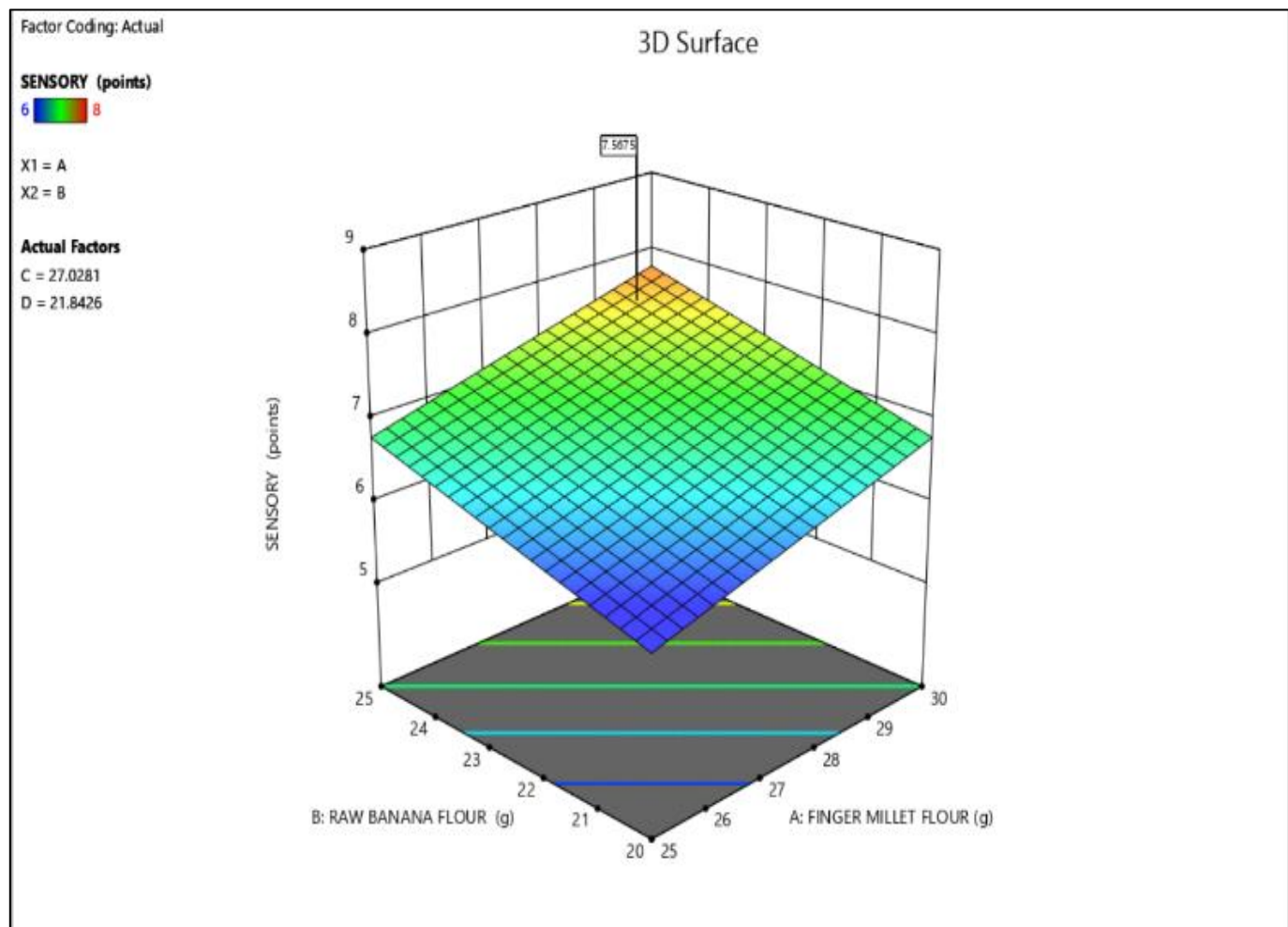


Fig 3: 3-D Model Graph of Optimized Sensory Points

