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Development of high fiber high protein 4 in 1 breakfast premix

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Abstract

Breakfast is of great importance as it forms an important part of everyday diet. There is a growing demand for having a quick, healthy and nutritious breakfast which is easy to prepare, saves a lot of time and provides optimum nutrition. The developed breakfast premix is rich in fiber and protein which is linked to beneficial effects on appetite, weight, body composition, aging & overall health. Also, helps to reduce the risk of developing various conditions, including heart disease, diabetes, lowering blood pressure, enhancing weight control & constipation. It is a wholesome product consisting of goodness of three different flours, semolina, spinach and flaxseed enhancing the nutritional value of the product. Along with good amounts of fiber and protein, it also contains iron and phenolic compounds. The formulated product was analysed for its physical, biochemical, sensory and microbial properties. The nutritional properties were determined on the basis of proximate analysis such as moisture content (2.71%), total fats (3.11g/100g), protein (18.92g/100g), carbohydrates(68.81g/100g), crude fiber (1.95g/100g), ash content (4.5), phenolic content (80.25mg/100g GAE) and Iron (2.2mg/100g). Microbial load was found to be within the limit. Organoleptic analysis based on attributes of colour, flavour, texture, taste and odour showed that the product was liked very much (Hedonic rating score-8) by the panellists. A suitable packaging for the product was selected taking into considerations the properties of the product, shelf-life and bulk density. The product has shelf life of 2 months from the date of manufacture. Thus, the developed product is rich in fiber, protein and other nutrients and can be used as a healthy breakfast option.

Keywords: Breakfast, high fiber, high protein, premix, spinach, weight control

1. Introduction

The demand for foods with positive impact on human health and wellness has exploded globally over the past two decades. Breakfast has long been considered the most important meal of the day, and recent research has reaffirmed its nutritional benefits, as well as other positive outcomes, including feelings of well-being immediately after consumption and longer-term improvements in overall diet quality. There is also intriguing, but less conclusive, evidence of improved weight management, reduced risk of cardiovascular diseases and type 2 diabetes, and better cognitive performance. However, despite common belief in and scientific support for its importance, breakfast is frequently skipped, and the composition of nutritious breakfast is poorly defined. (Dwyer, 2014) ^[5]

Traditional breakfast items like dosa, uttappa and idli need a lot of time for pre-preparation and fermentation process. A lot of time gets invested into it and it becomes difficult to manage. So, keeping this in mind and to overcome this problem, this product was formulated to save preparation time and serve as an instant breakfast option. The lengthy preparation time gets reduced to few minutes. Ultimately, serving as a quick and healthy breakfast option on these lines, a product with functional foods like oats, spinach and flaxseed was developed which may work as a healthier breakfast option and source of various nutrients.

1. Oats (*Avena sativa*) is distinct among the cereals due to its malfunctional characteristics and nutritional profile. Recent advancement in food and nutrition has revealed the importance of its various components. It is a good source of dietary fiber especially β -glucan, minerals and other nutrients. Oat and oat by products have been proven to be helpful in the treatment of diabetes and cardiovascular disorders. Oat bran in particular, is good source of B complex vitamins, protein, fat, minerals besides heart healthy soluble

- fiber β -glucan (Butt MS *et al.*, 2008) [6]
- Mung bean (*Vigna radiata* L.) is an important pulse consumed all over the world, especially in Asian countries, and has a long history of usage as traditional medicine. It has been known to be an excellent source of protein, dietary fiber, minerals, vitamins, and significant amounts of bioactive compounds, including polyphenols, polysaccharides, and peptides, therefore, becoming a popular functional food in promoting good health. (Dianzhi Hou *et al.*, 2019) [10]
 - Sorghum (*Sorghum bicolor*) is a rich source of various phytochemicals including tannins, phenolic acids, anthocyanins, phytosterols and policosanols. These phytochemicals have potential to significantly impact human health. (W. Rooney *et al.*, 2004) [11]
 - Semolina (*Triticum durum*) is a coarse flour made from durum wheat, a hard type of wheat. Semolina is high in protein and fiber — both of which slow digestion and increase feelings of fullness between meals. It's also high in vitamin B like thiamine and folate, which have many important roles in your body, including helping convert food into energy. (Zamarripa *et al.*, 2019) [12]
 - Flaxseed (*Linum usitatissimum* L.) is emerging as one of the key sources of phytochemicals in the functional food arena. In addition to being one of the richest sources of α -linolenic acid oil and lignans, flaxseed is an essential source of high-quality protein and soluble fibre and has considerable potential as a source of phenolic compounds. (oohma, 2001)
 - Spinach (*Spinacia oleracea* L.) is widely regarded as a functional food due to its diverse nutritional composition, which includes vitamins and minerals, and to its phytochemicals and bioactives that promote health beyond basic nutrition. Spinach-derived phytochemicals and bioactives are able to (i) scavenge reactive oxygen species and prevent macromolecular oxidative damage, (ii) modulate expression and activity of genes involved in metabolism, proliferation, inflammation, and antioxidant defence, and (iii) curb food intake by inducing secretion of satiety hormones. (Joshep L Roberts *et al.*, 2016) [18]
 - Roquette Nutriose FB 06 is a wheat soluble fiber that combines high fiber content (85%), sugar-free status and proven health benefits for digestive health, blood glucose response or energy release. Its high solubility, low viscosity and outstanding digestive tolerance enable high fiber enrichment of almost any kind of food.

