



IJEANS

International Journal of Food
And Nutritional Sciences

Volume 3 Issue 3 Apr-Jun-2014, www.ijfans.com e-ISSN: 2320-7876

INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES



Official Journal of IIFANS

A STUDY OF MULTIGRAIN GLUTEN FREE GROUNDNUT AND EDIBLE GUM BISCUITS

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ABSTRACT

A study was conducted to standardize an innovative nutritious product for consumer's acceptance. The product designed was a nutritious product for all age groups, gluten allergic people, pregnant and lactating mothers and under weight or malnourished children and people. The nutritionally rich common food product - multigrain gluten free biscuits, made with varied kind of flours (ragi, jowar, soybean, oats, maize), groundnuts, and functional food "dink". The product provides good amounts of proteins, functional property, vitamins (especially vitamin A) and minerals and adequate fiber. Shelf life study included sensory evaluation by scoring method based on a five point scale. Evaluation was done on sensory attributes like color, taste, texture, aroma, appearance, mouth feel and overall acceptability of the product. The other aspects covered in the study were packaging, budget management, nutritional labeling and marketing. The result showed that the product was widely accepted.

Keywords: multigrain gluten free biscuits, galactagogue, gluten allergic people, underweight, malnourished, proteins, vitamin A, β -gluten, sensory evaluation.

INTRODUCTION

Biscuits are typically round cakes of bread that are leavened with baking powder, baking soda or sometimes yeast. It may also refer to a cookie or cracker. They are mostly sweet and in history they were used by travelers as they were long-lasting foods and easy to carry (www.ask.com). It is made with different kind of flour, butter, sugar and other ingredients. It is often served with tea; coffee etc. It is a snack which is widely acceptable by all age groups and easy to carry while traveling.

Multigrain gluten free biscuits are made up of different flours, groundnut and a functional food ingredient "dink" which is also a galactagogue which is given to lactating women which helps in increasing the breast milk production. ^[15] It provides high amount of protein due to presence of different flours of cereals and pulses. It also has high amounts of calcium, vitamin A and adequate amount of other nutrients.

OBJECTIVE OF STUDY

- Standardize an innovative nutritious product for all age groups, gluten allergic people, pregnant and lactating mothers and under weight or malnourished children and people.
- To understand every step of entrepreneurship.
- To study the shelf life of the product using a sensory evaluation (colour, texture, aroma, taste)
- To design a nutritional label.

- To make a cost effective product by better budgeting.
- To select a packaging material and to market the product in an effective way.

A food product was to be designed under a course of Food Science and Nutrition as part of food product development. A lot of brain storming was done to innovate a new nutritious health recipe but cost effective. Highly acceptable product such as Frozen Soy Cutlet, Mix Vegetable Halwa, Oats Muffin With Nutrella And Groundnut Filling, Multigrain Pizza Base and multigrain gluten free biscuits were thought off.

Mix vegetable halwa and multigrain gluten free biscuits were short listed. The idea of food product was mainly based on consumer acceptance, palatability, cost-effective, and nutrients provided by each product.

DESCRIPTION OF INGREDIENTS

Soybean is one of the most economical and nutritious foods which can combat the diseases stemming from malnutrition and the nutraceutical ingredients present in it and can reduce the risk of major chronic diseases like cancer, atherosclerosis, osteoporosis and diabetes (Vineet, 2007). Soybean is an excellent source of quality protein and compares well with animal protein in essential amino acids pattern with the exception of sulphur containing amino acids. Soybean is the concentrated source of

vegetable proteins. It contains about 40% protein and 20% oil. Proteins are abundantly rich in lysine which is a limiting amino acid in most of the cereals. Soy fat being highly unsaturated has been found to be nutritionally desirable. Therefore, it can easily supplement the diet of poor Indians (Chauhan, 2005). It has high proportion of unsaturated fatty acids, such as linoleic and linolenic acids, it is considered as highly healthful oil. The ratio of polyunsaturated fatty acid to saturated fatty acid is 82:18, which is highly conducive to lower the blood cholesterol. Soy food contains most of the desirable characteristics therefore; it may be treated as consummate functional food. Soybean also contains many minor substances, which are biologically active non nutritive components known as 'phytochemicals', 'isoflavones' or 'phytoestrogen' also known as coumesterol or 'plant estrogen' (very similar to that of female sex hormone estrogen) with very weak activity of estrogen, which offers unique health benefits. Soybean is a good source of niacin, riboflavin, iron, potassium, calcium, magnesium, and phosphorous with several fat and water soluble vitamin B-complex (Tripathi, 2005).