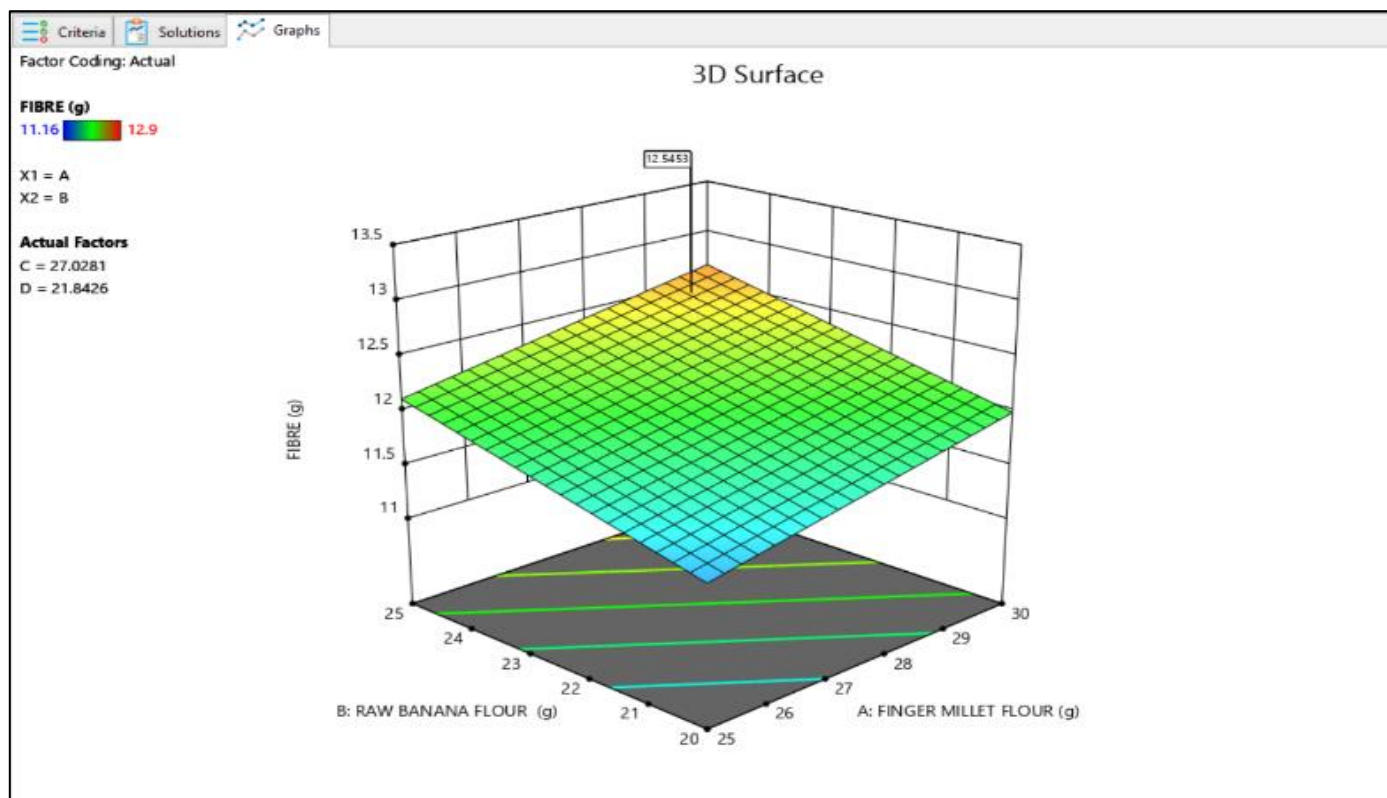


Fig 4 3-D model Graph of optimized fibre value.

