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Development of Wheat Bran Flakes Incorporate with Pomegranate and Pumpkin Seeds

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Abstract
Cereal flakes demand is growing globally, edible flakesmarket size has been valued about USD 17.45 million in 2020 and is predicted to grow more and more in coming days. Rising adoption to the cereal breakfast that is increasing among the working-class population ,millennials and college students. Wheat bran has been used since long time period as a part of Food product in ancient time period Wheat bran was made used in bread and muffins. Since29.6% of children's and adults suffer from the constipation problem. The wheat bran is rich in nutrients this helps lowering of the cholesterol, blood glucose level and avoid digestive related problem such as constipation. The wheat bran flakes were developed through three formulations(WF1,WF2 and WF3) by varying the ingredients and the best of the three formulations during the sensory evaluation that is WF2 formulation was taken for the further proximate analysis of the flakes. The wheat bran flakes were made with incorporated seeds like pomegranate and pumpkin which are rich in minerals and antioxidants helps in avoiding cellular damage in human body. The proximate analysis revealed that the carbohydrate is 84.29%, protein is 15.75%,total fat is 4.96%,acidity of extracted fat is 0.9164% total ash is 0.72% and acid insoluble ash was 0.063% per 100g of the sample. Microbial analysis was carried out with the adaption of nutrients agar medium where no colonies were found in the formulation WF2 after 48 hours of incubation and shelf- life study was carried out where the attributes which were considered for the shelf-life studies showed the slight variation in the values of moisture content and acidity of extracted fatbut even at the completion of the shelf life studies the values of the attributes were found to be within the standard specifications. The healthy wheat bran flakes were made and these wheat bran flakes can be consumed regularly as the breakfast cereal which results in decreased constipation and bowel disorders.

Key words: Wheat flour, wheat bran, pomegranate seeds, pumpkin seeds.

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I. INTRODUCTION

Wheat bran

Wheat bran flakes is a product of breakfast cereal similar to corn and oats flakes presently owned by Post holdings. The cereal contains of small toasted flakes of wheat bran together with seasonings and the binders. They may be fortified to add nutritional value. They are usually served with the cold milk. Wheat is the second most circulated cereal for human food after the crop rice. It is one of the furthermost main food crops consumed by more than one third of population of the world due to the presence of maximum number of calories. Wheat is not only measured as nutritious grain but is also a rich source of other nutrients such as proteins, minerals, vitamin B and dietary fibres. Wheat is mainly cultivated in India, China, Russia, USA.

The grain part is the side-effect of processing process and has food and non-food applications. The utilization of wheat grain by people has progressively expanded over the course of the years universally. Wheat is a piece of the external pericarp layer of the wheat grain, which is left as a result after the processing system which has both food and non-food claims. As the human ingesting of wheat grain has expanded more than a year a large number of the detached results of wheat horse shelter are accessible on the lookout. Wheat grain is plentiful in dietary strands, vitamin B, minerals, unpredictable mixtures and numerous bioactive mixtures which are helpful to the human wellbeing. There is an appeal and attention to the shoppers towards the better food varieties and this has prompted the consolidation and investigation of the fixings from the regular hotspots for the food creation and wheat grains has extremely fine mixed for the detachment of the mixtures with more wellbeing profits(19).

Arrangement of wheat grain is appropriately founded on the various methodologies utilized for its detachment, conditions, assortment which controls how much starch appended to layer of aleurone after the partition interaction. The piece of the wheat contrast generally among various yields, significantly involves nutrients, minerals and dietary filaments. Microbe can likewise be added to grain contingent upon the processing strategy with raising the wheat with lipids. Grain comprises of numerous essential minerals like zinc, iron,

manganese, magnesium and phosphorus(20).80% of Phosphorous in wheat is put away as phytates, shaping buildings with Mg, Fe and Mg, which Will impressively diminish their bioavailability(35). 34 to 63 % of the wheat Bran is locked in by the unexpected supply of solvent and insoluble dietary fiber, a composite compound made of palatable plant polysaccharides (hemicellulose and celluloses) required to lignin's, proteins and different parts which escape the hydrolytic enzymatic absorption process in the upper digestive system of the body. Soluble dietary fibre comprises of 5 % of the total dietary fibre, consisting of glycan and xylenes. Dietary fibre enhances the health of the gut, regulates appetite and long satiation. Enhanced satiety Can be credited to gigantic water retention of dietary fiber, diminished stomach travel time, enhanced digest a thickness in the small digestive tract, and expanded stool mass and short-chain unsaturated fat creation, in the colon, because of maturation of the fiber. Dietary fiber assists in the aversion of colon ailments, thwarting gastric harmful development, treating disagreeable guts with disordering, diminishing the bet of haemorrhoids and hiatal hernia, hypocholesteraemia, reducing the bet of chest sickness and type 2 diabetes and hyper strain. Notwithstanding the way that there have been some work concluding the character of Wheat grain dietary fiber in human weight rule process (21).

Table1.1: Nutritional composition of wheat bran per 100g (35)

Sl .No	Bioactive compounds in wheat bran	Quality /100 g of wheat bran
1	Niacin	14 to 18 mg
2	Vitamin E	1.4 mg
3	Zinc	7.3 mg
4	Riboflavin	0.39 to 0.75 g
5	Thiamine	0.54 mg
6	Biotin	0.048 g
7	Ferulic acid	500 to 1500 mg
8	Iron	11 mg
9	Pyridoxin	1 to 1.3 mg
10	Manganese	12 mg

Pomegranate seed: pomegranates are a centre of nutrition. People globally use them in both the savoury, sweet dishes and juice, snacks and smoothies. Dried pomegranate seeds are the prevalent ingredient in grenadine syrup, sauces, granola bars, salad dressings and trail mixes. This delightful, juicy fruit can keep your bones healthy and reduce inflammation and boost your performance in the gym. Pomegranate seeds are loaded with the minerals, phytochemicals and vitamins. *Ellagic acid*, one of the most plentiful antioxidants in this fruit, may improve metabolic health and avoid obesity**.** This natural compound reduces the expansion of white adipose tissue and fights inflammation making weight loss process calmer. This seed is ironic in polyphenols, a class of antioxidants that helps against the DNA damage and the reduce oxidative stress.

Table 1.2 :Nutritional composition of pomegranate seeds per 100g(53)

Sl. No	Nutrients in Pomegranate seeds	Per 100g of quantity
1	Potassium	236 mg
2	Sodium	3mg
3	Calcium	10 mg
4	Magnesium	12 mg
5	Phosphorous	36 mg
6	Zinc	0.35 mg
7	Dietary fibres	4 g
8	Cholesterol	0 mg
9	Protein	1.67 g

Health benefits of the pomegranate seeds

- Aids in weight loss
- Keeps heart healthy
- Rich in antioxidants that helps the body to protect from the free radicals
- Help in reducing kidney stones
- Supports Urinary and digestive health

Pumpkin seed

Pumpkin seeds are an excellent wellspring of solid oils, magnesium, and different supplements that work on the wellbeing of the bones, heart and different purposes. Pumpkin seeds overall are viewed as exceptional and confided in significant Source of calcium, magnesium and potassium .Plant seeds are likewise a decent wellspring of polyunsaturated unsaturated fats (PUFAs) and cell reinforcements. The unsaturated fats in

pumpkin seeds contain a scope of confided in Source of valuable supplements, like sterols, squalene, and tocopherols. Pumpkin seeds have been found to contain sterols and plant sterols and phytosterols are known to assist with lessening levels of the terrible Low thickness lipoprotein cholesterol.

Table 1.3 : Nutritional composition of Pumpkin seeds per 100g

Sl. No	Nutrients in Pumpkin seeds	Per 100 g
1	Energy	559 Kcal
2	Carbohydrates	10.71 g
3	Protein	30.23 g
4	Fibre	6 g
5	Niacin	4.98 g
6	Vitamin E	35.10 mg
7	Iron	8.82 g
8	Potassium	809 mg
9	Calcium	46 mg
10	Zinc	7.81 mg
11	Folate	58 µg

Health benefits of pumpkin seeds

- Improves heart health
- Improves kidney health
- Reduces risk of the diabetes
- Controls cholesterol levels
- Fights ageing
- Rejuvenates and improves skin health

Objectives of the project

- To develop wheat bran flakes incorporated with pomegranate seeds and pumpkin seeds
- To Evaluate sensory characteristics of product
- To conduct proximate analysis of product
- To carry out shelf-life study of the product

II. REVIEW OF LITREARUE

2.1 Cereal flakes as breakfast

These cereal flakes are formed from parts of bits or entire grain like maize, wheat, grain, rice, and oats. They are created so as to get pre-produce items and chipping corn meal that structure into a drop. The whole grains go through various cycles, for example, pre-processing, blending, cooking, cooling, drying, chipping, toasting, and bundling for the development of cereal flakes. The demand of the worldwide cereal flakes market is supposed to extend at a the CAGR(compound annual growth rate)of 6% to 7% during the gauge time frame 2022-2032. Rising accentuation on the presentation of novel worth added oat drops with creative flavours is assessed to incline toward the development in the worldwide market. Cereal flakesbreakfast are a favoured type of breakfast, ate as customary food by huge range of populace universally. With the growing discretionary cash flow, customers are turning out to be more cognizant towards wellbeing and the day-to-day food ate. Oat drops are consumed either plain or might be covered with honey, natural product flavour, sugar, chocolate, an7d other such fixings. Moreover, oat chips are likewise accessible in a few shapes and sizes. The cereal drops market has seen a huge development inferable from variables, for example, purchaser twisting towards good food items. Besides, the expansion popular of comfort food items gives a colossal market an open door to the vital participants working in the grain chips market.

