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Development of Value Added High Fibre Millet Bread Incorporated with Flax Seed and Sunflower Seed

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Abstract
An attempt has been made in the present investigation formulate a bread by incorporating the fluor of flax and sunflower seeds with an aim to increase the nutritional and organoleptic properties. Generally, breads are being made from wheat flour which has some inadequacies in terms of lesser protein content, mineral composition, vitamins and fiber contents. Interestingly, millets in general have relatively higher protein, minerals and fiber contents which in turn increases the nutritional and digestible properties of food made from them. Therefore, in the present study, bread formulated with incorporation of Banyard millet (Echinochloa frumentacea), flax seed (Linum usitatissimum) and sunflower seed (Helianthus annuus). Attempt has also been made to examine the organoleptic properties of the developed bread and to identify the suitable packaging techniques. The results obtained have been presented and discussed with up-to-date literature pertaining to this work.
Keywords: Millets, Nutraceuticals, Organoleptic Property, ω-3 Fatty Acids, Packaging

Introduction

Bakery products are gaining popularity day by day. Young generation mostly prefer the bakery products. Most of the bakery products are made up of wheat, the major food crop of India produced abundantly in India. Consumers are demanding newer options, and the industry has been experiencing fortification of bakery products in order to satiate the burgeoning appetite of the health-conscious Indian. Bakery products, due to high nutrient value and affordability, are an item of huge consumption (Ishrat Majid et al., 2014).

Barnyard millet (Echinochloa frumentacea) is an important minor millet having higher amounts of protein (12%) that is highly digestible (81.13%) coupled with low carbohydrate content (58.56%) of slow digestibility, ie., 25.88%. The dietary fiber is an important photochemical component of barnyard millet (13% total dietary fiber with 4.66 and 8.18% of soluble and insoluble fractions, respectively) that could be used in the management of disorders like diabetes mellitus, obesity , hyperlipidemia, etc. Thus, for the health conscious genera of the present world, minor millet especially Barnyard millet is one more addition to the existing list of healthy foods, owing to its nutritional superiority (Veena, 2003).

Flaxseed continues to surge forward in its recognition as a functional food, being rich in the essential omega-3 fatty acid, alpha linolenic acid and many phytochemicals.

Flaxseed also provides dietary fiber and protein (flax primer) and was singled out as one of six nutraceuticals. Flaxseeds combined with an abundance of omega-3 fatty acids makes them an increasingly popular addition to the diets of many health conscious consumers (Oomah et al., 1995).

The sunflower is an annual plant native to the Americas belonging to the family Asteraceae. Per 100 g of the seeds reported to contain 20.78 g of protein, 51.46 g of lipid (fat), 3.02 g of ash, 20 g of carbohydrate and 8.6 g of fiber with total energy of 2445 kj (USDA, 2008) Sunflower polyphenols such as caffeic, chlorogenic and ferulic acids exert a high antioxidative potential, which might be beneficial both from a techno functional and biofunctional points of view (Maier et al., 2009) Almost 90% of the lipid in sunflower seeds is found to be good unsaturated lipid. Due to the role of tocopherols as natural antioxidants, it is believed that tocopherols reduce various human diseases especially caused by oxidative stress including cancer, cardiovascular and coronary heart diseases (Adams and Best, 2002).

The main aim of the present research was to improve the nutritional and functional properties of millet bread by sunflower seeds and flax seed supplementation.

Objectives

- To formulate and standardize the flax seed and sunflower seed incorporated bread.
- To assess the organoleptic characteristics of the developed bread.
- To identify appropriate packaging of the developed product.

Review of Literature

Banyard Millet

Ballolli et al. (2011) have developed nutraceuticals enriched barnyard millet cookies and reported that cookies provided 5.46 g of protein, 23.83 g of fat, 9.79 g of dietary fiber and 461 K cal per 100 g.

The results obtained by Surekha, (2004) revealed that the barnyard millet based health mix would be an ideal food for the obese and diabetics as it showed a significant reduction in blood glucose level (7%) improved lipid profile and reduction of body weight (mean/kg) during a 28 days feeding experiment to obese diabetics.

Subsequently, Surekha et al. (2007) have developed and evaluated barnyard millet based health mix. The moisture and fat content of the health mix were low (4.63% and 4% respectively), protein fairly high (12%) and higher levels of dietary fibre (37%) with moderate total carbohydrate content (50%).