A. Tables of Result

Table 1: Proximate Analysis Result of the Flour

CONSTITUENTS	VALUE
MOISTURE	9.45
ASH	4.57
FAT	3.54
PROTEIN	11.9
CARBOHYDRATE	70.4
FIBRE	12.5

➤ *Ambient Condition*

Table 2: Weight Increase in the Samples in Ambient Condition

DAY	WEIGHT	REMARKS
0 th DAY	50.0g	Colour: darker, texture: same
15 TH DAY	50.1g	Colour: darker, texture: same
30 TH DAY	50.6g	Colour: darker, texture: same
45 TH DAY	50.9g	Colour: darker, texture: same

➤ *Accelerated Condition*

Table 3: Weight Increase in the Samples in Accelerated Condition

DAY	WEIGHT	REMARKS
0 th day	50.0 g	Colour: darker, texture: same
7 th day	50.6g	Colour: darker, texture: same
14 th day	50.9g	Colour: darker, texture: same
21 st day	51.3g	Colour: darker, texture: same
28 th day	51.7g	Colour: darker, texture: same
35 th day	51.9 g	Colour: darker, texture: same

➤ *Acidity and Peroxide Value*➤ *Accelerated*

Table 4: Changes in Acidity and Rancidity

DAY	ACIDITY VALUE	PEROXIDE VALUE	FREE FATTY ACID VALUE
0 th day	0.1 %	0	0.05%
7 th day	0.3 %	0	0.15%
14 th day	0.3 %	0	0.15%
21 st day	0.5 %	0	0.25%
28 th day	0.5 %	0	0.25%
35 th day	0.6%	0	0.30%
42 nd day	0.7%	0	0.3 5%

➤ *Ambient*

Table 5: Changes in Acidity and Rancidity

DAY	ACIDITY VALUE	PEROXIDE VALUE	FREE FATTY ACID VALUE
0 th day	0.3%	0	0.15%
15 th day	0.3%	0	0.15%
30 th day	0.4%	0	0.20%
45 th day	0.6%	0	0.30%

The result of proximate analysis of the flour prepared is presented in table no. 1, as follows; the moisture content of the flour is 9.45 g, ash content of the flour is 4.57 g, total fat content of the flour is 3.54g, total protein content of the flour is 11.9g, carbohydrate is 70.4 and fibre is 12.9g respectively. The moisture gain in the sample is presented in table no.2 and 3 respectively.

The moisture gain in accelerated condition was faster than that of ambient condition. The physical changes brought about by the moisture gain in accelerated and ambient conditions were same. The appearance of the flour in terms of its colour was darker

than it was first kept under shelf life study in both the conditions. Throughout the shelf life study the samples remained darker. Texture of the flour remained same; grainy and non-sticky.

The changes in acidity and rancidity of the flour is presented in table no.4 and 5 respectively. The acidity value was obtained in both accelerated and ambient conditions together with the free fatty acid value. Though, the peroxide value of the flour was near to non-existent as there was no rancidity instilled in the flour. The ingredients used in the formulation of the given flour sample had very less fat content.

CHAPTER FIVE CONCLUSION

The formulated product demonstrated minimal variations in tested parameters when subjected to accelerated storage conditions, as compared to those observed under ambient conditions. The ingredients were carefully selected to meet specific dietary requirements of the target population, while remaining suitable for consumption by the general public.