2. Objective

The main objective of this present study is to develop a high fiber high protein product which is

- Rich in fiber, rich in protein, nutrient dense and healthier as compared to other instant breakfast premixes.
- To use ingredients which contain all the required nutrient content, healthy for body and confer beneficial effects.
- To estimate proximate, nutritional analysis organoleptic studies and sensory evaluation of the formulated product.

3. Methodology

3.1 Materials

The raw materials used in formulating the product were Oats, Yellow mung, Sorghum, Semolina, Spinach, Flaxseed, Salt, baking powder and Roquette Nutriose Fiber FB06 which were procured from market.

3.2 Processing of raw materials

The raw materials were subjected to cleaning, washing, drying, roasting, grinding and sieving.

3.3 Method of preparation



Fig 1: flowchart for standard preparation of premix

4. Product Formulation Trials

Table 1: different trails for formulating the premix

Ingredients	T1	T2(in g)	T3(in g)	T4(in g)
Oats	½ cup	50	50	29
Yellow Moong	½ cup	50	50	29
Sorghum	¼ cup	25	25	11
Semolina	¼ cup	25	34	18
Spinach powder	1 tbsp	28.3	16	4
Flaxseed powder	1 tsp.	5	5	1
Salt	1 tsp.	5	5	1.8
Baking powder	1 tsp.	5	5	1.35
Fiber (Roquette)	0	0	10	5

Out of four trials that were carried out, 4th trial was taken ahead to formulate the product as it was appropriate and was meeting the expectations.



Fig 2: picture of formulated premix



Fig 3: picture of food items that can be made using premix i.e. idli, dosa, utthapa and dhokla

5. Proximate evaluation of the product

Proximate analysis of the product was carried out by using different methods.

5.1 Evaluation of Moisture Content

Moisture Content of the product was evaluated by using Oven Drying Method. The sample was weighed and treated at 105 °C for 2 hours in the Hot Air Oven.

5.2 Evaluation of Ash Content

Ash Content of the product was evaluated by using Muffle Furnace. The sample was weighed and incinerated to remove the carbon molecules from the product and ignited at 450 – 550 °C in the Muffle Furnace.

5.3 Evaluation of Fat Content

Fat content of the product was evaluated by using Soxhlet Method. Crude fat was determined using Soxhlet Extractor and Petroleum Ether as a solvent.

5.4 Evaluation of Protein Content

Protein content of the product was evaluated by using Biuret Method. Different proteins give similar color with biuret and

the color intensity is proportional to concentration of protein and it was estimated colorimetrically at 540nm.

5.5 Evaluation of Crude Fiber

Crude Fiber was evaluated by Acid-Alkali Hydrolysis method. The sample is treated with Acid and Alkali the residue obtained is weighed, incinerated, cooled & weighed again. The loss in weight gives the crude fiber content.

5.6 Evaluation of Energy Content

Energy Content was determined by multiplying the Crude Proteins, Crude Carbohydrates and Crude Fats by water factors 4, 4 and 9 respectively.

5.7 Evaluation of Carbohydrates

Carbohydrate Content was determined by subtracting from 100 the sum of the values of moisture, protein, fat, ash and crude fiber.

6. Estimation of total phenols

The concentration of Phenols was estimated by Folin-Ciocalteu's method using colorimetry.

7. Microbial evaluation of the product

The determination of Microbial load was done by using Total Plate Count Method. The sample were prepared using Serial Dilution Method. The sample was spread on Nutrient Agar plate for bacterial count and Sabouraud's Agar plate for the moulds and fungi count.

8. Mineral evaluation of the product

Iron Content was evaluated by α, α - dipyridyl method. Iron when react with α, α - dipyridyl gives pink colour whose concentration is directly proportional to the amount of iron which is present in the given sample and it is estimated colorimetrically at 510nm.

9. Sensory evaluation of the product

The sensory evaluation of the product was done by using a 09- point hedonic scale for various sensory parameters such as appearance, odour, color, taste, and its overall acceptability using 30 untrained Panelists.