Flax Seed

Teradal et al. (2017) have investigated the effect of wholesome grain based functional food formulation, on clinical and biochemical parameters in 24–30 months old Wistar albino geriatric rats, corresponding to human age 60–75 years. Animals were randomly divided into five, groups. Experimental diets were compared to the basal rat diet (Group I). Four food, formulation were—wheat based (Group II), finger millet based (Group III), wheat based, diet + fenugreek seed powder (Group IV), finger millet based diet + fenugreek powder, (Group V). These five types of diets were fed to the experimental rats for 6 weeks. Hematological and biochemical parameters were evaluated. The results showed that, several hematological and serum mineral values were influenced by the type of diet. The type of diet did not influence the organ's weight. A moderate hypoglycemic and hypercholesterolemic effect was observed in composite mix fed rats. This study clearly justifies the recommendation to use wholesome grain based functional foods for geriatric population.

Sturgeon et al. (2007) have studied the effects of flaxseed on serum sex hormones implicated in the development of breast cancer. Flaxseed is a rich source of dietary lignans. Experimental studies suggested that lignans may exert breast cancer preventive effects through hormonal mechanisms. Results suggested that dietary flaxseed may modestly lower serum levels of sex steroid hormones, especially in overweight/obese women.

Morris, (2004) has reported flaxseed as the best source of lignans and is rich in the lignin secoisolariciresinol diglycoside, and contains small amounts of matairesinol, pinoresinol and

isolariciresinol. Lignin compounds have estrogen like actions in human and animal cells. The health benefits derived from flaxseed contribute tothe prevention of cardiovascular disease, stroke, cancer, osteoporosis, diabetes and the improvement of immune function, blood pressure and kidney function.

Sunflower Seed

The sunflower oil also contains a significant amount of liposoluble vitamin E that is part of chemical compounds called tocopherols. There are several types of tocopherols in nature, the alpha-tocopherol is the most powerful form of vitamin E and has a high biological and nutritional value. The oxidation of fat generates the free radical soluble molecules that having an electron in the middle are very unstable, extremely reactive and can cause extensive damage to the body, from cancer to thrombosis, to DNA damage. Vitamin E has a major role as an antioxidant in the prevention of oxidation of polyunsaturated fatty acids (lipid peroxidation). Vitamin E is a potent immune stimulant, it acts in the prevention and treatment of heart disease such as coronary thrombosis and heart attack, in which the vessels are blocked by blood clots and part of the heart is deprived of its blood supply (Rosa et al., 2015).

Methodology

The basic ingredients of bread like whole wheat flour, sugar, yeast, salt, margarine (vegetable fat), Banyard millet (Echinochloa frumentacea), flax seed (Linum usitatissimum) and sunflower seed (Helianthus annuus) were incorporated into the preparation of bread. The incorporated ingredients were available at local supermarkets in Madurai. These ingredients were stored under highly clean and hygienic conditions.

Procession of Barnyard Millet and Edible Oil Seeds

Drying was carried out in a hygienic environment and the Barnyard millet and seeds were free from insect, microbial spoilage and off-odour. The first step was selecting and cleaning the incorporated ingredients, and followed by sun drying for a few minutes in early morning. The ingredients were made into powder by a mixer grinder. Finally, the flour is obtained. These are stored in dried airtight containers. These flours are used for bread preparation.

Preparation of Flour Mixture

The flour obtained from slightly roasted Barnyard millet, flax seed and sunflower seed is divided into two portions.

Table 3.1 Development of Bread Incorporated with Flax Seeds and Sunflowers Seeds

Ingredients	Sample A	Sample B	Sample C (Normal wheat bread)
Barnyard millet	25g	25g	---
Flax seed	10g	15g	---
Sunflower seed	10g	15g	---
Whole wheat flour	75g	75g	75g
Refined wheat flour (Maida)	100g	100g	100g
Margarine (vegetable oil)	20g	20g	20g
Sugar	50g	50g	50g
Caramel	1 ml	1 ml	1ml
Yeast	0.5 g	0.5 g	0.5 g
Salt	3.5 g	3.5 g	3.5 g
Water	150 ml	150 ml	150 ml
Weight of dough	250g	250g	250g
Weight of loaf	350g	350g	350g