➤ Images

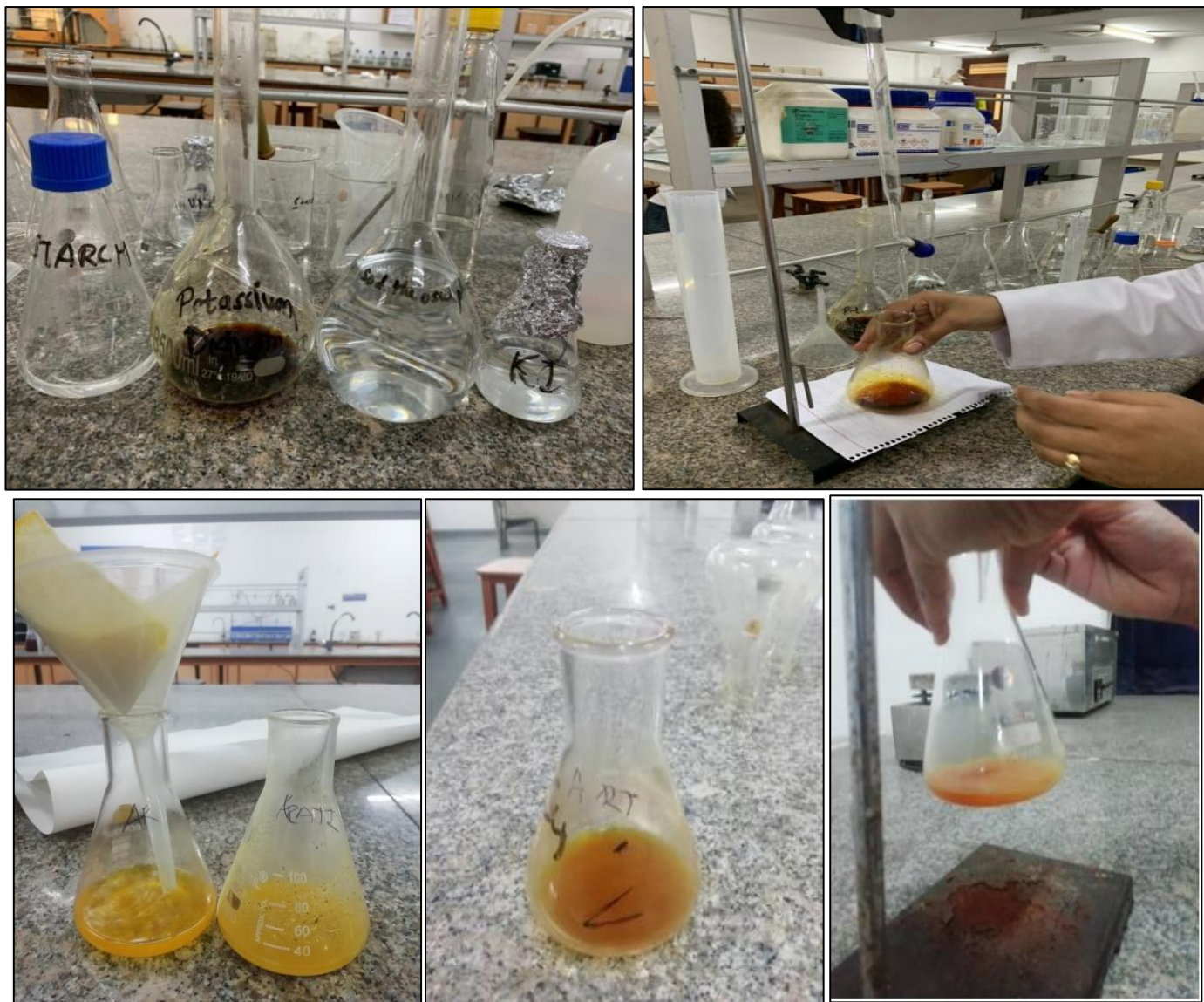


Fig 5: Images of the Process of Titration

REFERENCES

- [1]. Mathanghi S. K., Sudha K. (2012). Functional and phytochemical properties of finger millet for health.
- [2]. Gaertn; Nutraceutical Value of Finger Millet and Their Improvement Using Omics Approaches *Eleusine coracana* (L.).
- [3]. Nwogu Nwanyinnaya, Uwakwe Ezekiel, Ikedinobi Chinelo ; Comparative Proximate Analysis of Maize and Sorghum Bought from Ogbete MainMarket of Enugu State, Nigeria Ape David, Geeth G. Hewavitharana , Dilini N. Perera, S.B. Navaratne, I. Wickramasinghe; Extraction methods of fat from food samples and preparation of fatty acid methyl esters for gas chromatography: A review
- [4]. Dasari, S.R., Goud, V.V., 2013. Comparative extraction of castor seed oil using polar and non-polar solvents. *Int. J. Curr. Eng. Technol* 1, 121–123.
- [5]. Faisant, N., Gallant, D. J., Bouchet, B., & Champ, M. (1995). Banana starch breakdown in the human small intestine studied by electron microscopy. *European Journal of Clinical Nutrition*, 49, 98–104.
- [6]. Maribel Ovando-Martinez a , Sonia Sáyo-Ayerdi b , Edith Agama-Acevedo a , Isabel Goñi b , Luis A. Bello-Pérez a Unripe banana flour as an ingredient to increase the undigestible carbohydrates of pasta Ana Luisa Falcomer,¹ Roberta Figueiredo Resende Riquette,² Bernardo Romão de Lima,¹ Verônica C. Ginani,¹ and Renata Puppim Zandonadi¹Health Benefits of Green Banana Consumption: A Systematic Review
- [7]. Bantle JP, Wylie-Rosett J, Albright AL, et al; American Diabetes Association. Nutrition recommendations and interventions for diabetes: a position statement of the American Diabetes Association. *Diabetes Care*. 2008;31(suppl 1):S61- S78.
- [8]. David J. A. Jenkins, MD, PhD; Cyril W. C. Kendall, PhD; Livia S. A. Augustin, PhD; Sandra Mitchell, RD; Sandhya Sahye-Pudaruth, RD; Sonia Blanco Mejia, MD; Laura Chiavaroli, MSc; Arash Mirrahimi, MSc; Christopher Ireland, BSc; Balachandran Bashyam, PhD; Edward Vidgen, BSc; Russell J. de Souza, ScD; John L. Sievenpiper, MD; Judy Coveney, RD; Lawrence A. Leiter, MD; Robert G. Josse, MD; Effect of Legumes as Part of a Low Glycemic Index Diet on Glycemic Control and Cardiovascular Risk Factors in Type 2 Diabetes Mellitus A Randomized Controlled Trial Manual of methods of analysis of foods food safety and standards Authority of India ministry of health and family welfare government of India New Delhi, 2016 cereal and cereal products.
- [9]. SR Mehta, AS Kashyap, S Das Diabetes Mellitus in India: The Modern Scourge, Nastasia Belc, Liviu Gaceu, Oana Bianca Oprea, Mona Elena Popa; Sorghum Flour: A Valuable Ingredient for Bakery Industry Livia Apostol, Sumit Oberoi and Pooja Kansra; Economic menace of diabetes in India: a systematic review
- [10]. Kimeera ambati and sucharitha KV; MILLETS-REVIEW ON NUTRITIONAL PROFILES AND HEALTH BENEFITS Dr. Santosh k, Yadav Deepika Hassani; STUDY OF CONSUMER BEHAVIOUR TOWARDS INSTANT FOOD PRODUCTS.