Sorghum is the most important cereal crop in the world with India contributing to nearly 14% of its total global production which is equivalent to about 8 million metric tons (FAO 2006). In this study, the effect of grain moisture content (12–20%), temperature (140–180 °C), and time (5–15 min) of roasting on the quality attributes of sorghum grain was studied. The response functions were rheological attributes of powder flow ability, color, water absorption capacity, and sensory acceptability. Higher temperature and longer roasting time had a detrimental effect on color and sensory acceptability of product. An increase in moisture content of grain induced lower cohesion characteristics in the flour. Raw sorghum flour exhibited highest peak viscosity for roasted samples. Optimum condition for maximum sensory acceptability was achieved with a grain moisture content of 16–20% and temperature 161–179°C for 12 min of roasting.^[11]

Oat bran provides many health benefits such as serum cholesterol lowering (Anderson and Chen 1986; Malkki et al 1992, Behall et al 1997, Kahlon & Woodruff 2003), reduce coronary heart disease (Berg et al 2003, Truswell 2002) & diabetic symptom (Pick et al 1996, Tappy et al 1996), reduce blood pressure (Kestin et al 1990, Saltzman et al 2001) and cancer prevention (Adom and Liv 2002) in human. Primary health beneficial oats hydrocolloid (OH) ingredient, with 5-50% β -gluten content (dry weight DW) commercially available (Inglett 1993, Carriere and Inglett 2000, Lee et al 2005).^[6] This review presents current information about principal, biologically active compounds contained in grains of cereals that are most popular in Europe (wheat, rye, barley and oat). The tendency to provide consumers with safe foods, which promote their health and are based on cereal grains and/or their components with the high nutritive value, has been recently observed. The intake of protective substances

contained in whole grains and their fractions contributes to a decreased risk of food-dependent diseases like the coronary heart disease and insulin-dependent diabetes. This study describes the structure, occurrence in cereal grains, technological importance and beneficial influence on human health of bioactive substances such as arabinoxylans, β -glucans, alkylresorcinols, tocopherols and phytosterols.^[12]

Maize protein is deficient in lysine and tryptophan. However; soybean/maize blend would provide a nutritionally balanced food because of the improved protein quality and increase energy value of the blend. However the extended use of soybean/maize is to incorporate it as an ingredient for the production of finished product (Narayana and Narasing Rao 1982) cookies constitute an important component of the Nigerian diet. They could provide an excellent meal of improving nutritional quality through incorporation of vegetable protein. Therefore, the objective of this study was to determine the chemical and functional property of soybean/maize flour blend and to evaluate the performance of the blend and cookies.^[7] Maize is the coarse grain, which provides the desired level of economic viability to the processing units because of the unmatched increase in value by-products obtained from it. Out of 29 major maize growing countries, India ranks 5th in the area and 8th in the production.^[8]

Finger millet (ragi) is mainly used in India and Africa. It is rich in calcium, iron and functional fiber.^[9] Wheat flour was replaced with native finger millet flour (NFMF) and germinated finger millet flour (GFMF) at 30–50% levels to make soft dough biscuits. Dough rheological properties and baking characteristics of the blends were evaluated. The results of the study indicated that the replacement level of 40% with either NFMF or GFMF produced biscuits with acceptable sensory attributes.^[10] Finger millet (*Eleusine coracana*) is a grass crop grown in Africa, India, Nepal, and many countries of Asia. It is rich in polyphenols and particularly in calcium. Food made from malted ragi is traditionally used for weaning and has been the source of low viscosity weaning foods that can deliver more energy per feed than those based on gelatinized starch. There is some evidence that foods from finger millet have a low glycaemic index and are good for diabetic patients.^[13]