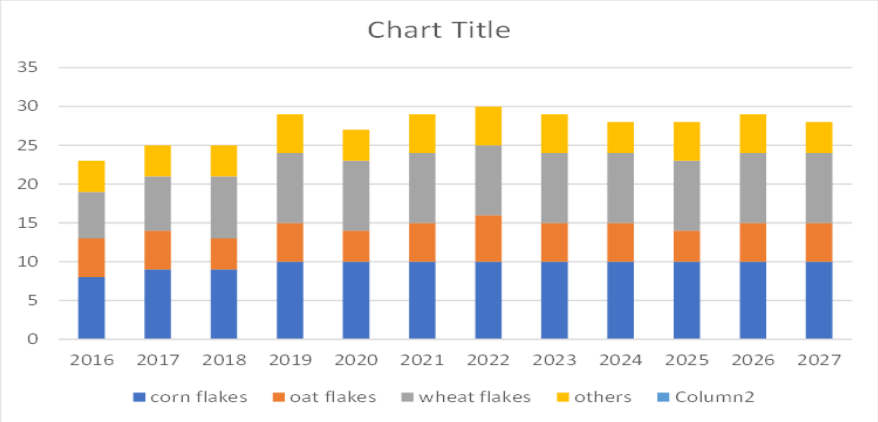


Fig 2.1 The cereal flakes market statistics according to USD

2.2 Different types of flakes

Flaked cereals are produced from the whole grain part or the parts of kernels of wheat, rice or corn and are produced with the addition of other Ingredient's such as the artificial or natural flavours, additives and other preservatives. There are many different types of Cereal flakes in the market and their composition is listed in the above Table No.3 . corn flakes is the one of the cereal flakes which is consumed world-wide and According to the USD around 6.3 million people consumed the corn flakes around daily basis and globally around 153 countries consume the corn flakes Kellogg's is the one of the leading corn flakes manufacturers in the current market (1). Then there are other food companies involved in making of different cereal flakes such as health sutra, Margins, Quaker these respective brands are involved in the manufacturing of the cereal flakes such as sorghum, Ragi, oats and rice flakes respectively (2). Ragi flakes are also more consumed by the consumers direct to its health benefits and naturally occurring nutrients and Health sutra is one of the brands involved in production of Ragi flakes . Ragi flakes are nutritious to human health and help on many health complications(3). Even the sorghum flakes are been included in the cereal flakes products where this sorghum flakes is mainly rich source of magnesium, a mineral which is more important to the bone health and other 600 biochemical reactions in human body(4).

Table 2.1: Different types and composition of Flakes

Sl .No	Different types of flakes	Company producing flakes	Composition of the flakes	References
1.	Corn flakes	Kellogg's	Corn, sugar, Malt extract, flavours, Vitamins and minerals	1
2.	Oats flakes	Quaker	Oats, sugar, artificial flavour, gaur gam, caramel colour, folic acid.	2
3.	Ragi flakes	Health sutra	Ragi flour, almond, honey, additives, preservatives.	3
4.	Sorghum flakes	Health sutra	Sorghum, rice flour, sugar, ammonium bi carbonate, preservatives etc.	4
5.	Bajara flakes	Murgins	Bajara, natural flavours, sugar, sodium bi carbonate ,additive and preservatives	5

2.3 Nutritional value-added flakes

For increasing the nutritional value of the flakes different flour combination of flour, seeds, herbs were incorporated with the flakes which indirectly enhances the Nutritional benefits to human health. Papaya flakes were formulated with combination of flour like corn, Maida and rice flour. The papaya flakes were sensory evaluated and packed in pouches and kept for 6 months for study and other quality characteristics were checked (5). Flax seeds were incorporated with the rice ,corn and wheat flour and in India flax seeds are considered as staple food crops and is used diversely due to its good nutritional benefits that is high in alpha linolenic acid (6). Dehydrated herbs are also been added in the flakes making the herbs such as basil, drumstick and mint these impart the high Nutritional factors as well as benefits such as rich in vitamins and minerals. This addition of dehydrated herbs to the flakes was acceptable by the subjects during sensory evaluation (7). Then the water melon seeds and dried pluses were also were added to flakes as a value addition to the food product. Investigation into the properties of the pulses and knowing the nutritional benefits may lead to cost reduction and help in production of ready- to- eat foods.

Table 2.2 : Nutritional value-added flakes and their nutritional benefits

Sl. No	Flakes	Nutritional value-added Ingredients	Combination flour used in flakes	Nutritional factors	Health benefits	References
1.	Papaya flakes	Papaya fruit	Corn, rice, Maida flour	Rich in vitamin A, vitamin C, magnesium and phosphorus	Lowers cholesterol, improves thyroid gland and immunity functions.	6
2.	Flax seeds flakes	Flax seeds	Rice, corn, wheat flour	High in alpha linoleic acid, omega 3 fatty acids and aspartic acid	Helps in lowering blood cholesterol and helps to protect from obesity.	7
3.	Black bean pulse flakes	Black bean	Maida, rice, wheat flour.	Rich in Vitamin B, minerals and fibres	Protect against the high cholesterol, type 2 diabetes and obesity	8
4.	Dehydrated Herb rice flakes	Basil and mint herbs	Rice and wheat flour	Rich in Macronutrients such as calcium and Vitamin K	Helps in curing worm Infection, stomach spams	9
5.	Water melon ragi flakes	Water melon seeds	Ragi, corn and wheat	Have good amount of zinc, copper, magnesium and phosphorus	Helps in digestion, improves immunity, promote healthy metabolism of the body	10

Table 2.3 : Flakes manufacturing brands and price of the flakes

SL.NO	Flakes	Brand	Quantity	Price(Rs)	References
1.	Corn flakes	Kellogg's	250g	95	According to Edible flakes market forecast
2.	Corn flakes	Nestle	1 kg	198	
3.	Corn flakes	Patanjali	100g	124	
4.	Oats flakes	Giva agro	1 kg	150	
5.	Wheat flakes	Natural land	250g	79	
6.	Wheat flakes	Baggrys	500g	230	
7.	All bran flakes	Kellogg's	425g	220	
9.	Ragi flakes	Health sutra	500g	230	
10.	Oat bran flakes	Arrow head	1 kg	170	

2.4 Types of seeds used in flakes

Seeds are the result of matured ovule, after the undeveloped organism sac is prepared by sperm from dust, shaping a zygote. The undeveloped organism inside a seed creates from the zygote, and develops inside the mother plant to a specific size before development is ended. The seed coat emerges from the integuments of the ovule Adding seeds or nuts to baking is an incredible method for upgrading the flavour as well as the presence of your heated merchandise. Besides the fact that they add surface, flavour and dynamic tones yet they likewise pack in heaps of nutrients and minerals(8). In above mentioned tabled no.6 mainly t authors have summarised the use of seeds in different food product that is the flax seeds are Developing mindfulness about the job of diet and journey for human wellbeing has fuelled interest in 'Practical food sources and utilitarian credits of numerous conventional food varieties are being revaluated. Flax keeps on flooding forward in its acknowledgment as a practical food and has as of late acquired consideration in the space of cardiovascular sickness principally on the grounds that it is the most extravagant known wellspring of alpha-linolenic corrosive, the phytoestrogen, lignin's, as well similar to a decent wellspring of dissolvable ,and these flax seeds find application in products like flakes, breads and the energy bars(9). And also, chia seeds are mainly good source of nutrients which have been used in the making of puddings, smoothies and salad dressings(10). The addition of these Seeds are incredible sources of the fibre. They likewise contain monounsaturated fats, polyunsaturated fats and numerous significant nutrients, minerals and cancer prevention agents. When consumed as a component of a sound eating regimen, seeds can assist with diminishing glucose, cholesterol and pulse.

Table 2.4 : Different types of seeds used in food product

SL.NO	Seeds used	Food product	Nutritional benefits	References
1.	Flax	flakes, breads, cereals, energy bars, oil	Lower cholesterol, reduce blood pressure	11
2.	Poppy	Muffins, rusk, bagel and sponge cakes	Rich in Manganese and helps in body to utilize Carbohydrates and fats	12
3.	sunflower	Salad oil, cookies, pesto sauce.	Rich in calories and loaded with Thiamine, riboflavin , Niacin helps in lowering rate of cardiovascular diseases	13
4.	Chia	Pudding, smoothies, salad dressing and energy bars	Rich in copper, Niacin, Manganese and helps in scalp health and body nourishment	14
5.	Nigella	Vegetable salad, crackers and Curries	Prevents stomach ulcers, packed with antioxidants and helps in blood sugar regulation in body	15
6.	Caraway	Breads, pastries, curries and stew	Prevent digestive problems such as heart burn, bloating stomach	16

2.5 Wheat bran recipes

Wheat bran are broadly utilized aswellspring of dietary fibre with improved medical advantages. Notwithstanding, its high application level in bread kitchen items caused lower nature of these items (e.g. Diminished size and expanded hardness of item). Diverse mechanical, physical or compound techniques are utilized for alteration of wheat grain physicochemical properties. Wheat grain got from the two wheat assortment was utilized to assess the impact of grain adjustment process on subjective properties of prepared merchandise. Adjustment was performed utilizing hot air and microwave warming. Different wheat bran recipes have been prepared as per above mentioned (Table 7) where different recipes with Ingredients ,baking temperature and time is also mentioned. (11).Wheat grain has a sweet taste, yet not all think that it is engaging. It's additionally critical to begin slow while adding wheat grain to food sources. Excessively much can undoubtedly bring about the runs. Adding wheat grain to biscuits, flapjacks, rolls, waffles, or even treats is an incredible method for building up the healthy benefit of a food, particularly its fibre content. A limited quantity of wheat grain can be added to smoothies, particularly when it is finely powdered.