First of all, mixing of the all basic ingredients of bread preparation was done in dry state and later incorporated with the flour of Barnyard millet, flax seed and sunflower seed. The dough was optimally mixed using the mixer for about 10 to 15min until the dough became soft and elastic. After mixing, 300g of the samples was weighed individually and moulded into a shape manually and then the fermentation was carried out 45 min at 32-35˚. The moulded dough was placed on a greased tray at 30˚. After 1hr-1/2hr, the dough was placed on a tray and baked in a baking machine at 180˚C for 1 hr. The baking breads were cooled further before testing. Later the baked breads were measured the weight of bread in 350g. And then finally the breads were packed into polyethylene bags.

Organoleptic Evaluation of Developed Bread

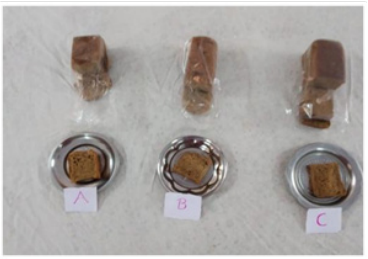

Figure 3.2 Samples of Bread

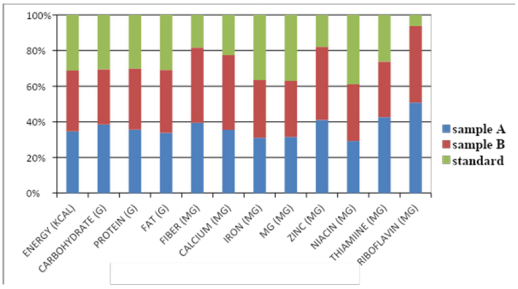

Figure 3.3 Total Nutrient Composition of the Developed Breads

Organoleptic evaluation is done to estimate the acceptability of the developed millet bread. The numerical score card rating was used to sense the parameters like appearance, colour, flavor, texture and taste of the developed bread. 32 college going students were selected for the evaluation and the panelists were asked to assess the degree of liking for each sample and the scores obtained were tabulated. To perform the evaluation, Panelists evaluated bread samples on a 5 point scale quality analysis with 5= excellent, 4= very good, 3 = good, 2 = fair, 1 = poor. The preparation of breads was used for obese people and children.

Nutrient Composition of The Developed Bread

Nutrient composition of the developed bread samples was evaluated. The nutrients for the developed bread was carbohydrate, protein, fat, crude fibre, vitamins and minerals.

Statistical Analysis

After the data collection it is essential to organize the information in a systematic manner in order to obtain the desired result and their interpretation scientifically. Hence the primary data obtained consolidated and statistical analysis was done using microsoft excel program.

Mean score of the three replicates for each test (for all bread samples) were calculated.

Results and Discussion

Computation of Nutrients Present in Barnyard Millet, Flax Seed and Sunflower Seed

Nutritive value of barnyard millet, flax seed and sunflower seed presented in the Table.

Table 4.1 Computation of Nutrients Present in Barnyard Millet, Flax Seed and Sunflower Seed

Nutrients	Barnyard millet (100g)	Flax seed (100g)	Sunflower seed (100g)
Calorie (kcal)	331	530	620
Carbohydrate (g)	69.6	28.9	17.9
Protein (g)	12.3	20.3	19.8
Fat (g)	4.3	37.1	52.1
Fiber (g)	8.0	4.8	1.0
Vitamin E (mg)	---	8.28	12.93
Calcium (mg)	31	170	280
Iron (mg)	2.8	2.7	5.0
Phosphorous (mg)	290	370	670

The above table indicates that Barnyard millet, flax seed and sunflower seed are rich sources of protein and fat per 100g. These three ingredients compared to the phosphorus level for sunflower seed was higher than other ingredients. The three basic ingredients were highly nutritious ingredients for sunflower seed.