Groundnut, or peanut (*Arachis hypogaea*), is a major source of edible oil and protein meal and considered highly valuable for human and animal nutrition especially in the developing world.^[21]

Celiac disease is an immune-mediated enteropathy, characterized by lifelong intolerance to gluten in genetically susceptible individuals. This study aims to develop hypoallergenic pasta using blends of *Triticum durum semolina*, 40% of other non-wheat flours and additives. Formulated pasta samples were evaluated for product quality characteristics and also subjected to biochemical analysis. Results showed that cooking loss ranged from 6.9% to 7.4%, which were within the

acceptable range of 8%. Color change was low and in vitro protein digestibility of the pasta was found to be insignificant. Pasting characteristics of the hypoallergenic flour showed the increased peak viscosity and decreased gelatinization temperature. The scanning electron microscopy results demonstrated less-affected microstructure of gluten network. Texture profile analysis and descriptive sensory analysis revealed that optimized hypoallergenic pasta with xanthan gum as additive was acceptable and comparable with control. In conclusion, the hypoallergenic pasta prepared by replacing *T durum* flour by 40% of other non-gluten flours could be useful for celiac patients because of its low antigenic activity.^[14]

MATERIAL AND METHOD

Multigrain gluten free biscuits were made with different kinds of flour, groundnut and dink. It is high in calcium, fiber, vitamin A; it also contains protein, iron.

RAW MATERIALS

The raw material used such as Ragi (Scientific Name: Eleusine Coracana), Jowar (Scientific Name: Sorghum), Oats (Scientific Name: Avena Sativa), Maize (Scientific Name: Zea Mays), Soybean Flour (Scientific Name: Glycine Max), Groundnut (Scientific Name: Arachis Hypogaea) Dink (Edible Gum), Milk, Sugar, Butter, Oil, Cardamom, Salt (Scientific Name: Sodium Chloride) and Baking Powder (Scientific Name: Sodium Bicarbonate).

PREPARATION OF MULTIGRAIN GLUTEN FREE BISCUITS

Type 1: Multigrain Gluten Free Biscuits with groundnuts

Type 2: Multigrain Gluten Free Biscuits with dink

Type 3: Multigrain Gluten Free Biscuits with groundnuts and dink

TABLE I: The Amount of Ingredients Used For the Preparation

INGREDIENTS	Type 1	Type 2	Type 3	Standard
Ragi flour (Eleusine Coracana)	10g	10g	15g	12g
Jowar flour (Sorghum)	8g	8g	10g	8g
Maize flour (Zea Mays)	5g	4g	5g	4g
Soybean flour (Glycine Max)	5g	5g	10g	8g
Oats flour (Avena Sativa)	8g	8g	10g	8g
Bajra flour (Pennisetum glaucum)	5g	5g	-	-
Sugar	35g	40g	35g	28g
Butter	35g	30g	15g	12g
Cardamom	-	-	2 pieces	2 pieces
Oil	-	15g	10g	7g
Dink (Edible Gum)	-	15g	15g	12g
Groundnut (Arachis Hypogaea)	15g	-	10g	8g
Milk	25ml	10ml	10ml	10ml
Salt	A pinch	A pinch	A pinch	A pinch
Baking powder	¼ tsp	¼ tsp	¼ tsp	¼ tsp

FLOW CHART FOR THE PREPARATION OF MULTIGRAIN GLUTEN FREE BISCUITS

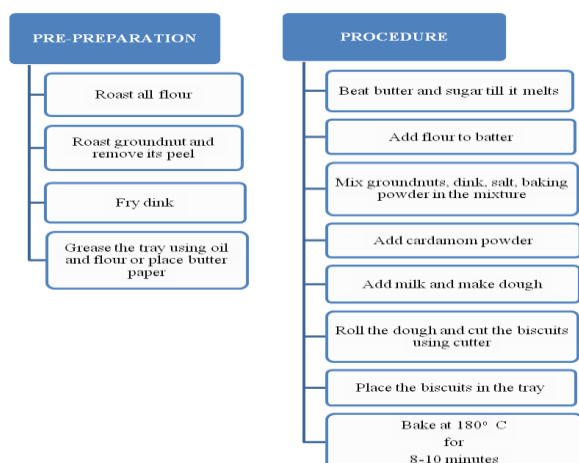


Figure 1: The Preparation of Multigrain Gluten Free Biscuits

SENSORY EVALUATION FOR STANDARDISED RECEPIE

Sensory evaluation for standardized scoring test was done with the help of train panelist. It includes colour, texture, aroma, appearance and taste which was scored on a 5 point scale where 5 = excellent, 4 = very good, 3 = good, 2 = fair and 1 = poor.

