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DEVELOPMENT OF NUTRIENT ENRICHED FUNCTINAL BISCUITS FOR MALNOURISHED SCHOOL GOING CHILDREN

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ABSTRACT

A nutrient-enriched functional biscuit was developed for malnourished children as a supplementary food in the present study. One control biscuits and vitamin premix enriched three sample biscuits were formulated and organoleptic properties were tested for evaluation. Total 11 children performed sensory evaluation. Control biscuits were devoid of vitamin premix, whereas in sample-1, 2 and 3 incorporating 0.5, 0.75 and 1% vitamin premix added respectively. Proximate composition analysis showed that controlled biscuits contain 4.8% moisture, 2.3% crude fiber, 14.7% protein, 19.5% fat, 56.1% carbohydrate, 2.1% ash and energy 458 Kcal. In case of organoleptic evaluation, sample -2 biscuits was more acceptable compared to all other quality characteristics by the organoleptic test. Sample-2 biscuits contain 4.5% moisture, 3.5% crude fiber, 14.6% protein, 19.9% fat, 55% carbohydrate, 2.3% ash and energy 457 Kcal. Proximate analysis and sensory evaluation concluded that, our newly developed biscuit-2 has the optimum taste and nutrient content; therefore, further implications of this research are necessary in favour of school-going children.

KEYWORDS: Functional biscuits; Malnourished; School going Children.

1. INTRODUCTION

The nutritional status of school-going children is a composite of many interrelated factors. They include feeding practices, environmental, economical, biological, educational, and cultural factors, as well as issues pertaining to food security. The frequency of illness also affects nutritional status. The nutritional status of children can thus be used as an indicator of the socioeconomic development of a community or nation.[1] School age is the active growing phase of childhood.[2] Childhood in school going period is a very crucial time for their growth and development. School going children is mainly prone to malnourished. In this period, the rate of growth is slow but continuous.[3] Childhood in school going period is a very crucial time for their growth and development. Growth monitoring and promotion process of school going children is there of particular importance for better nourishment of them. The fact that most of the risk factors associated with inadequate diet and changes in lifestyle habits that in most cases begin in childhood and are passed into adolescence, linking them with prevention, which should start in the early period of child life.[4]

The health problems due to miserable nutritional status in primary school-age children are among the most common causes of low school enrolment, high absenteeism, early dropout and unsatisfactory classroom performance.[2] Iodine deficiency can lead to a spectrum of disorders ranging from severe mental retardation to milder forms of motor and cognitive deficits.[5] Although damage due to iodine deficiency early in life is usually irreversible, recent studies suggest that there might be an additional component of iodine deficiency that can be reversed.[6] Vitamin A deficiency also affects iron metabolism. It has been shown that responses to iron fortification are limited in children with marginal vitamin A status,[7] and that supplementation with iron is more effective when iron is given in conjunction with vitamin A.[8]

The healthy food as an important part of our health. Chronic under nutrition in childhood is linked to slower cognitive development and serious health impairments later in life that reduce the quality of life of individuals.[9] Children are much more sensitive than adults in terms of accuracy and errors in diet. Sometimes food habits or dietary patterns responsible for their health and nutritional status as well as their future directions.[10] The role of proper nutrition means the adequate nutrient intake and total energy dense food. The good and proper diet does not mean that the child can't eat what it wants to or that it must eat what it doesn`t want. It actually means variety and moderation in diet. The child can

choose certain foods because it is tasty or as "just" that has the menu.[11]

School going children belongs to the age group 6 to 12 years. In this stage an adequate intake of energy and other nutrients in the diet would seem of importance in order to build up the full potential of an individual. Their health and nutrition status will largely determine the quality and caliber of the next generation. Further under nutrition in school going children may cause poor body growth and other malnutrition such as stunting, wasting etc. So, for school going children nutrition is important in many aspects. Therefore, attempts have been taken for formulation and development of a newly developed functional biscuits for school-going children.

School-aged children grow significantly, but at slower rate, whilst being very physically active in general. As a result, their nutritional needs are high and critical. Additionally, genetic background, gender, body size and shape are all important determinants of nutrient requirements. At the same time, they may face new challenges regarding food choices and habits. During the primary school years, a greater proportion of meals may be eaten away from home in the school setting. In order to fulfilling nutritional demand fortified food items is very crucial for school age children. Biscuit is a bakery product which is high in carbohydrates, fat and calorie but low in fiber, vitamin, and mineral which make it unhealthy for daily use. The formation of nutritionally balanced biscuits is necessary.