Table 2.5 : Different wheat bran food recipes existing in market

SL.NO	Recipes made out of wheat bran	Ingredients	Baking temperature and time	References
1.	Wheat bran Muffins	Wheat bran, butter milk, sugar, oil, egg, baking soda, baking powder and salt	176 °C For 20 minutes	17
2.	Wheat bran cookies	Wheat bran, maida, oats, melted butter, baking soda, brown sugar and vanilla extract	135 °C for 33 minutes	18
3.	Wheat bran bread	Wheat bran, milk, Maida, sugar, molasses, salt, dry yeast and water	190 °C for 30 minutes	19
4.	Wheat bran yeast bread	Wheat bran, egg, salt, Maida flour, warm water, yeast and honey	190 °C for 35 to 40 minutes	20
5.	Wheat bran pan cakes	Maida flour, salt, maple syrup, wheat bran, wheat flour, milk, butter and baking powder	Cooked at medium flame for 5 minutes	21
6.	Wheat bran waffles	Wheat flour ,wheat bran, salt, almond milk,baking powder, Maida, Vegetable oil.	140 °C for 12 minutes	22

2.6 Proximate analysis parameters

The proximate analysis parameters plays a very vital role in retaining the quality characteristics of the food product as in the different cereal flakes the Ingredients used were different the proximate analysis parameters also differ in their values. The main parameters are the moisture, acid insoluble ash, fat, carbohydrates and proteins these parameters also impart their role in the Shelf-life study of the food product and the moisture in case of ragi flakes was high that is 11.6% and rice bran has the lowest moisture content in the referred papers that is 5.4%(12).The moisture content of the food product leads to vital role if the value is more than the standard value than that product undergoes the microbial contamination and damaging of the food product is observed. Ash is 0.1% maximum value according to FSSAI for the baked cereal products and this mainly represents the other components such as inorganic residue in the food product, Than it is observed that

the Carbohydrates content is high in all cereal flakes when compared to the Protein content . The water absorption capacity of the cereal flakes was more so the fat used in the making of flakes is less in quantity for example in ragi flakes its 0.7 and rice flakes 0.2 and the value of the fat contributes to the rancidity that might cause due to free fatty acids in the food sample. proximate examination permits us to make authentic correlations of feeds based on unambiguous supplements. This makes it conceivable to realize how much preferred one feed is over one more regarding explicit supplements (13).

Table 2.6 : Proximate analysis parameters of different cereal flakes

SL.NO	Flakes	Moisture %	Acid insoluble ash %	Carbohydrate(g) Per 100g	Protein (g)per 100g	Fat(g)	References
1.	Corn flakes	7.5	0.06	84	8	1	23
2.	Oats flakes	12	0.08	67.7	16.9	1.2	24
3.	Ragi flakes	11.6	0.07	80	30	0.7	25
4.	Bajara flakes	10.3	0.09	61.7	9.6	2	26
5.	Sorghum flakes	10.2	0.06	77	11	3	27
6.	Rice bran flakes	5.4	0.09	59	13	0.4	28

2.7 Sensory evaluation methods

Sensory assessment is a critical strategy to survey the flavour nature of food sources since it estimates what shoppers truly see; notwithstanding, it is an emotional technique. For instance, one purchaser might portray an example as unpalatable while another shopper might consider a similar example satisfactory. These distinctions are normal in tactile assessment and can be made sense of by identity, culture, individual variety, and so on. To get more objectiveness through tangible assessment, a sensible number of specialists should be prepared(14).Preparing conventions and boundaries should be painstakingly planned in light of the natural attributes of the tried food lattice and any conceivable variety among various examples brought about by food detailing, handling, bundling, capacity conditions, and so on. Consequently, tangible assessment can be extremely tedious and exorbitant. In the above referred papers form table No.9 the Hedonic Sensory method was adapted in more cases due to this method gave and scaling of 5,9 0r 10 which was used to illustrate the quality of food product in more mannered and acceptable way. The primary benefits of Hedonic rating tests are that the got results convey that estimated data linking with the agreeableness level of the thought about examples and the unalike item credits. Such tests likewise yield data with respect to the epicurean distance between the examples. Sensory Evaluation has been characterized as "A logical discipline used to bring out, measure, investigate and decipher responses to those properties of food varieties and materials as they are seen by feelings of vision, smell, taste, contact, and hearing. Four factors influence assessment: the food, individuals and the testing climate and test techniques utilized(15).

Table 2.7 : Sensory evaluation methods adapted for cereal flakes.

Sl. No	Sensory method	Attributes	Number of panelists	Number of scales	References
1.	Hedonic method	Colour, flavour, texture and Overall Acceptability of product	15	9	29
2.	Paired Comparison method	Aroma, flavour, taste, crispness and colour	20	7	30
3.	Hedonic Method	Taste, flavour, colour, over all Acceptability of product	15	12	31
4.	Sensitivity and descriptive method	Taste, smell, flavour and texture	15	5	32
5.	Rating method	Aroma, mouth feel, texture and colour	20	9	33
6.	Hedonic method	Flavours, crispness, mouth feel, aroma and colour	15	7	34
7.	Hedonic scale method	Colour, texture, aroma, mouth feel, over all Acceptability of product	15	9	35

2.8 Shelf – life studies

shelf life is a realistic usability is the period of time that a product might be put away without becoming unsuitable for use, utilization, or sale at the end of the day, it could allude to whether a ware ought to at this point not be on a storeroom rack (ill-suited for use), or presently not on a grocery store rack (unsuitable available to be purchased, yet not yet ill suited for use). A study evaluates the food item quality and cleanliness

by going through an exhaustive compound and physical, as well as microbiological examination and gives food makers and makers certainty of their item's timeframe of realistic usability. guard their image and buyers(16). The shelf-life study time period depends on the different food product and the Shelf-life attributes plays important part such as the moisture content of the food that is water activity results in degrading of food if the value is high. The Acidity of extracted fat is another attribute where the value of it denotes the extent of the rancidity of the food sample due to free fatty acids the rancidity results to bad odour. The shelf-life study were carried out for 3,6, 9 months after manufacturing of the product and the main factor was also that what kind of the packaging material was used during storage the material used were plastic container, glass container, paper boards and sealed plastic bags. Along with the packaging material the storage temperature matters more to the food sample since The guideline for putting away baking fixings that don't need refrigeration or freezing is to put them in a sealed shut holder in a space that is cool, dim, and dry. Ideal conditions are somewhere in the range of 50° and 70° F with a general mugginess level at or below 60%.Appropriate capacity of fixings and heated merchandise is fundamental for keeping food new and delectable and not gambling foodborne diseases(17).

Table 2.8 : Shelf-life study of cereal flakes for specific time period and attributes

SL.NO	Different type of flakes	Shelf-life time period	Storage temperature	Attributes checked	Type of packaging used for storage	References
1.	Corn flakes	3 months	25	Moisture, Acidity of extracted fat and taste	Paper boards box	36
2.	Corn flakes	6 months	15	Aroma, Moisture, Crispness and Acidity of extracted fat.	Plastic container	37
3.	Ragi flakes	6 months	26	Texture, Moisture, Acidity of extracted fat and taste	Cardboard box	38
4.	Bran flakes	3 months	35	Total acidity, Moisture and taste	Plastic films	39
5.	Corn flakes	6 months	25	Moisture content, Acidity of extracted fat and sensory attributes.	Air tight glass container.	40
6.	Oats flakes	3 months	18	Moisture content, Total acidity and taste	Air tight Plastic container	41
7.	Ragi flakes	6 months	26	Taste, colour moisture content and Total acidity	Sealed plastic bags	42

III. MATERIALS AND METHODS

3.1Procedure for making wheat bran flakes

Wheat bran flakes are rich in dietary fibres. and in making of wheat bran flakes The ingredients which were used were wheat bran, wheat flour, pomegranate seeds, pumpkin seeds, jaggery, baking powder, cardamom, cashew, vegetable oil and rice flour. The control sample was also considered where the pomegranate and the pumpkin seeds were not added to the mixture of the ingredients the quantity of the wheat flour and wheat bran was varied from the composition referred from the edible cereal market research and based on the different quantities of the wheat bran and wheat flour the three formulations that are WF1, WF2 and WF3 were formulated. The seeds cashews and almonds were roasted at low flame for 1 min so that moisture content to be reduced and roasting the dry fruits and seeds before adding to the other Ingredients is a great way for boosting their flavour. and roasting not only just enhance the existing flavours, but also unlock completely new flavour that weren't there before. After the roasting procedure the seeds and dry fruits (cashew and almond) were completely cooled so that the seeds and dry fruits become little crisp, and to avoid the sogginess. Then they are grinded into fine powder mixed with the other ingredients. The all Ingredients are mixed with water and kneaded properly to form a dough. The standing time of the dough was given 5 minutes as the wheat bran and wheat flour has high capacity of water absorption. Then after the completion of the dough standing time the dough was made into small balls so that they were feeded to the flake making machine, the small balls of dough were feeded to the flake machine top hopper and the dough balls were converted to the thin flakes. Then those flakes were subjected to the oven at temperature of 110 °C for 7 min. The flakes were taken out of the oven after 7 minutes and were cooled for 10 minutes before moving to packaging . Cooling time is more important for ensuring the significant loss of the moisture form the food product. After the completion of the cooling time of the, flakes. They will be directly directed towards the packaging. This allows them to protect them from the dirt, damage and moisture uptake by the product from the atmosphere the flakes were stored in the air tight container for retention of the quality of the wheat bran flakes.