- [11]. Akram T Kharroubi, Hisham M Darwish; Diabetes mellitus: The epidemic of the century Waqas Sami, Tahir Ansari, Nadeem Shafique Butt, Mohd Rashid Ab Hamid ;Effect of diet on type 2 diabetes mellitus: A review; Jason Kam, Swati Puranik, Rama Yadav, Hanna R. Manwaring, Sandra Pierre, Rakesh K. Srivastava, Rattan S. Yadav; Dietary Interventions for Type 2 Diabetes: How Millet Comes to Help
- [12]. Englyst HN, Kingman SM, Cummings JH; Classification and measurement of nutritionally important starch fractions.
- [13]. Palanisamy Bruntha Devi, Rajendran Vijayabharathi, Sathyaseelan Sathyabama, Nagappa Gurusiddappa Malleshi, and Venkatesan Brindha Priyadarisini; Health benefits of finger millet (*Eleusine coracana* L.) polyphenols and dietary fiber: a review.
- [14]. Kavitha MS, Prema L. Post prandial blood glucose response to meals containing different CHO in diabetics.
- [15]. Mohammed, Abdelrahman R. Ahmed, B. Senge; Effects of chickpea flour on wheat pasting properties and bread making quality Tasleem A. Zafar, Fatima Al-Hassawi, Fatima Al-Khulaifi, Ghanima Al-Rayyes, Carol Waslien, and Fatma G. Huffman; Organoleptic and glycemic properties of chickpea-wheat composite breads.
- [16]. Idriss M, Ahmed AR, Senge B. Dough rheology and bread quality of wheat–chickpea flour blends. *Food Analysis Laboratory Manual*; S. Suzanne Nielsen
- [17]. Arun G. Kulamarva, Venkatesh R. Sosle, and G.S. Vijaya Raghavan; Nutritional and Rheological Properties of Sorghum
- [18]. Devinder Dhingra, Mona Michael, Hradesh Rajput, and R. T. Patil; Dietary fibre in foods: a review Rolls BJ, Bell EA, Castellanos VH, Chow M, Pelkman CL, Thorwart ML; Energy density but not fat content of foods affected energy intake in lean and obese women Yolanda Brummer and Steve W. Cui ; Understanding carbohydrate analysis.
- [19]. David S Ludwig, professor, Frank B Hu, professor, Luc Tappy, professor, Jennie Brand-Miller; Dietary carbohydrates: role of quality and quantity in chronic disease.
- [20]. Miguel Herrero, Alejandro Cifuentes, Elena Ibáñez, Maria Dolores del Castillo; ADVANCED ANALYSIS OF CARBOHYDRATES IN FOODS
- [21]. Geeth Hewavitharana, Dilini Perera, Senevirathne Navaratne, Indira Wickramasinghe; Extraction methods of fat from food samples and preparation of fatty acid methyl esters for gas chromatography: A Review; Yuthana Phimolsiripol, Panuwat Suppakul; Techniques in Shelf Life Evaluation of Food Products
- [22]. Yong Wang, Layun Deng, and Youhua Fan; Preparation of Soy-Based Adhesive Enhanced by Waterborne Polyurethane: Optimization by Response Surface Methodology; Mahmoud Yolmeh, Seid Mahdi Jafari; Applications of Response Surface Methodology in the Food Industry Processes
- [23]. MANUAL OF METHODS OF ANALYSIS OF FOODS FOOD SAFETY AND STANDARDS, AUTHORITY OF INDIA MINISTRY OF HEALTH AND FAMILY WELFARE, GOVERNMENT OF INDIA NEW DELHI 2015; OILS AND FATS
- [24]. L. Manzocco, S. Calligaris and M. C. Nicoll; Methods for food shelf life determination and prediction