PACKAGING MATERIAL: ALUMINIUM FOIL CONTAINER





Figure 2: Aluminium foil container

Aluminium is best used material as a food-packaging as it tolerates a wide range of temperatures. This characteristic makes it suitable for foods that need to be frozen, grilled, baked or just kept fresh. Containers can be made robust enough to handle large quantities of food, yet still retain a lightweight quality. It is available in different types such as Square, Rectangular, Medium or large rounds, Oval, Compartmental etc...It is Easy to store and transport, Retain taste and quality of food, Recyclable. [20]

NUTRITIONAL LABEL

It is an important process in food processing. Label gives an identity to the product, the quantity of contents, and the ingredients to ensure that the consumers are not being misled or cheated. For the manufacture, the label is a major vehicle for promoting products and product lines. [16] It is used to identify one product from another and to decide which product to purchase. Nutrition label is an important marketing tool for a product it should be attractive and eye catching .It should also provide information such as ingredient, nutritional quality, manufacturing date, MRP, expiry date, net weight etc.

BUDGETINDG

Budgeting is important to achieve financial success. Products budget must be cost effective so that all income groups can afford. For the bulk production, food ingredients were brought from the wholesale marketing to reduce the expense and increase the profit.

SENSORY EVALUATION FOR SHELF LIFE STUDY

To study the shelf life of multigrain gluten free biscuits sensory evaluation was conducted every week which was done by trained panel member(total no = 10). Scoring test was done with the help of trained panelist. It includes colour ,texture, aroma ,appearance and taste

which was scored on a 5 point scale where 5 = excellent, 4 = very good ,3 = good , 2 = fair and 1= poor .

RESULT AND DISCUSSION

DEVELOPMENT OF THE MULTIGRAIN GLUTEN FREE BISCUITS

After assessing the sensory evaluation of the products the final product was made by adding flour in correct ratio i.e. [Ragi flour (3): Soybean flour (2): Oats flour (2): Jowar flour (2): Maize flour (1)]. Sugar and butter were taken in adequate amount. Dink and groundnuts were taken in equal proportion. Thus the product was standardized.

SENSORY EVALUATION OF MULTIGRAIN GLUTEN FREE BISCUITS

The sensory evaluation of the multigrain gluten free biscuit was shown in figure 3.

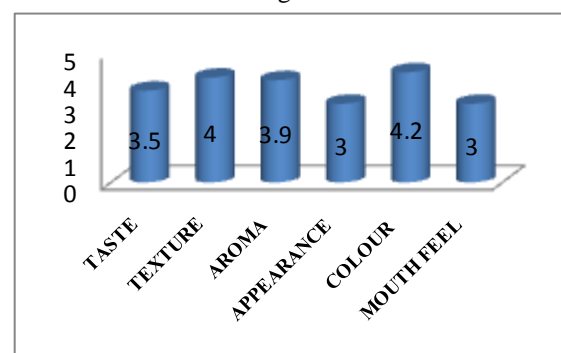


Figure 3: Sensory Evaluation of Standardised Multigrain Gluten Free Biscuits

It can be observed that colour, texture and aroma of multigrain gluten free biscuits scored very well and taste, appearance, and mouth feel scored well. Thus the product had a very good acceptability and was finalized.

PACKAGING MATERIAL





Figure 4: Aluminium Foil Container

Semi-rigid aluminium foil container was used for packaging of multigrain gluten free biscuits. They keep foods fresh. Aluminum foil containers are easy to clean up for re-use or for recycling. [18] Their heat conductivity is excellent and at home, the food can also be warmed, steamed, baked or grilled directly in the aluminium package which does not lose any of its protective properties. [19] One of aluminum's environmental advantages is its recyclability. [18]

BUDGETING

All ingredients and packaging materials were bought in bulk, to reduce cost. Table-2 shows the cost calculation for the ingredients used for multigrain gluten free biscuits.