3.2 Formulations used for preparation of wheat bran flakes per 100g

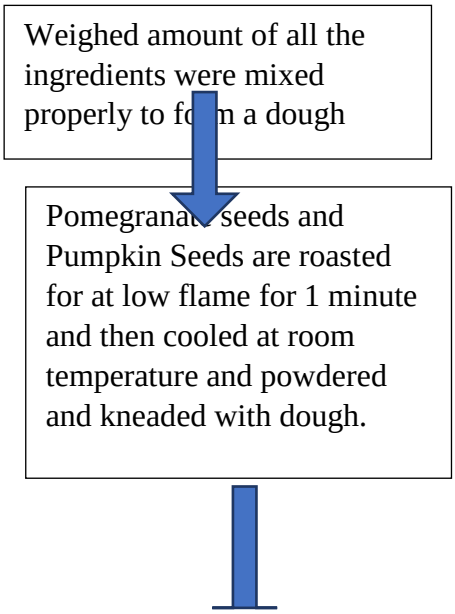
Table 3.1 : Different formulation of wheat bran flakes

SL. No	Treatment	wheat bran	wheat flour	pomegranate seeds	pumpkin seeds
1	Control	20g	40g	0	0
2	WF1	20 g	40 g	4 g	4 g
3	WF2	30 g	30 g	4 g	4 g
4	WF3	40 g	20 g	4 g	4 g

Note: WF: Wheat flakes

Flow chart of making wheat bran flakes

The weighed amount of all Ingredients that is Wheat bran, wheat flour, rice flour, pomegranate seeds, pumpkin seeds, jaggery, vegetable oil, cashew and almonds were mixed together for the formation of dough



Dough formation

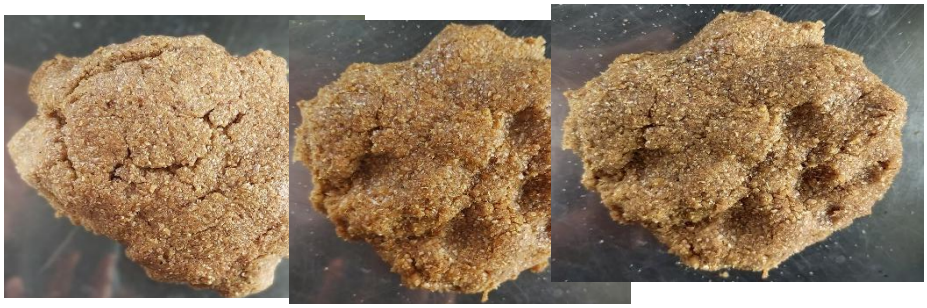


Fig 3.1:WF1formulation Fig 3.2:WF2 formulation Fig 3.3:WF3 formulation

Formation of small balls before dough is put into the flake making machine

Fig 3.4: Making balls of the dough

9

Fig.3.5: Flake making machine

Formation of flakes of all the three formulations

Fig 3.6: WF1(before baking)

Fig 3.7:WF2(before baking)

Fig 3.8:WF3(before baking)

Baking of Wheat bran flakes was carried out at 120ºC for 7min in oven

Fig.3.9: Electric oven

After baking of the flakes, the trays were cooled at room temperature

Fig 3.10: WF1(after baking)

Fig 3.11:WF2(after baking)

Fig 3.12: WF3(after baking)

The flakes are completely cooled at room temperature and packed in air tight container


Fig 3.13: WF1


Fig 3.14: WF2


Fig 3.15: WF3

3.3 Sensory evaluation of the wheat bran flakes

Sensory analysis involves the scrutiny of a product by the senses taste, touch, odour and hearing of the various quality attributes which involve aroma, texture, sound and flavour. In this wheat bran flakes product project the Hedonic scale method was adapted for the sensory evaluation. This test elaborates the degree of consumer satisfaction and acceptance regarding product qualities. It shows the overall acceptance and relative importance of each attribute of the product.

During the Sensory evaluation of the wheat bran flakes product the place was made ensure that the room is free from the smell and place was quiet since a quiet and small free place helps in the focusing on the product in more well manner . All three formulated wheat bran flakes along with the Control was given(Control,WF1,WF2and WF3) for the sensory evaluation and 15 panellists were involved in the sensory evolution in which Staff and students were present and 5 scale hedonic sensory evaluation was carried out. Before carrying out the evaluation the instructions were conveyed to the panelists that not to discuss their opinions with other and the water full of bottles were placed Infront of panellists so that's they rinse their mouth with water after tasting each formulation The main of purpose of rinsing procedures is to maintain the baseline during the sensory evaluation to ensure that there is no any alterations of the perception based on the residual ambiances or sensations. The following attributes were considered in sensory evaluation of the wheat bran flakes

Aroma: is first partner of taste. These are the unstable mixtures which are assumed by the scent receptors of olfactory tissues of nasal pit. Sweet-smelling buildings are delivered during the biting system. Smell evaluates the fragrance of food that is basic in appreciation of flavour.

Taste: It includes the understanding of constituents subsequent to being broken down in the spit, water or oil by taste receptors in the taste buds tracked down quickly on the tongue and different pieces of mouth.
Mouth feel: Mouthfeel mentions to the physical sensations in mouth produced by food or drink, making it different from the taste. It is an important sensory attribute which along with smell and taste, governs the complete flavour of a food product.

Colour:The main nature of any food's appearance is its tone, especially when it is straightforwardly going with other nature of the food credits, for instance the adjustment of the misfortune in variety quality as food ruins or becomes unsatisfactory for purchasers.

Texture: Texture denotes to those qualities of a food that can be felt with tongue, fingers and teeth.
Based on the sensory evaluation of the product the majority of the panelists voted for the WF2 formulation that crispness is 9 panelists voted for WF2 due its taste and crispness during eating and Overall mouth feel. The formulation WF1 was less acceptable due to less in crispness and not good in overall mouth feel and WF3 was not acceptable due to high bran quantity made panelists to chew hard. So WF2 was an acceptable Wheat bran flakes by the panelists and the WF2 formulated fake were used for the further proximate analysis and storage process (12).

HEDONIC RATING OF FOOD PRODUCT

Basaveshwar Engineering College (Autonomous), Bagalkote

Department of Biotechnology

Sensory evaluation of Wheat Bran Flakes

NAME:

Attributes	WF1	WF2	WF3	
Color (Appearance)				
Taste				
Mouth feel				
Aroma				
Texture				
Acceptability				
Preference				

3.4 Proximate analysis of the wheat bran flakes

Proximate Analysis is a method to determine the values of macronutrients present in the food samples. generally, those values are being declared or displayed as nutritional facts which are shown usually on the labels of final food products, but they are also being resolute during the process of production. The beginning of the nutritional analysis instigates back in 1861 and since then it has been continuously advanced and altered .

3.4.1 Estimation of carbohydrate in wheat bran flakes

The phenol-sulphuric acid method was adapted in the estimation of the total carbohydrate present in the wheat bran flakes. This method detects the all classes of the carbohydrate counting mono, di, oligo and polysaccharides. Among many other colorimetric methods for the carbohydrate estimation, the phenol-sulphuric acid method is the reliable and easiest method. It has been used in the measuring of the neutral sugars present in the glycoproteins, proteoglycans, glycolipids and oligosaccharides . This method has been widely used due to its simplicity and sensitivity procedure.

In this phenol-sulphuric acid method the sample was grinded finely into powder and then 0.1g of sample was taken and diluted to 100ml of distilled water and was vortexed so that the sample undergo agitation to lead to homogenization of the sample before it was used for the estimation. Then glucose standard was prepared for 25 micro gram/100 ml this standard was added to the first 6 test tubes in the amount of 0, 0.2, 0.4,0.6, 0.8, 1.0 ml than distillate water was added in first 6 test tube amount of 1,0.8,0.6,0.4,0.2,0 ml. The seventh test tube was added with 1ml of prepared sample . Then in each test tube 1ml of 5% of phenol reagent and 5 ml of concentrated sulphuric acid was added. Then the test tubes were incubated for 20 minutes in the room temperature after the completion of the incubation time the solution in test tube turned in to orange brown colour and then the OD (optical density) was read through the colorimeter at 490nm and through help of graphical representation the total carbohydrate was estimated of the food sample(26).

Calculation

Carbohydrate%= (Unknown OD× Dilution factor×100)/weight of the sample------Eq. (1)

Fig 3.16: Colorimeter apparatus

3.4.2 Estimation of protein in wheat bran flakes

Protein was estimated through the Kjeldahl method which principle convey that the food is digested with the strong acid so that the food releases nitrogen which can be determined with the suitable titration technique. The amount of the protein present in the food is then calculated from the amount of the nitrogen concentration present in the food sample.

The first step in protein estimation was of preparation of the sample. Sample was grinded finely into powder than was used for the estimation process. The Kjeldahl method was adapted for estimation of protein of the product this Kjeldahl method mainly has three steps such as digestion, neutralization and titration process. The digestion of the food sample got initiated with the adding 0.5g of copper sulphate, 5g of potassium sulphate to the digestion tubes and sample was weighed up to 0.1g than next 15 ml of Concentrated sulphuric acid was added to the digestion tubes carefully by using the PPE(personal protective equipment) precaution .The digestion tubes were placed in the digestion chamber for around one and half hour in the digestion step digestion converts the any nitrogen in the food into ammonia and other organic matter such as carbon dioxide and water. Ammonia gas does not get liberated in acid solution because ammonia is in form of ammonium ion which binds to the sulphate ion and thus remain in the solution. After the digestion is completed the digestion tubes are left for cooling at room temperature. Next the second step neutralization was carried out where the solution present in digestion tube is made alkaline by the addition of sodium hydroxide(NaOH), which in turn converts ammonium sulphate into ammonia gas. The ammonia gas that is formed is than liberated from solution and moves out of digestion flask an than into the receiving flask - which contains an 2% of 50 ml boric acid. The low pH of the solution in receiving flask converts the ammonia gas into ammonium ion and concurrentlychanges boric acid to borate ion.Than the last step is titration in this step the nitrogen content was estimated by titration of the formed ammonium borate with concentrated hydrochloric acid using and indicator methyl red for confirming of the end point. The concentration of hydrogen ions needed to reach end-point is equivalent to concentration of the nitrogen that was food sample (27).

Calculation:

Nitrogen (N) %= (Burette reading)×0.014/weight of the sample × 100--------Eq. (2)

Protein % = N% × 6.25(protein factor).----------Eq. (3)

Fig 3.17: Kjeldahl apparatus

3.4.3 Estimation of moisture content in wheat bran flakes

Moisture content is the amount of water present in the food sampl**e.** Moisture content is used in a very wide range of technical and scientific areas ,and is expressed in form of a ratio, which can range from 0 that is completely dry to the value of the materials absorbency at the level of saturation.

In the estimation of the moisture content in Wheat bran flakes the standard oven method was adapted where initially the sample was powdered finely through the help of Piston and mortar. The petri dish was kept in oven for 10 minutes to ensure there is no water content and dish is completely dry, than the petri dish was taken out from the oven a cooled in the desiccator after cooling the empty weight of dish was weighed and noted down that is W1.Than 10g of sample was added into petri dish weight was noted down that is W2 and then petri

dish was kept in oven at 105 °C with lid open until the weight is obtained constant it took 4 hours for the complete loss of Moisture from food sample. The petri dish lid was closed while taking out of oven after 4 hours and placed in desiccator to cool completely, then after cooling of petri dish the weight was noted down that is W3 and the Calculation was carried out (According to FSSAI) (27).

