



Nutritionally Enriched Functional Biscuits for School-Going Children Who Are Malnourished

Abduz Zaher Uddin

¹Institute of Nutrition and Food Science, University of Dhaka, Dhaka, Bangladesh.

Article Info

Received: 31-09-20254

Revised: 19-10-2024

Accepted: 30-10-2024

ABSTRACT

The current research aimed to complement the diets of malnourished children by creating a functional biscuit that was high in nutrients. The organoleptic qualities of one control biscuit and three samples of biscuits enhanced with vitamin premix were evaluated. Eleven students completed the sensory assessment. Biscuits in the control group did not include any vitamin premix, while samples 1, 2, and 3 had 0.5%, 0.75%, and 1% of the supplement added, respectively. Controlled biscuits, according to proximate composition analysis, include 4.8% moisture, 2.3% crude fiber, 14.7% protein, 19.5% fat, 56.1% carbohydrates, 2.1% ash, and 458 kcal of energy. Sample 2 biscuits fared better than the other samples in terms of organoleptic assessment, which takes into account all other quality parameters. The biscuits in Sample 2 have the following composition: 4.5% water, 3.5% crude fiber, 14.6% protein, 19.9% fat, 55% carbohydrates, 2.3% ash, and 457 Kcal of energy. Further implications of this study are important for school-going youngsters, since proximate analysis and sensory assessment determined that our newly-developed biscuit-2 has the ideal flavor and nutritious content.

KEYWORDS: Functional biscuits; Malnourished; School going Children.

1. INTRODUCTION

There are several interconnected aspects that contribute to the nutritional condition of children attending school. Concerns about food insecurity are among them, along with eating habits, ecological, economic, biological, educational, and cultural considerations. Nutritional status is influenced by the frequency of sickness as well. So, a nation's or community's level of socioeconomic development may be gauged by looking at the nutritional condition of its children. The busy developing era of children is known as school age [1]. The years spent in school throughout childhood are formative for many reasons. Malnutrition is more common among school-aged children. During this time, growth is steady but modest. The years spent in school are formative for children's personal and intellectual development. It is of utmost significance to monitor and promote the growth of school-aged children in order to provide them with better nutrients. Because most risk factors linked to unhealthy eating and other lifestyle changes start in infancy and persist into adolescence, preventative efforts should begin throughout the formative years of a child's life. [4]

Among the most prevalent reasons of low school enrollment, high absenteeism, early dropout, and bad classroom performance are health issues caused by poor nutritional status in children of elementary school age. A variety of problems, including severe mental retardation and lesser types of motor and cognitive abnormalities, may be caused by an iodine shortage [2]. According to current research, there may be a reversible component of iodine deficit, even though harm caused by iodine deficiency in early

life is often permanent. [6] Iron metabolism might be impacted by vitamin A deficiency as well. Taking an iron supplement is more effective than iron fortification in improving children's vitamin A status, according to research [7]. efficient when used with vitamin A. [8]

As a vital component of our well-being, nutritious eating is essential. A worse quality of life is associated with cognitive delays and major health problems in adulthood, both of which are associated with chronic childhood undernourishment. [9] The sensitivity of children to dietary inaccuracies and mistakes is far higher than that of adults. Their nutritional condition, current health, and potential future outcomes are all affected by their eating habits and dietary patterns. [10] Adequate nutrient intake and consumption of total energy-dense food constitute the function of healthy nutrition. A healthy and balanced diet does not imply that a kid has to give up any of its favorite foods or force itself to consume

anything it dislikes. What it implies is that you should eat a balanced diet with diversity. Even a youngster can accomplish make a selection based on what's "just" on the menu or what sounds good. Children enrolled in formal education programs often fall between the 6–12 age bracket. At this point, it seems that getting enough calories and other nutrients from food is crucial for developing one's potential to its fullest. Their nutritional condition and overall health will have a significant impact on the standard and excellence of subsequent generations. Inadequate nutrition in school-aged children may lead to stunting, wasting, and poor overall growth. Thus, there are several reasons why proper nutrition is vital for school-aged children. Consequently, efforts were made to formulate and produce a functional biscuit specifically for school-aged youngsters.