1.2 Specific objectives

- To formulate the multi-nutrient enriched functional biscuits based on native food sources and vitamin premixes.
- To analyze the proximate composition of the prepared different functional biscuits sample.
- To assess the organoleptic quality of the prepared biscuits in different functional biscuits sample.

2. MATERIALS AND METHODS

This special research work was carried out at the factory of New Olympia Bread and Biscuits Pvt. Limited at Savar areas of Dhaka city and the laboratory work was carried out at the Dept. of Food Technology & Nutritional Science, Mawlana Bhashani Science and Technology University during the period of June-August 2019.

2.1 Study design

In the present study an attempt has been made to develop multi-nutrient enriched functional biscuit by incorporating native food sources and vitamin premixes. Vegetable oil and Dalda mixture was used in the preparation of biscuit as a fat source.

2.2 Procurement and collection of raw material and vitamin premix

The ingredients required for the preparation of products were procured from the local supermarket. The functional ingredient, full fat soy flour and vitamin Premix for research purposes only, was collected from a renowned Bakery industry (New Olympia Biscuits Industries (Pvt.) Ltd., Savar, Dhaka), who was the pioneer World Food Program- High Energy Biscuit (WFP-HEB) producer for school feeding program in Bangladesh.

2.3 Standardization of biscuit

Standardization is the optimum goal for a recipe development procedure. The recipe itself is a blueprint for food production. It should facilitate the reproduction of a food item with easy and accuracy. Recipe standardization is the process of "tailoring" a recipe to suit a particular purpose in a specific foodservice operation. Acceptance and implementation of standardized techniques and guidelines have widespread continuing benefits for both clients/management and the food professional. Standardization of recipe development gives further credibility to the value of the traditional home economics discipline. As the importance of proper recipe development is continuously emphasized, the much needed and skilled service of the food technologist will be strengthened.

Table 1: Standardization of different ingredients in the formulation of control biscuits.

Ingredients	Levels (100 g white wheat flour basis)
Full fat Soy-flour, g	4, 5 and 6
Fat, g	25, 30 and 35
Sugar, g	35, 40 and 45
Baking powder, g	0.3, 0.4, and 0.5
Ammonium bi-carbonate, g	0.7, 0.75 and 0.8
Skim-milk powder, g	5, 6 and 7
Water, ml	15, 16 and 17

Table 1 represents the variations were made in the formulation to improve the acceptability of biscuits prepared from white wheat flour. The level of each ingredient giving the best product in terms of sensory characteristics were selected and used in the formulation for the standardization of next ingredient. After standardization, sweet biscuits were prepared using the traditional creamery method as per the following recipe.

Table 2: Different ingredients used for the preparation of control biscuits.

Ingredients	Quantity
Refined wheat flour	100 g
Full fat Soy-flour	5 g
Vegetable oil and Dalda mix	30 g
Sugar	40 g
Baking powder	0.4 g
Ammonium bi-carbonate	0.75 g
Skim-milk powder	6 g
Common salt	1 g
Water	

Powdered sugar, fat and flavor (Vanilla) were creamed in a mixer. To this, a skimmed milk was added (SMP : water is 1:1.5), a well-mixed blend of white flour and baking powder was added along with water containing common salt and ammonium bicarbonate and the contents were mixed further for 2 minutes to make the dough. Using a wooden rolling pin, the dough was sheeted on a metal platform to a uniform thickness of 1.5 mm. Circular biscuits of approximately 5 cm diameter were cut and baked for 4 to 5 minutes at 200oC / 2200C (top / bottom) in a baking oven (Continental Equipment & Instrumental Co.). The organoleptic characteristics of biscuits were determined according to the principle.[12]

2.4 Product development

The above standardized recipe was used to develop the multi-nutrient enriched functional biscuit using vitamin premix at 0.5, 0.75 and 1.0% level (Table 3). Vegetable oil and Dalda mix was used as fat source for the preparation of biscuit, the total fat content of biscuit was adjusted by estimating the fat content of other ingredients. Biscuits were prepared from white flour and blends of white flour and full fat soy flour using the following proportions by the procedure mentioned above.