Calculation: (W2-W3)/(W2-W1) × 100----------Eq. (4)

W1- weight of empty petri dish

W2- weight of petri dish with sample

W3- weight of petri dish after drying

Moisture content of the food sample

Fig 3.18: Hot air oven

3.4.4 Estimation of total ash and acid insoluble ash of wheat bran flakes

Ash contentof the food sample states to inorganic residue remaining after the ignition or the total oxidation of the organic matter present in the food sample. The inorganic residue primarily contains primarily of the micronutrients which are present in food sample.

Acid insoluble ash content is the proportion of the food sample that is not hydrolysed by the acid and is not properly volatilised by the incineration of this Acid Insoluble Residue present in the food sample

The total ash content of wheat bran flakes was estimated through following procedure that is the empty weight of crucible was weighed that is W1 than 5g of finely powdered sample was added into crucible after addition of sample the weight was noted that is W2.The crucible was kept in muffle furnace at temperature of 520 degree °C for 4 hours, after 4 hours of ignition the ash is formed in the crucible than crucible is taken out the muffle furnace and completely cooled in the desiccator. Then cooled crucible is weighed that is W3. Then calculation is carried out. Then the acid insoluble ash is performance by taking the crucible which has ash in it. The crucible is added with 5ml of 5N HCl and standing time is given for 2 minutes than the solution present in the crucible is filtered through the ash less filter paper after filtration the filtrate along with the filter paper is kept in the same crucible and placed in the muffle furnace at temperature of 520 °C for 4 hours and after ignition crucible is cooled in desiccator and crucible is weighed that is W4 than calculation was carried out (26).

Calculation: Total ash= (W3-W1)/((W2-W1)(100-M)) × 10,000 ---------Eq. (5)

W1- weight of the empty crucible

W2- weight of the crucible with sample

W3- weight of the crucible after ignition

M- Moisture content of the food sample

Calculation: Acid insoluble ash (AIA) = (W4-W1)/((100-m)(W2-W1)) × 100-----Equation(6)

W1- weight of the empty crucible

W2- weight of the crucible with sample

W4- weight of the crucible after 8 hours of ignition

M- Moisture content of the food

Fig 3.19 Muffle furnace apparatus

3.4.5 Estimation of fat and acidity of extracted fat(AEF) of wheat bran flakes

Total fat of the wheat bran flakes was estimated through Soxhlet procedure and Acidity of extracted fat was assessed through titration method. The Acidity of extracted fat indicates the rancidity of the of the food sample. According to FSSAI (Food safety and standards authority of India) has claimed that the Acidity of extracted fat of baked foods should not be more than 1.5%.

The total fat present in wheat bran flakes was estimated by Soxhlet procedure that is first the empty thimble weight was weighed (T1) and then 10g of finely powdered sample was added in the thimble and thimble was weighed (T2). Then petroleum ether was the organic solvent used for the extraction process. Petroleum ether is non-polar solvent which forms an homogeneous mixture and is of low cost. Boiling point of petroleum ether is 70 °C .The empty weight of round bottom flask was noted down(RBF1).Than petroleum ether is added to the round bottom flask. The flask is attached to an extractor and followed with condenser. The thimble is placed insideextractor and round bottom flask is placed on heating mantle at 70 ºC. The petroleum ether boils in the round bottom flask and get vaporized and condensed back through extractor and then back to round bottom flask. The Soxhlet process was made to run for completion of the twenty cycles and then the fat get settled at the bottom of round bottom flask and the flask is weighed(RBF2).Then for Acidity of extracted fat process goes hand in hand with the fat extraction process where the fat present in the round bottom flask is added with the 50 ml of 97% ethanol than phenolphthalein indicator is added up to 8 drops and titrated against 0.1N NaOH until the solution turns pink which is the end point of the titration. the amount of NaOH consumed was noted down and then calculation was carried out(28).

Calculation: Total fat = (T2-T1)/(RBF1-RBF2) × 100---------Eq.(7)

T1-Weight of empty thimble

T2-Weight of thimble with sample

RBF1- Weight of empty the round bottom flask

RBF2- Weight of the round bottom flask with fat(After extraction)

Calculation: AEF = (TV× Normality of NaOH×28.2)/(RBF2-RBF1)×100------Eq.(8)

TV- Titration value

RBF1- Weight of empty round bottom flask

RBF2- Weight of round bottom flask with fat (After extraction)

Fig 3.20: Soxhlet Apparatus

3.4.6 Microbiological analysis of wheat bran flakes

Microbiological analysis of the food product is the use of biological, molecular, chemical and biochemical approaches for the identification, enumeration and detection of the microorganisms in a material (e.g., Food or drink). It is often applied to spoilage and diseases causing microorganisms. The microbial analysis plays an important role due to many of the microbes are harmless to the human health, others can lead to serious problems also. They have the complete capacity to spoil the food product, cause disease and also introduce the toxin in food. The importance of microbiological testing is to quickly identify the contaminants and treat them before they undergo irreversible damage and effect the human health.

In the microbial analysis of wheat bran flakes The total plate count method was adapted where total bacterial concentration is known after incubation of 24 hours. The nutrient agar medium was used where the media was prepared as per following that is media was prepared for 250 ml with the composition 0.5g of yeast extract, peptone 1.25g, sodium chloride 1.25g, agar 3.75g, beef extract 0.25g and 250ml of distilled water. The petri plates, prepared media was sterilized in auto clave for 1 hour at 15 Lb pressure and then the 1 gram of powdered sample of wheat bran flakes was taken and serially diluted in the 10 ml of sterilized distilled water of ratio 10^{-1},10^{-2} and 10^{-3}.

And then the media and petri dish were made to cool in laminar air flow and then 1ml of serially diluted sample was added to the three petri dish respectively and then the media was added and was gently shaken so that sample and the media was mixed uniformly than the media was allowed to cool and get solidified than kept in incubator at 32 degree temperature for 24 hours and then the results were noted down and the number of colonies were counted manually after completion of the incubation period(29).

Calculation: CFU/m= (Number of colonies × total dilution factor)/vol of the culture plated in ml----------

------Eq (9).

CFU= colony for unit

3.5 Shelf-life study of the wheat bran flakes

Shelf-life is the time period within which the food product retains its all-quality characteristics which is suitable for the human consumption and does not have any adverse effect on health when consumed. In a food industry, shelf life of a food product is time amid the packaging of the food product and the time when it becomes improper for consumption under few environmental conditions. There are many factors that effects the Shelf-life of the food product such as firstly Intrinsic factors such as the raw materials, composition of the product (additive added), total acidity and available oxygen. Second factor is extrinsic factors such as exposure to sunlight, temperature, humidity and damage in packaging.

In the Shelf-life study of the wheat bran flakes the product was manufactured and warehoused or stored in the air tight container at room temperature. The Shelf-life study was carried out for one month where the parameters involved in the Shelf-life study were Moisture content, Acidity of extracted fat, Taste and crispness of the wheat bran flakes. The Shelf-life study was supported out twice in a week and the results were noted down

For the moisture content of Wheat bran flakes the standard oven method was adapted, Acidity of extracted fat was estimated through Soxhlet and titration method and sensory attributes were involved in taste and crispness

of the wheat bran flakes. The purpose of the shelf-life study is to benefit the consumers to feel safe while eating food product and to convey information about the food product.The shelf-life of the food product should only be considered valid only if the product has been purchased intact and undamaged manner. Consumers must always follow the manufacturers' instructions and guidelines on the storage of the food product, particularly the temperature and use of the product after opening the lid(28).

IV. RESULTS AND DISCUSSIONS

4.1 Sensory evaluation of wheat bran flakes (WF2)

Fig. 4.1: Sensory evaluation

Fig.4.2: Panellist's during sensory evaluation

The sensory evaluation of the first formulation was carried out that is WF1.It contained the more amount of wheat flour that is 40g and 20g of wheat bran per 100g of the composition other ingredients were added in same quantity .Total 15 panelists were involved in the sensory evolution where the attributes were rated as below form Table. No. 13 the panelists mainly did not appreciate the taste as it was slight bitter and crispness was not up to the mark and the texture was good. Out of 5 attributes the panelists only liked the aroma of the first formulation and other attributes did not match up to the expectation .so the mean acceptability is 2.7 out of 5 scale according to the panellist's decision of the formulation WF1.From the graph mentioned that is Fig.4.1.5.Indicates that the aroma attribute was liked and accepted more and the overall acceptability of the first formulated product is less. The total mean of respective attributes where the appearance was 3.26,Taste was 2.66,Mouth feel was 2.60,Aroma was 4.06, Texture was 3.60.