Children in the school years have rapid, but gradual, physical development and growth. Consequently, they have very high and vital nutritional requirements. Nutritional needs are also affected by factors such as gender, genetics, size, and structure of the body. Meanwhile, individuals can encounter fresh obstacles related to their eating habits and preferences. In elementary school, students often eat more of their meals at school rather than at home. It is highly important to provide fortified food products to school-aged children in order to meet their nutritional needs. A biscuit is a baked good that is harmful to eat on a regular basis due to its high carbohydrate, fat, and calorie content and its poor fiber, vitamin, and mineral content. Biscuits that are balanced nutritionally must be made.

1.2 Specific objectives

- Using locally sourced ingredients and vitamin premixes, create functional biscuits that are multi-nutrient filled.
- To examine the close proximity of the ingredients in the various functional cookies that were created.
- To evaluate the produced biscuits' organoleptic quality in various functional biscuit samples.

2. MATERIALS AND METHODS

This unique study was conducted at New Olympia Bread and Biscuits Pvt. Limited's facility at

The research was place from June to August 2019 in the Savar regions of Dhaka city and the laboratory work was done at Mawlana Bhashani Science and Technology University's Department of Food Technology and Nutritional Science.

2.1 Research plan

The current research aimed to create functional biscuits that were multi-nutrient fortified by using vitamin premixes and natural food sources. As a fat source, the biscuits were made using a combination of vegetable oil and Dalda.

2.2 Getting the ingredients and vitamin premix

The items needed for their preparation were purchased from the nearby grocery store. A well-known bakery industry in Bangladesh, New Olympia Biscuits Industries (Pvt.) Ltd., Savar, Dhaka, was the first to produce World Food Program-High Energy Biscuits (WFP-HEBs) for the country's school feeding program. They provided the functional ingredient, full-fat soy flour, and vitamin Premix for the sole purpose of research.

The 2.3 Biscuit Standard

A recipe development approach should aim toward standardization. A recipe is just a plan for making food. It should be possible to replicate a dish with relative ease and precision using it. Standardizing recipes is like "tailoring" them to fit a certain need in the food service industry. Adopting and using standardized processes and standards will benefit the client/management and the food professional much in the end. The uniformity of recipe formulation further validates the traditional discipline of home economics. As the need of proper recipe development is continually emphasized, the function of the food scientist—who is both vital and very competent—will only become more significant.

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 200°C / 220°C (top / bottom) in a baking oven (Continental Equipment & Instrumental Co.). The organoleptic characteristics of biscuits were determined according to the principle.^[12]

2.1 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

2.2 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.

2.3 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.

2.4 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 $\pm$ SD	Result	Mean $\pm$ SD	Result	Mean $\pm$ SD	Result	Mean $\pm$ SD	Result
Appearance	4.07 $\pm$ 0.24	> 4	4.09 $\pm$ 0.17	> 4	4.01 $\pm$ 0.16	> 4	4.08 $\pm$ 0.12	> 4
Color	4.27 $\pm$ 0.41	> 4	4.37 $\pm$ 0.35	> 4	4.05 $\pm$ 0.24	> 4	4.17 $\pm$ 0.51	> 4
Flavor & Smell	4.13 $\pm$ 0.28	> 4	4.35 $\pm$ 0.42	> 4	4.13 $\pm$ 0.5	> 4	3.73 $\pm$ 0.65	> 3
Texture	4.41 $\pm$ 0.44	> 4	4.29 $\pm$ 0.36	> 4	4.05 $\pm$ 0.24	> 3	3.95 $\pm$ 0.55	> 3
Overall taste acceptance	4.26 $\pm$ 0.33	> 4	4.34 $\pm$ 0.43	> 4	4.05 $\pm$ 0.46	> 4	4.04 $\pm$ 0.47	> 4

Table 4 shows that sample-2 obtained higher score 4.09 $\pm$ 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

Malnutrition affects a significant number of people in Bangladesh, particularly children, who live in this developing nation. Extra soy-flour and vitamin premix are not often added to regular biscuits. In contrast, samples 1, 2, and 3 all included 5% full-fat soy flour and varying amounts of vitamin premix (0.5, 0.75, and 1%, respectively) when they were made. Following the examination of proximate composition

These biscuits have the following composition: 4.8% water, 2.3% crude fiber, 458 kcal of calories, 14.7% protein, 19.5% fat, 56.1% carbohydrates, and 2.1% ash. Sample 1 included 4.6% moisture, 2.2% crude fiber, and 460 near-by substances.