Table 3: Different ingredients used for the preparation of control biscuits.

Ingredient	Quantity			
	Control	Sample -1	Sample -2	Sample -3
Vitamin Premix	0 g	0.5 g	0.75 g	1.0 g
Refined wheat flour	100 g	100 g	100 g	100 g
Full fat Soy-flour	5 g	5 g	5 g	5 g
Vegetable oil and Dalda mix	30 g	30 g	30 g	30 g
Sugar	40 g	40 g	40 g	40 g
Baking powder	0.4 g	0.4 g	0.4 g	0.4 g
Ammonium bi-carbonate	0.75 g	0.75 g	0.75 g	0.75 g
Skim-milk powder	6 g	6 g	6 g	6 g
Common salt	1 g	1 g	1 g	1 g
Vanilla Water		16 ml	16 ml	16 ml

2.5 Process of Biscuit Manufacturing

Ingredient was used for preparation of biscuits according to above stated recipe. The refined wheat flour was sieved and other dry ingredients and were mixed together to obtain a uniform blend. Vegetable oil, sugar was mixed together to obtain sweetened shortening cream. Then slowly mixed dry flour was added to shortening cream with addition of water to prepare dough. The dough was prepared by manual kneading of all the dry and liquid ingredients to attain uniformity with desirable viscoelastic characteristics. When dough was ready it was kept for 10-15 minutes as it is and then used for sheeting, sheets were made by rolling balls of dough on wooden platform. These sheets were cut by hand operated metal dye, arranged on olive oil coated tray and were kept for baking. Baking takes place in three successive stages in electric oven. In the beginning structural changes take place due to heating of dough. In second stage greatest loss of moisture take place. In third stage the color of biscuit changes to typical light brown color of finished biscuit. Each lot requires 25-30 minutes at 160 o C for baking. The flow sheet for preparation of biscuits.

2.6 Organoleptic Analysis (Sensory evaluation of physical parameters of the developed biscuit)

Various methods have been used to measure food preferences. The most common method is a questionnaire of generated foods or food categories in which a hedonic scale is used to rate the degree of likings. Hedonic scale is an organoleptic quality rating scale where the judge expresses his/her degree of likings. Overall tests are conducted by using five point Hedonic scale.[13]

Points given by the sensory panel based on the likings and disliking were analyzed by SPSS program.

2.7 Nutrient analysis of the developed biscuits

Moisture, ash content, fat, protein content, crude fiber of the samples were analyzed for their chemical qualities. All the developed soy incorporated multi-nutrient enriched functional biscuits were analyzed for proximate composition moisture, protein (N x 6.25), crude fat (ether extractives) ash, crude fibre, carbohydrate content and Minerals, mainly iron (colorimetric) and calcium (titrimetric) were estimated using standard,[14] method.

3. RESULTS AND DISCUSSIONS

3.1 Comparison of the Organoleptic Qualities of Biscuits

Organoleptic tests of the biscuits depend on its first appearance, color, flavor & smell, texture, and overall taste of the sample. Table 3 and Figure 1 show the comparison among the biscuits of their organoleptic quality factors. The general form of the organoleptic Hedonic scale was used in the following rated: 1 = Dislike very much; 2 = Dislike; 3 = Neither like nor dislike; 4 = Like; 5 = Like very much. The overall band score among the four types of biscuits is acceptable in quality but their specific characteristics slightly differs by the test panel board.

Table 4: Comparison of the different organoleptic quality parameters (Sensory evaluation) of biscuits.