Table 4.1: Sensory evaluation scores of the formulation WF1

Attributes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total sum	Mean
Appearnce	4	3	3	4	3	4	3	2	3	4	3	2	3	4	4	49	3.26
Taste	3	2	3	3	2	2	3	3	3	2	3	3	2	3	3	40	2.66
Mouth feel	3	3	3	2	2	3	2	3	2	3	3	2	3	2	3	39	2.60
Aroma	4	5	4	4	4	4	4	4	3	4	4	4	4	4	5	61	4.06
Textrure	4	3	4	3	4	4	3	4	4	3	4	4	3	3	4	54	3.60
Acceptability	3	3	2	3	3	3	2	3	2	3	2	3	3	3	3	41	2.73

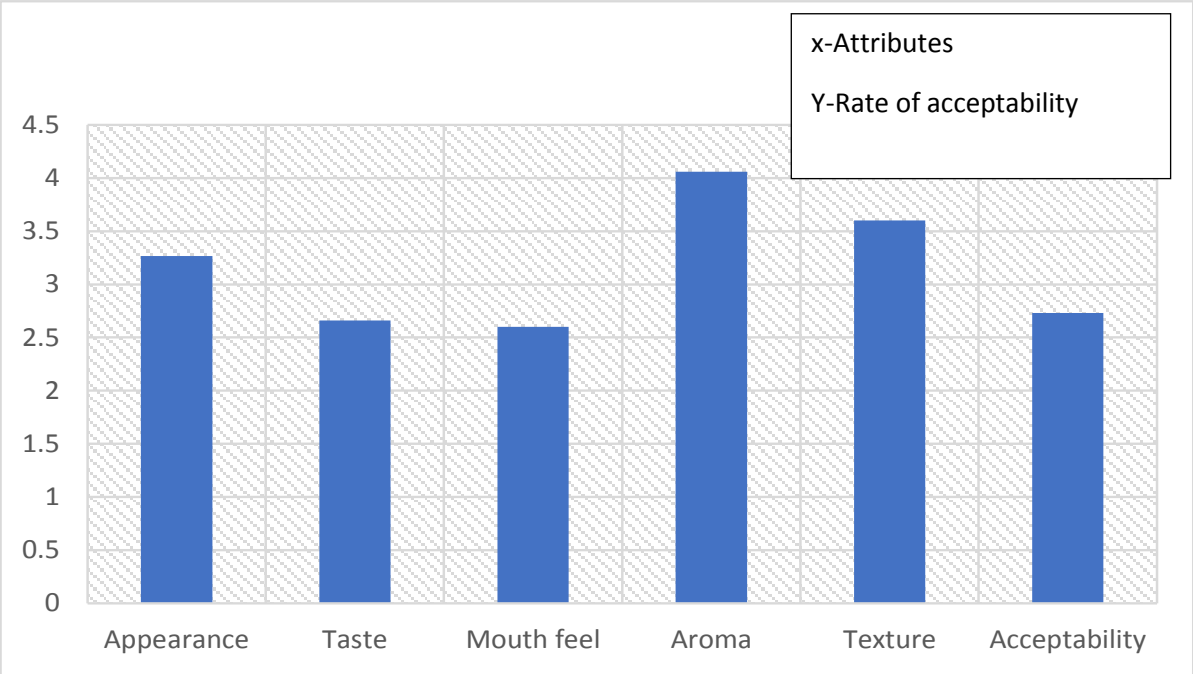


Fig.4.3: Graphical representation of the attributes and acceptability rate of WF1

In the second formulation that was WF2 the equal amount wheat flour and wheat bran that is 30g each for 100g of composition of the wheat bran flakes was added.This formulation was accepted the most among the three formulations this was justified through the following tableNo.14 and graphical representation Fig.4.4 all the attributes were more liked by the panelists due to good mouth feel and crispiness of the flakes the Overall Acceptability is 4.53 for the scale of 5.The respective total mean of the attributes were appearnace was 4.26,taste was 4.60, mouth feel was 4.33,aroma was 4.6,texture was 4.066 these total mean of the attributes were for the scale of 5. The same sample for taken for the further proximate analysis of flakes.

Table 4.2 : Sensory evaluation scores of formulation WF2

Attributes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total sum	Mean
Appearnce	4	5	4	4	5	5	4	4	4	5	5	5	4	5	5	64	4.26
Taste	5	5	5	5	5	4	5	4	4	5	5	4	4	5	4	69	4.60
Mouth feel	4	4	4	4	5	4	5	5	4	5	4	5	4	4	4	65	4.33
Aroma	4	5	4	4	4	4	4	4	3	4	4	4	4	4	5	61	4.06
Textrure	4	4	4	4	4	4	4	4	4	5	4	4	3	5	4	61	4.06
Acceptability	5	4	5	4	5	4	5	4	4	5	4	4	5	5	5	68	4.50

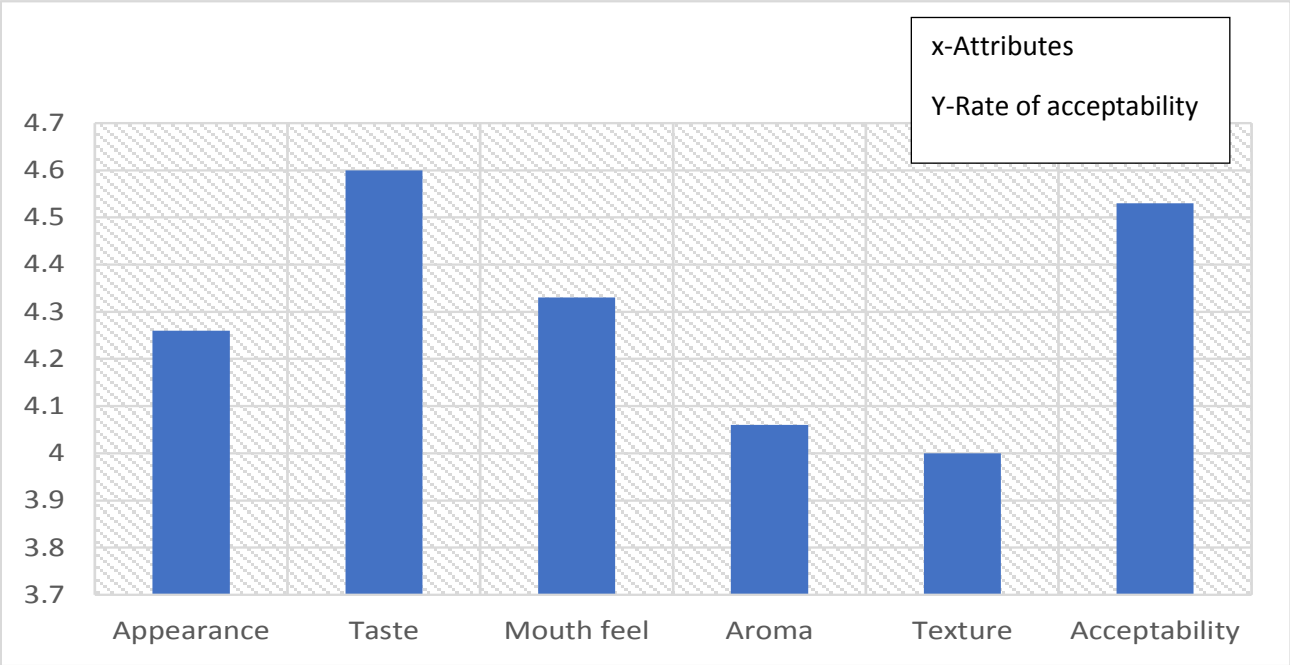


Fig.4.4: Graph represents the attributes and acceptability rate of WF2

The third formulation mainly consists of the more quantity of wheat bran and less amount of wheat flour that is 40g and 20g respectively. The panelists liked the texture and the aroma more than other attributes in the flakes the mouth feel was the lowest rated attribute because the taste of the bran was left out more at the end of the sensory and even the bran particles were left out at the end of chewing made panelists to dislike the overall mouth feel .The following table No and Fig mainly shows the overall acceptability rate that is 3.06 the respective total mean of the attributes were Appearance was 3.133,Taste was 3.200, Mouth feel 2.600,Aroma was 3.666, Texture 3.533.

Table4.3: Sensory evaluation of the formulation WF3

Attributes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total sum	Mean
Appearnce	3	3	3	3	4	3	3	3	3	3	4	3	3	3	3	47	3.13
Taste	3	3	3	4	3	3	3	3	3	4	3	3	4	3	3	48	3.20
Mouth feel	3	3	3	2	2	3	3	3	2	2	3	3	2	2	3	39	2.60
Aroma	3	4	3	4	5	3	4	2	3	4	4	5	4	3	4	55	3.66
Textrure	3	4	4	4	3	3	4	3	4	3	4	3	3	4	4	53	3.53
Acceptability	3	3	2	3	3	3	3	3	3	3	3	4	3	4	3	46	3.06