Nutritional breakdown: 14.8% protein, 20.1% fat, 55.5% carbohydrates, and 2.2% ash. Sample-2, in contrast, has 4.5% moisture, 3.5% crude fiber, and 457 kcal.

fuel, with carbohydrates making up 55% of the total and protein 14.6%.

2.3% ash and 4.7% moisture are seen in sample 3, 4.1%

protein (14.9%), fat (19.3%), carbohydrates (54%), and ash (2.3%), with 449 kcal of energy. Sample 2 biscuits were deemed more acceptable by the judge in the organoleptic examination when compared to all other quality attributes.

5. REFERENCES

1. Syed S, Rao R. Factors impacting academic performance among urban slum children in Hyderabad, India. The citation for this article is International Journal of Contemporary Pediatrics, 2015, volume 2, issue 4, pages 335-9.

The nutritional condition of school-age children in urban slums in India: a scenario (Srivastava A, Mahmood SE, Srivastava PM, Shrotriya VP, Kumar B.). December 2012, Archives of Public Health, 70(1), 8.

3. Martorell R. The causes and effects of childhood malnutrition. Nutrition and Food Bulletin, 1999, 20, 3, 288–292.

4. The relationship between psychosocial stresses and childhood obesity: a review by Gundersen, Mahatmya, Garasky, and Lohman. May 2011, 12(5): e54-63; published in Obesity Reviews.

5. Delange F. Iodine insufficiency and its negative effects on the brain. This sentence is paraphrased from Bautista et al. (2006). Oral iodized oil's impact on IQ, thyroid function, and physical development in school-aged children living in endemic goiter areas. Jan 1, 1982; 35(1): 127-34; American journal of clinical nutrition.

7. Kvalsvig JD, Faber M, Kruger M, Kenoyer DG, and Benadé AS were authors of the study. 12. Primary school children's micronutrient status as affected by iron-, iodine-, and β -carotene-enriched biscuits: a controlled experiment with random assignment of participants. On March 1, 1999, in the American Journal of Clinical Nutrition, volume 69, issue 3, pages 497–503. Vitamin A's function in iron deficient anemia (Mejia LA, 2008). 93–93 in Nestle Nutrition Workshop Series, 1993, volume 30, pages.

9. The work of Mells GF, Pells G, Newton JL, Bathgate AJ, Burroughs AK, Heneghan MA, Neuberger JM, Day DB, Ducker SJ, Sandford RN, and Alexander GJ. The UK-PBC nationwide research examined the effect of primary biliary cirrhosis on the quality of life as perceived. July 2013; 58(1): 273–283. Hepatology.

10. Armenta-Majem LL, Ribas L, Perez-Rodrigo C. The enKid research looked at the relationship between children's and teenagers' sociodemographic characteristics and their eating habits. In the August 28, 2003, issue of the European Journal of Clinical Nutrition, the authors Furst, Connors, Bisogni, Sobal, and Falk published a study. A model of the process of food choice conceptualized. Jun 1, 1996; 26(3): 247-66. Appetite.

Amerine MA, Pangborn RM, and Roessler EB (2013). Principles of sensory assessment of food. Retrieved September 11, 2013 from Elsevier.

The Association of Official Analytical Chemists (AOAC) published the Official Methods of Analysis in 1990 in Washington DC. The document covers pages 1–50.

14. A review of methodology and theory: hedonic scaling (Lim J.). Dec 1, 2011, 22(8): 733–747; Food Quality and Preference.