10. Results and conclusions

10.1 Evaluation of Proximate Analysis

Table 2: Result of Proximate Analysis

Parameters	Quantity per 100g (Mean \pm SD)
Energy (kcal)	378.91
Carbohydrates (g)	68.81
Protein (g)	18.92g \pm 2.26
Fats (g)	3.11% \pm 0.07
Ash	4.5% \pm 0.26
Moisture	2.71% \pm 0.36
Crude fiber (g)	1.95% \pm 1.06

10.2 Estimation of Phenols

Table 3: Result of estimation of phenols

Parameters	Quantity /100g
Phenols (mg)	80.25

10.3 Evaluation of Microbial Analysis

The total bacterial count was found to be 187×10^4 CFU/g, which falls within the limits while the total fungal count was found to be < 30 CFU/g which also is within limits.

10.4 Evaluation of Sensory Analysis

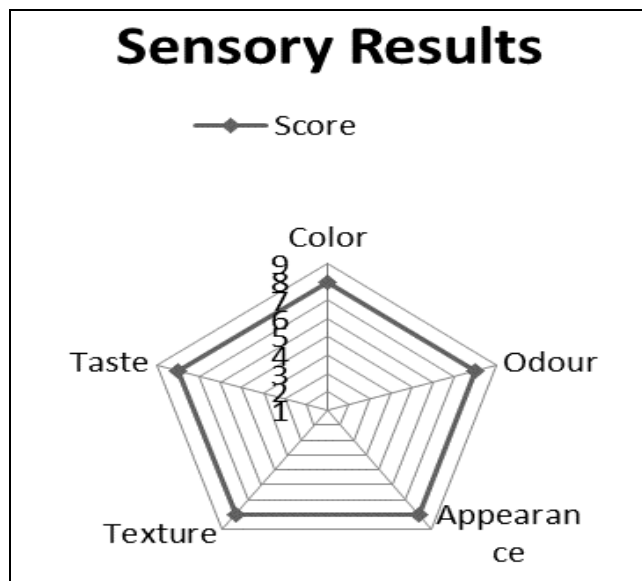


Fig 4: Result of Sensory Evaluation (Radar Diagram) Rating scale

Table 4: Scores and Remarks for Sensory Analysis

Score	Remark
1	Terrible
2	Very bad
3	Bad
4	Just a little bad
5	May be good or may be bad
6	Just a little good
7	Good
8	Very good
9	Great

11. Food labelling and packaging

11.1 Packaging of the product

Packaging is the science, art and technology of enclosing or protecting products for distribution, storage, sale, and use. The packaging material for the product was selected according to the Food Safety and Standard (Packaging) Regulation, 2018 (schedule IV – List of suggestive packaging material). The packaging of the final product was done in PET/MET-PET/LDPE, three layered packaging material. PET (polyethylene terephthalate) is the chemical name for polyester. It is clear, strong, light weight plastic that is widely used for packaging foods. It is durable, heat resistant film with very good oxygen barrier property. MET is nothing but PET film laminated with metal foil. It increases film’s oxygen-water barrier and blocks out UV rays. LDPE (low density polyethylene) is a thermoplastic made from monomer ethylene which is a soft, flexible and lightweight. It has high clarity, heat-seal ability, high elongation and softness.

11.2 Filling and Packaging of the product

- After preparation, 100g of premix was added into the pouches.
- The pouches were then sealed using sealing machine.
- These packed pouches were then labelled and stored in cool and dry place.

11.3 Labelling of the product

Food labelling includes any written, printed or graphic matter that is present on the label, accompanies the food, or is displayed near the food, including that for the purpose of promoting its sale or disposal. The labelling of the product was done according to Food Safety and Standard (Labelling and Display) Regulation, 2018. Following labelling requirements were followed.

- Name of the food
- List of ingredients
- Nutritional information
- Label claims
- Veg logo
- Name and address of manufacturer
- Net quantity
- Date of manufacture or packaging
- Best before date
- Instructions for use



Fig 5: Picture of front and back label

12. Conclusion

A High Fiber High Protein product was developed and its proximate and nutritional analysis were carried out. From the results, it is evident that the product is rich in protein having 18.92g/100g. (According to FSSAI regulations for Advertising and Claims, 2018, the product must contain 20% of RDA per 100g of solid product), rich in fiber having 6.95g/100g, out of which 1.95g of crude fiber and 5g of Roquette Nutriose Fiber FB06. (According to FSSAI regulations for advertising and claims, 2018, the product must contain atleast 6g of fiber per 100g of solids) and contains carbohydrate, phenolic compounds, iron and less amount of fat. The product has a shelf life of two months. A feedback obtained from the sensory analysis showed that the product was ‘liked very much’ (Hedonic Score- 8) based on their attributes of colour, taste, texture, mouthfeel and odour. Thus, from all the results it can be concluded that, the formulated product is rich in fiber, rich in protein and contains other nutritive qualities. It also possesses good organoleptic properties. Hence, the developed product is acceptable and can be a part of the daily diet of consumers owing to the health benefits it imparts.

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