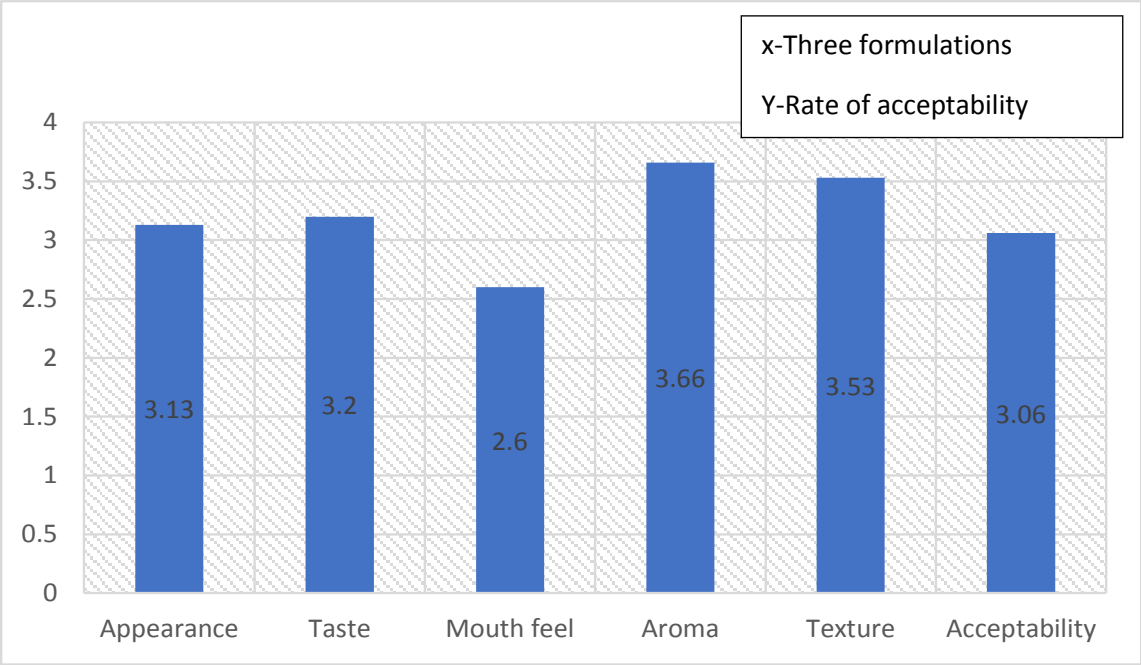


Fig.4.5: Graph represents the attributes and acceptability rate of WF3

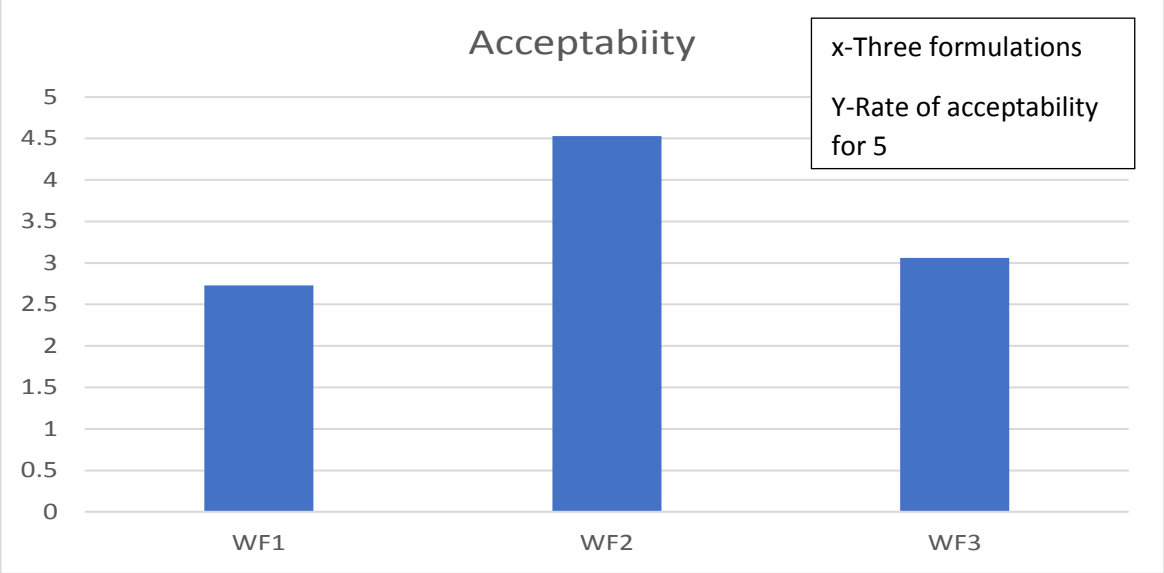


Fig.4.6: Comparison of all the acceptability of the three formulations (WF1,WF2 and WF3)

In the Fig.4.6 The Acceptability Comparison of the three formulations were compared where the first formulation(WF1) having wheat flour quantity more was having the acceptability rate of 2.7. The second formulation (WF2) having both wheat bran and wheat flour in equal amount was most accepted among the three formulations of having acceptability rate of 4.53. And the third formulation(WF3) having wheat bran in more quantity had the acceptability rate of 3.06. Based on the graphical representation of the sensory evolution the second formulation was accepted by the panelists regarding of all the attributes and WF2 was taken for further proximate analysis.

4.2 Carbohydrate Estimation of wheat bran flakes (WF2)

The carbohydrate estimation was carried out through phenol-sulphuric acid method where the standard glucose was used as a standard the standard Tabular column is as represented in Table. No.4.4.In the Paper (26) the standard procedure adapted was the phenol-sulphuric acid method for carbohydrate estimation.

Table4.4: Standard glucose tabular column

SL.NO.	Standard	Concentration µg/ml	Distilled water	Phenol(5%)	Sulphuric acid		OD at 490nm
1	0	0	1	1 ml	5 ml	Incubation for 20 minutes at room temperature	0
2	0.2	20	0.8				0.22
3	0.3	40	0.6				0.4
4	0.4	60	0.4				0.58
5	0.5	80	0.2				0.76
6	0.6	100	0				0.92

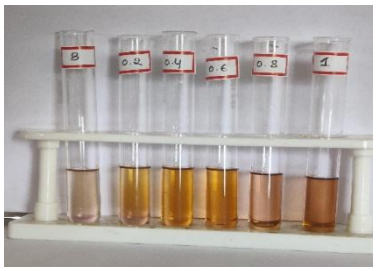
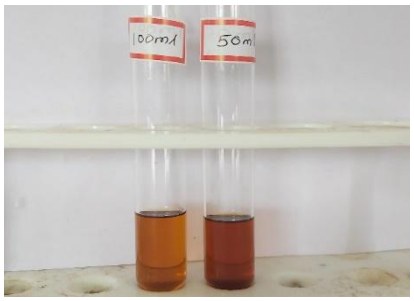


Fig.4.7: Prepared standard glucose



4.8: incubation at room temperature for 20min

Fig.4.9: OD read through Colorimeter

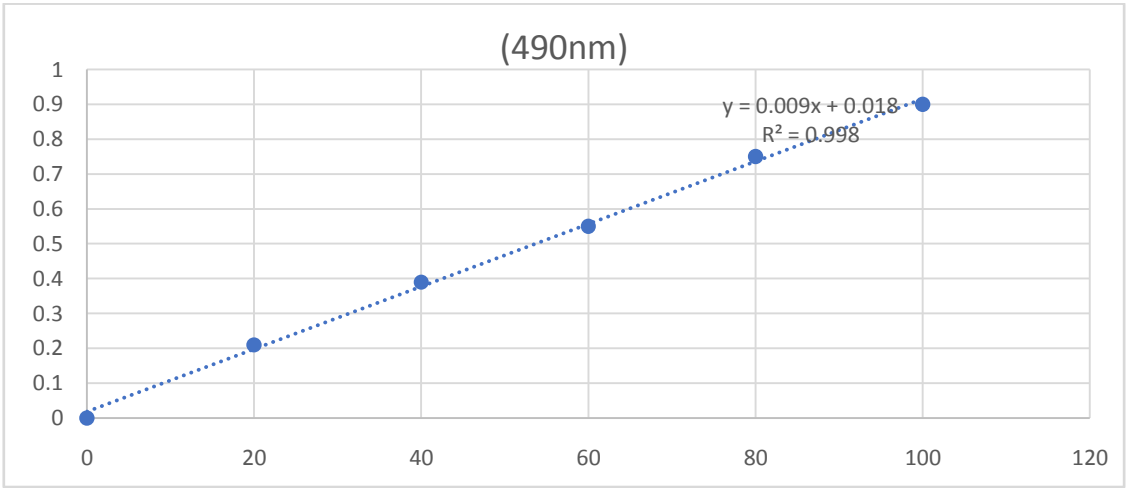


Fig 4.10 Standard graph of glucose for phenol-sulphuric acid method of carbohydrate estimation

Slope	Intercept	Sample OD	Carbohydrate%/100g
0.0091	0.0229	0.79	84.29

Table 4.5 : Total carbohydrate percentage in 100g of the wheat bran flakes

The total carbohydrate present in the 100g of the wheat bran flakes is 84.29% the flakes are rich in the carbohydrate. According to the paper referred (9) the total carbohydrate is 86.53% for 100g of the flakes. The wheat flakes have the vital content of the carbohydrate where keeps the stomach full for long time period and a good source as the cereal breakfast option.

4.3 Estimation of protein in wheat bran flakes (WF2)

The protein estimation was carried out by adapting the Kjeldahl method where the steps like Digestion, Neutralization and Titration was carried out of wheat bran flakes. In the Fig. was the stage of completion of the digestion process where all the polypeptides present in sample are broken down in to the simpler chemicals such as carbon dioxide and ammonia after the completion of digestion the solution turns to ocean blue indicating the completion of process. Then in the Fig4.3.2. The Neutralization process was carried out where the sodium hydroxide was used as alkali and the borate ion captures the ammonia gas and the colour changes to brown colour than after neutralization process is completed the transparent solution is obtained and further in Fig. 4.3.3. Indicating the process of titration with concentrated hydrochloric acid with methyl red the end point was pink in colour and the amount of hydrochloric acid used up during Titration was noted down(27) .

Calculation: Nitrogen %= ((2.34)×0.1×0.014/0.13)× 100

= 2.52%

Protein % = 2.52 × 6.25(protein factor).

= 15.75%

In the above referred papers that is (Rene, 2019) the total protein estimated was 16.5% for 100g of the sample. In the protein estimation of wheat bran flakes the percentage of nitrogen was 2.52% and the total protein is 15.75% for 100g sample of wheat bran flakes. So, the paper the protein present in 100g of wheat bran ranges from 14% to 17% so the obtained protein content falls between the range of standard value. The percentage of protein content varies according to the different protein rich ingredients added as the part of food product.

Fig.4.10: Digestion process of the sample

Fig.4.11: Neutralization process through Kjeldahl apparatus

Fig.4.12:Titration process of the sample

4.4 Estimation of moisture content in wheat bran flakes (WF2)

The moisture determination of wheat bran flakes was carried out with the standard oven method its self where the petri dish with sample and lid open was kept in the oven for 4 hours and Calculation was carried out(27)

Calculation: $M=((W2-W3)/(W2-W1)) \times 100$

W1- 88.933

W2- 98.869

W3- 98.220

Moisture %= ((98.869-98.220)/(98.869-88.933))×100

= 6.53%.

The standard Moisture is 7% t0 9% according to AOAC the obtained Moisture of the wheat bran flakes of WF2 is 6.54% which falls within the range of the standard value the moisture content of the sample plays vital role where if value is more or out of the specification than the product will not be able to retain its quality characteristics and the degradation of the product will be in short time period and high Moisture content results in the growth of the microbes.

Fig.4.13: Petri dish with sample placed in hot air oven

Fig.4.14: Petri dish kept in oven

4.5 Estimation of total ash and acid insoluble ash (WF2)

The total ash and acid insoluble ash were valued in a continue procedure where the Sample was ignited for 4 hours in Total ash estimation and the same ash was dissolved in Concentrated HCl and filtered through ash less filter paper and then was ignited for 4 hours to get acid insoluble ash of the sample(According to AOAC).