Quality Parameters	Sample-1		Sample-2		Sample-3		Controlled biscuits	
	Mean ±SD	Result	Mean ±SD	Result	Mean ±SD	Result	Mean ±SD	Result
Appearance	4.07± 0.24	> 4	4.09± 0.17	> 4	4.01±0.16	> 4	4.08±0.12	> 4
Color	4.27± 0.41	> 4	4.37± 0.35	> 4	4.05± 0.24	> 4	4.17 ± 0.51	> 4
Flavor & Smell	4.13± 0.28	> 4	4.35± 0.42	> 4	4.13 ± 0.5	> 4	3.73 ± 0.65	> 3
Texture	4.41± 0.44	> 4	4.29± 0.36	> 4	4.05± 0.24	> 3	3.95 ± 0.55	> 3
Overall taste acceptance	4.26± 0.33	> 4	4.34± 0.43	> 4	4.05± 0.46	> 4	4.04 ± 0.47	> 4

Table 4 shows that sample-2 obtained higher score 4.09±0.17 for its appearance. Appearances of biscuits depend on appearance of wheat and other raw appearance of ingredients and on processing technique. In the appearance acceptability test, Hedonic scale showed that sample-2 liked very much (>4) by the all Judges.

Table 4 shows that normal biscuits without incorporation of multi vitamin premix controlled biscuits (mean is 4.17 ± 0.51) liked very much for its color acceptance. Similarly all the functional biscuits were like very much categories acceptance range and sample-2 shows the best color quality of biscuits.

The flavor and smell of the products depends on the volatile constituents of raw material. The flavor mean score were 4.13 ± 0.28, 4.35 ± 0.42, 4.14 ± 0.51, 3.83 ± 0.65 of sample-1, sample-2, sample-3 and controlled biscuits respectively shows in the Table 4. In the flavor and smell acceptability test showed that sample-2 was liked very much (>4) by the judges and they also like other prepared sample-1 and 3.

Texture of the biscuits depends mainly upon the rate of development of the dough and the proportion of sugar used. The wide variation in the quality parameter of biscuits can be attributed to the manufacturing conditions type of raw material used. The mean score of texture were 4.40 ± 0.74, 4.20 ± 0.56, 4.05 ± 0.14, 3.25 ± 0.75 respectively shows in the Table 4 Texture of sample-1 was very much liked (>4) by the judges.

Taste is also influenced by the quality of the raw materials used in the processing of biscuits. The mean taste score of biscuits were 4.46 ± 0.63, 4.43 ± 0.53, 4.03 ± 0.43, 4.14 ± 0.57 respectively shown in the Table 4 .In taste acceptability test, Hedonic scale showed that the sample-1 biscuit was more acceptable comparing with all quality characteristics by the judge.

Table 5: Nutritive Value of the control and different samples.

Nutrients	Content per 100gm			
	Control	Sample 1	Sample 2	Sample 3
Moisture (%)	4.8	4.7	4.7	4.8
Protein (%)	14.7	14.8	14.9	14.9
Fat (%)	19.5	20.1	20.1	20.1
Ash (%)	2.1	2.2	2.3	2.3
Crude fiber (%)	2.3	2.9	2.9	2.9
Carbohydrate (%)	56.1	55	55	55
Energy (Kcal)	458	460	461	461

Table 5 shows the nutrient contents of normal biscuits that was estimated by using different analytical methods. Per 100 gm (normal biscuits) of product contain 4.8% moisture, 2.3% crude fiber, 458 Kcal energy and 14.7% protein, 19.5% fat, 56.1% carbohydrate, 2.1% ash.

4. CONCLUSION

Bangladesh is a developing country with a large portion of people suffering from malnutrition especially children. In normal biscuits no extra soy-flour and vitamin premix was added. Where as in sample-1, 2 and 3 incorporating 5% full fat soya flour and 0.5, 0.75 and 1% vitamin premix added respectively during the product formulation. After proximate composition analysis

controlled biscuits contain 4.8% moisture, 2.3% crude fiber, 458 Kcal energy and 14.7% protein, 19.5% fat, 56.1% carbohydrate, 2.1% ash. However in sample-1 the proximate was 4.6% moisture, 2.2% crude fiber, 460 Kcal energy and 14.8% protein, 20.1% fat, 55% carbohydrate, 2.2% ash. On the other hand sample-2 contain 4.5% moisture, 3.5% crude fiber, 457 Kcal energy and 14.6% protein, 19.9% fat, 55% carbohydrate, 2.3% ash and sample-3 contain 4.7% moisture, 4.1% crude fiber, 449 Kcal energy and 14.9% protein, 19.3% fat, 54% carbohydrate, 2.3% ash. In case of Organoleptic evaluation sample-2 biscuits was more acceptable comparing with all quality characteristics by the judge.

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