Table-2 Cost calculation for the ingredients and material used for multigrain gluten free biscuits.

Ingredients	Wholesale Price (Rs.)
Ragi flour	25
Jowar flour	15
Maize flour	10
Soybean flour	20
Oats flour	66
Sugar	40
Butter	130
Cardamom	25
Oil	40
Dink	99
Groundnut	39
Milk	17
Salt	2
Baking powder	23
Packaging material	82
Label Printout	30
Labour	82
Electricity	41
Gas	41
Room rent	21
Traveling	50
Total	898

Total 41 packets were made out of which 40 packets were sold & remaining 1 was kept for sensory evaluation of Multigrain Gluten free biscuits. Total cost for production of Multigrain Gluten free biscuits was Rs.898/-, per packet price was Rs.28 /-. After selling the product total gain was Rs.1120/- out of which profit was Rs.222 /-. As the ingredients were purchased at wholesale rates profit was more. The price of product was high because of use of so many ingredients in small amounts but if they are produce on a large scale the price of production and packaging can be reduce to large extent.

NUTRITIONAL LABELING

It consists of Ingredients, Nutritional Information, Net Weight, Manufacturing date, Expiry Date, Price, benefits or special recommendations. Nutritional Labeling for multigrain gluten free biscuits is shown in figure 5.

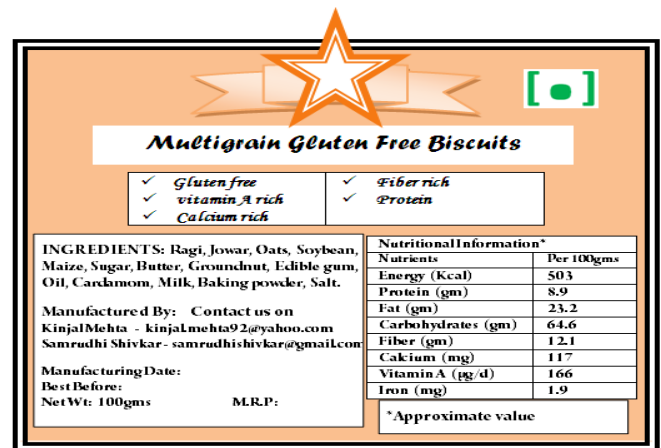


Figure-5 - Nutritional Labeling For Multigrain Gluten Free Biscuits

SENSORY EVALUATION OF MULTIGRAIN GLUTEN FREE BISCUITS FOR FOUR WEEKS AFTER BULK PRODUCTION

The sensory evaluation of the multigrain gluten free biscuit was shown in figure: 6.

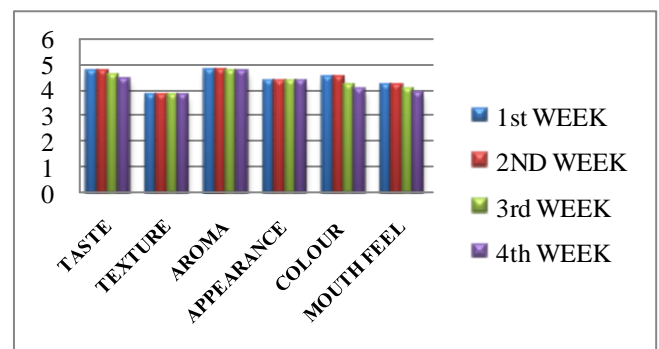


Figure-6- Sensory Evaluation of Multigrain gluten free biscuits for 4 weeks after Bulk production with the help of Scoring Test

It can be observed that product was constant for 2 weeks. Texture and appearance remained constant throughout the 4 weeks. There is a slight decline in taste, colour and mouth feel but the aroma of the product was somewhat similar to the 1st two weeks.

CONCLUSION

Multigrain gluten free biscuits is a product providing variety of nutrients and can be recommended for all age groups as it has good Proteins, vitamin A, Calcium and Fiber. It can be specially recommended for gluten allergic people, lactating women for galactagogue, malnourish people.

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