Calculation: Total ash= (W3-W1)/((W2-W1)(100-M)) × 10,000

W1- 73.254

W2- 78.209

W3- 73.287

M- 6.53

Total ash= (73.287-73.254)/((78.209-73.254)(100-6.53)) × 10,000

Total ash = 0.72%

Calculation : Acid insoluble ash (AIA) = (W4-W1)/((100-m)(W2-W1)) × 100

W1- 73.254

W2- 78.209

W4- 73.256

M- 6.53

Acid insoluble ash (AIA) = (73.256-73.254)/((100-6.53)(78.209-73.254)) × 100

AIA= 0.063%

According to the AOAC that is association of official analytical chemists contains technical specifications and criteria designed to be consistently used for the analysis of the food samples as per the AOAC standards the maximum total ash is 1% and acid insoluble ash is 0.1% of the baked food products. So the obtained total ash and acid insoluble ash of the wheat bran flakes is 0.72% and 0.063% respectively which are within the standard values. So, the product is acceptable in regarding of total ash and Acid insoluble ash parameter.

Total ash

Fig 4.15: Crucible with sample kept in muffle Fig 4.16: Ash formed after ignition for 4 hrs Furnace

Acid insoluble ash

Fig.4.17: Filtration of ash with Conc.HCl Fig. 4.18: Ignition along with ash less paper

Fig 4.19: Ash formed after ignition of 4 hours along with ash less paper

4.6 Estimation of total fat and acidity of extracted fat(WF2)

The fat content and the acidity of extracted fat was carried out with the Soxhlet process and the values were expressed in the form of percentage. The Calculation of the total fat and Acidity of extracted fat is as mentioned below(35)

Calculation : Total fat =((RBF2- RBF1)/T2-T1))× 100

T1- 1.110

T2- 11.110

RBF1- 139.500

RBF2- 139.5496

Total fat =((139.5486-139.500)/(11.110-1.110))×100

Total ash = 4.96%

Calculation: AEF = (TV× Normality of NaOH×28.2)/(RBF2-RBF1)

TV- 1.5

RBF1- 139.500

RBF2- 141.7354

AEF=(1.5×0.05×28.2)/(141.7354-139.500)

AEF= 0.9164%

The total Fat percentage obtained was 4.96% for 100g of the sample according to the standard AOAC the fat percentage ranges from 4% to 6% per 100g of the flakes so as the obtained Total fat of the wheat bran flakes is within the range of the specification the product is acceptable in terms of total Fat percentage. The AEF according to FSSAI standards the maximum AEF is 1.5% where the obtained AEF of the wheat bran flakes is 0.916% for 100g of the sample so even the AEF is within the standard specifications and AEF range was acceptable.The total fat and AEF plays an important role in the rancidity aspect so as the both Total fat and AEF are not out of specification so no chances of causing rancidity.

Fig. 4.20: Soxhlet process for extraction of fat

Fig.4.21: Titration process for AEFestimation

4.7 Microbial analysis of wheat bran flakes(WF2)

While many of the microbes are harmless to the human health but there are few microbes which causes serious helath issues to human and microbes can induce the toxin and sopil the food and cause disease to the human health. Due to this reason the microbial analysis is carried to avoid the irreversible action of the microbes. The microbial analysis was carried out with the pour plate method through serial dilution procedure and the incubation was carried out of 48 hours and the results were observed(50).

Table 4.5 : Microbial analysis of W2 formulation on nutrient agar media

Samples	**10^{-1}**	**10^{-2}**	**10^{-3}**
Number of colonies	1	0	0
CFU/ml	1×10^{-1}	0	0

The microbial growth was oberved only in the 10^{-1} dilution of the perti plate where only one colony was observed .In the dilutions 10^{-2} and 10^{-3} no colonies were observed.

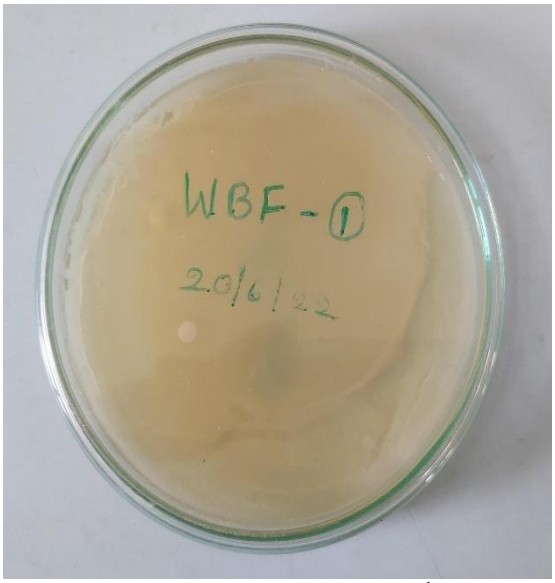


Fig 4.22: WF2(10^{-1}) on NA

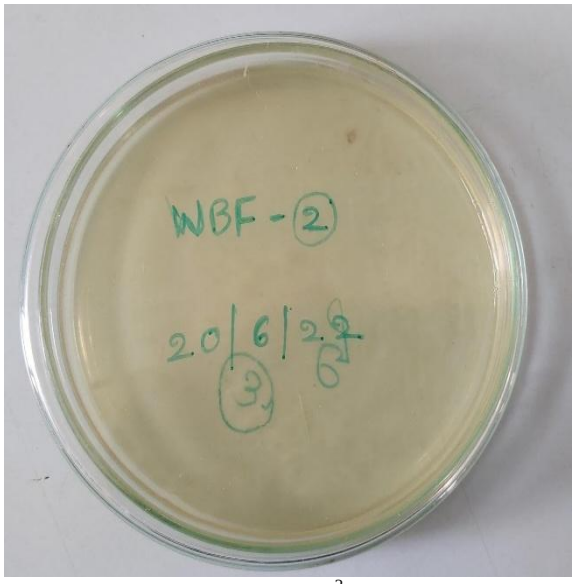


Fig 4.23: WF2(10^{-2}) on NA

Fig 4.24: WF2(10^{-3}) on NA

4.8 Shelf-life study of wheat bran flakes

Shelf-life study was carried for totally 32 days and the Shelf-life study were carried out for alteratnative 4 days with the four attributes such as Moisture, Acidity of extracted fat, taste and crispness of the flakes. During the Shelf-life study it was observed that the 1st and 4th day had a Moisture differences of just 0.29% the moisture content were 6.53 and 6.82 respectively. The Acidity of extracted fat remained same for the 1st and 4th day and taste, crispness were retained exactly as the day of manufacturers or flakes were made. Next

in up comping 8th and 12th that is second Week the acidity of extracted fat got raised for 0.01% when compared to previous days. The moisture content was 7.01% and 7.35% for 8th and 12th day respectively and there Was no change in the tatse and crispness of the flakes. During the 16th and 20h day the moisture content increased that is 7.51% and 7.92% respectively the acidity of extracted fat,tatse and crispness remained same for the second Week of study. During the 24h and 28th day of study the moisture content was 8.01% and 8.45%, AEF was 0.07% and 0.08%, there was a observeable change in the tatse and crispness where the tatse was slight bitter and flakes were got softer and was not much crispier as the previous days.On the last day of the Shelf-life study that is on 32nd day the moisture was 8.82%, Acidity of extracted fat was 0.08% and the tatse was bitter at the end of the mouth feel and flakes were less crisp. The moisture content and the acidity of extracted fat were within the standard specifications through out the Shelf-life study.

Table 4.6 : Shelf-life study of wheat bran flakes with the attributes -Moisture, AEF, crispness and taste.

Week	Day	Moisture (%)	Acidity of extracted fat(%)	Taste	Crispiness
Week 1	1	6.53	0.05	Good	Brittle
	4	6.82	0.05	Good mouth feel	Brittle
Week 2	8	7.01	0.06	Good	Brittle
	12	7.35	0.06	Good	Brittle
Week 3	16	7.51	0.06	Good	Brittle
	20	7.92	0.07	Good	Brittle
Week 4	24	8.01	0.07	Little bitter	Soft
	28	8.45	0.08	Little bitter	soft
Week 5	32	8.82	0.08	Little bitter	Easy to break

4.9 Nutritional comparison of the flakes

Table 4.7: Nutrient comparison of the wheat bran flakes and other flakes

Sl. No	Nutrients% for 100g	Wheat bran flakes	Other flakes
1	Carbohydrate	84.29 %	82-86%
2	Protein	15.75%	12-16%
3	Fat	4.96%	0-6%

In the above Table 4.7 the nutrient comparison of the wheat bran flakes and other flakes can be observed where the nutrient content falls in the same margin of both the flakes. But the difference is that the others flakes present in the market have the components such as sugar and maida which are not healthy to the human body but the wheat bran flakes produced do not contain maida as well as sugar .The sugar is replaced with the jaggery, maida is replaced with wheat flour the replaced components adds the beneficiary ingredients to the human body which makes the flakes more nutritious.

V. CONCLUSION

The wheat bran flakes product was developed with the three formulations with different varying ingredients that is wheat bran and wheat flour along with seeds the formulation developed and coded as WF1,WF2 and WF3. Firstly, the sensory evaluation of the product was carried out with 5 scale hedonic method and WF2(wheat bran 30g,wheat flour 30g) formulation was rated the most liked formulations compared to other two formulations. Proximate analysis was carried out where the total carbohydrates obtained for 100g was 84.29% , total Protein was 15.75%, moisture content was 6.53%, Total ash was 0.72%, acid Insoluble Ash was 0.063% Total fat was4.96% per 100g of the wheat bran flakes and acidity of extracted fat was 0.916% . The microbial analysis was carried out where only one colony was found in the first formulation that is WF1 and no colonies were found in other two formulations. In the Shelf-life study reveals that of the wheat bran flakes the study was carried out for 32 days where the parameters such as moisture content and acidity of extracted fat were within the standard specifications even at the end day of the Shelf-life study. The present study concluded that the wheat bran flakes were rich nutrients good breakfast cereal for human consumption.

FUTURE PROSPECT

In the further phase of the project the nutritional content of the wheat bran flakes can be increased more with addition of the antioxidants and vitamins. The wheat bran flakes can be produced in large scale also further modifications can be carried out for improving the nutrient margin as well as the flavour of the product. The cost estimation of the product can also be improved.

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