- [25]. Sajad Ahmad Wani* and Pradyuman Kumar; Fenugreek: A review on its nutraceutical properties and utilization in various food products.
- [26]. Akanksha Srivastava, Zoomi Singh, Vandana Verma, Tashi Choedon; Potential Health Benefits of Fenugreek With Multiple Pharmacological Properties.
- [27]. Yadav, R., Kaushik, R., & Gupta, D. (2011). The health benefits of *Trigonella foenum-graecum*: A review. *Int. J. Engineering Research and Applications*, 1(1), 32-35
- [28]. Sinha, R., Rauniyar, G. P., & Panday, D. R. (2015). Fenugreek: Pharmacological actions.
- [29]. Roberts, K.T. 2011. The potential of fenugreek (*Trigonella foenum-graecum*) as a functional food and nutraceutical and its effects on glycemia and lipids.
- [30]. Costa, Regina Teixeira da, Silva, Sinara Cristina da, Silva, Luana Sousa, Silva, Washington Azevêdo da, Gonçalves, Aline Cristina Arruda, Pires, Christiano Vieira Martins, Amanda Mattos Dias, Chávez, Davy William Hidalgo, Trombete, Felipe Machado; Whole chickpea flour as an ingredient for improving the nutritional quality of sandwich bread: Effects on sensory acceptance, texture profile, and technological properties.
- [31]. N. W. G. Young ; The influence of ingredients on product stability and shelf life MIZRAHI S (2000), 'Accelerated shelf-life tests', in Kilcast D and Subramaniam P (eds), *The stability and shelf-life of foods*, Cambridge, Woodhead