Computation of Nutrients in Developed Bread

Table 4.2 Computation of Nutrients in Developed Bread

Samples	Energy (kcal)	CHO (g)	Protein (g)	Fat (g)	Fiber (mg)	Calcium (mg)	Iron (mg)
Sample A (10g)	1989.8	213.35	30.33	112.69	4.03	132	10.75
Sample B (15g)	2047.3	215.7	29.4	223.07	4.32	154	11.17
Standard (normal wheat bread)	1792	193.5	23.3	102.7	1.95	79	9.4

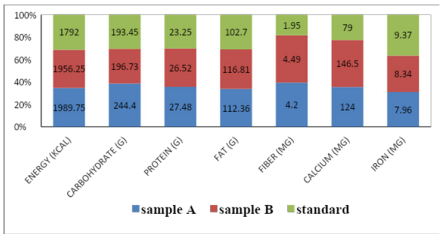

Figure 4.1 Computation of Nutrients in Developed Bread

The greatest nutritive value of the barnyard millet, flax seed and sunflower seed is in their content of various calorie, carbohydrate, protein, fat, calcium and iron. Above these tables explain the nutrient composition of the bread. The preparation method involved for this bread mixing of flours, baking and packaging. The equipment used for this bread is an oven. The time taken for the preparation of bread was 1 hour. The bread prepared with incorporation of 10g of bread had good appearance, colour, flavor, texture and taste scored a highly overall acceptability than 10g of incorporation. The value of fat, protein, fiber, calcium and iron from sample A and sample B has increased based on the level of incorporation breads. The nutritive value was improved in sample A and sample B compared to the standard bread.

Consumer Acceptability of Developed Bread

The breads based on barnyard millet, flax seed and sunflower seed was prepared and subjected to sensory evaluation by 32 individuals. 32 members were given the score containing 5 points on the hedonic scale. The results of the sensory evaluation are discussed below.

Consumer Acceptability for Three Samples of Breads

Table 4.3 Mean Score of Consumer Acceptability of the Developed Bread Sensory Quality of Three Samples of Bread

Samples	Appearance	Colour	Flavour	Taste	Texture	Totally over all acceptance
SAMPLE A	3.56	3.65	3.43	3.34	3.5	3.496
SAMPLE B	3.28	3.46	3.31	3.34	3.62	3.402
SAMPLE C (Standard normal wheat bread)	4.34	4.59	4.12	4.21	4.43	4.338

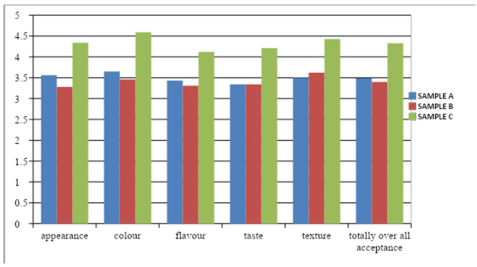

Figure 4.2 mean score of consumer acceptability of the developed bread sensory quality of three samples of bread

The data indicate the consumer acceptability of the developed bread and comparison of the standard (normal wheat bread). The appearance, colour, flavor, texture, taste which always score higher than the developed breads. The overall consumer acceptability for the standard bread mean value for (4.33). But, developed breads were sample A mean value for (3.49) and sample B value for (3.40). Appearance, colour, flavour of sample A bread are high mean values. But, sample B bread's mean value is slightly low. Taste was both the same mean values. Texture was different for 0.1 is high for sample B. But, overall acceptability was both of the same value.

Summary and Conclusion

Now-a-days, people become more aware about their health and the kind of food they are eating. People are more interested in functional foods which provide them health benefits. Barnyard millet, flaxseed and sunflower seed were one of the functional foods which have its unique components and provide a lot of health benefits. So, the main aim of the current study was to develop a functional food which provides additional health benefits. In current research, barnyard millet, flaxseed and sunflower seed were incorporated in bread which are convenient foods and can be readily consumed by people of all age groups. Addition of barnyard

millet, flax seed and sunflower seed incorporation bread enhanced the nutritive values. Addition of barnyard millet (25g) is common for both samples. But, incorporating ingredients such as flax seed and sunflower seed were 10g and 15g. On the basis of sensory evaluation scores, developed bread like sample A (10g) was highly acceptable. Sensory attributes like colour, appearance, taste, texture, and flavor are also found to be acceptable and so can be consumed by college going students. The developed bread was good sources of energy, carbohydrate, protein, fat, crude fiber, vitamins and minerals. They are rich sources of available crude fiber, proteins, ω-3 fatty acids and lower cholesterol.

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