

Development of High Fiber Biscuits Supplemented with Selective Natural Immune Boosters

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Abstract

Enrichment in biscuits has been very popular for many years. Very recently enrichment of fiber or dietary fiber in biscuits has drawn much attention to the researchers as it exerts lot of health beneficial effects to consumers. The present study was designed to explore the possibility of development of high fiber biscuits using different fiber sources as well as supplementation of natural immune boosters in it. The entire study was divided into four groups where different types of fiber sources were used in developing biscuits. Group 1 served as the control group where basic ingredients were used to make biscuits. Other Three groups i.e. T₁, T₂ and T₃ were designed to serve as treatment groups where whole wheat, Chickpeas and barley were used respectively as the additional fiber sources along with other basic ingredients. Another fiber source, Wheat bran was used in all groups except control group. Natural Immune boosters, black cumin (*Nigella sativa*) and ginger (*Zingiber officinale*) were supplemented in each group except control groups. The proximate compositions of biscuits from different groups were analyzed using standard procedure. There were significant differences ($P < 0.05$) among almost all parameters in all groups. The fiber content was highest (5.84%) in T₃ and lowest (3.05%) in control group. Protein (9.11%) and fat (20.47%) content were recorded higher in T₂ group and lower in Control group. There was no significant difference in case of ash content in all groups. The Carbohydrate content was higher in control group (67.37%) and lower in T₁ group (65.97%). The sensory evaluation or organoleptic test suggested that, the addition of different fiber sources effect on the sensory parameters of biscuits. Therefore, this study concludes that High-fiber-biscuits might be prepared according to the formulation used in T₃ groups.

Keywords

Biscuits, Fiber, Immune Boosters, Proximate Composition, Supplementation

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1. Introduction

Biscuits, the most popularly consumed bakery items have become an indispensable part of our daily food habit and we can hardly imagine a cup of tea without biscuits. Biscuits have become traditional and significant food in many countries. This may be as a result of variety in form and taste combined with long shelf life and convenience of use. Biscuit is also known as an excellent

vehicle for incorporation of different nutritionally rich ingredients, thus making it a useful tool in meeting the nutritional requirements of the increasing population [1]. Now a days, the food industry has a challenge to produce low-cost, nutritive and convenient foods. Beside this, the offer of functional foods has increased, since they have the potential to health promotion, due to the bioactive compounds that are present or added to traditional formulations [2]. As the consequences of it different types of

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enrichments in biscuits is being made and some are already done. There is lot of research works exists in this avenue. Some research works have been done previously for making high fiber containing biscuits as dietary fiber intake provides many health benefits [3]. A generous intake of dietary fiber reduces risk for developing coronary heart disease [4], stroke [5], hypertension [6], diabetes [7], obesity [8] and certain gastrointestinal disorders [9]. Furthermore, increased consumption of dietary fiber improves serum lipid concentrations [10], lowers blood pressure [11], improves blood glucose control in diabetes [12], aids in weight loss [13] and appears to improve immune function [14]. Similarly, natural immune boosters like black cumin, gingers are very effective to boost up our immune system that are widely used and also trusty [15]. They also exert lot of health beneficial effects and prevent our body from different diseases [16-20]. The developed countries are very concern about producing functional food like high fiber food and they have already developed different arrays of functional foods beneficial for human health. In Bangladesh, the progress towards development of new functional foods especially on high fiber containing food is not satisfactory. Moreover, a wide range of people in this country, specially living under the poverty line are hardly concern about the daily nutritional requirement. Therefore production of high fiber biscuits supplemented with natural immune boosters will definitely help them to maintain sound health.

2. Materials and Methods

2.1. Raw Materials

Fine wheat flour and refined sugar were procured from the Fresh flour and united sugar limited, Dhaka, Bangladesh. All other ingredients including whole wheat flour, chickpea, barley, salt, vegetable oil, Fresh ginger rhizome, black cumin etc. were procured from local market of Dhaka, Bangladesh. All chemicals used were of high analytical grade.

2.2. Processing of Raw Materials

Chickpeas and barley were sundried and then properly grinded through grinder to make powder. The fresh ginger rhizome were cleaned and sliced into thin layer and then sundried. The dried ginger was grinded into powder. Black cumins were cleaned and sundried.

2.3. Preparation of Biscuits

Ingredients were used for preparation of different types of biscuits according to the recipe (Table 1). All dry ingredients including wheat flour were properly mixed together to get a uniform blend. Vegetable oil, sugar were creamed in a mixer to obtain a sweetened shortening cream. Then prepared blend of dry materials 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 visco-elastic characteristics. When the dough preparation was done it was used for sheeting. Circular biscuits of 6 cm diameter were cut and then baked for 8-9 minutes at 200°C in a baking oven. The biscuits of different types were cooled immediately after baking and packaged individually in an air tight container and kept at room temperature until used for analysis and sensory evaluation.

2.4. Analysis of Proximate Composition

Moisture content was determined by oven-drying method, Crude fiber by AOAC – 1996 method [21] Protein by Kjeldahl method,, Fat was determined by soxhlet apparatus method and ash was determined by incineration method.

2.5. Sensory Evaluation

The sensory evaluation of different types of biscuits was done by a 15 expert member panel

Table 1. Recipe for different types of biscuits.

Ingredients	Control	T1 (Whole Wheat)	T2 (Chickpeas)	T3 (Barley)
Wheat four (%)	60	42	42	42
Whole wheat flour (%)	-	15	-	-
Chickpea Powder (%)	-	-	15	-
Barley Powder (%)	-	-	-	15
Bran (%)	-	3	3	3
Cumin (%)	-	0.5	0.5	0.5
Ginger (%)	-	0.5	0.5	0.5
Sugar (%)	12.5	12.5	12.5	12.5
Salt (%)	0.5	0.5	0.5	0.5
SMP (%)	1	1	1	1
Vegetable Oil (%)	16.5	16.5	16.5	16.5
Lecithin (%)	0.157	0.157	0.157	0.157
Invert syrup (%)	1.75	1.75	1.75	1.75
Malt Extract (%)	0.5	0.5	0.5	0.5
Ammonium Bi Carbonate (%)	0.6	0.6	0.6	0.6
Sodium Bi-Carbonate (%)	0.2	0.2	0.2	0.2
Sodium Meta Bisulfite	0.016	0.016	0.016	0.016
Water (%)	5.5	5.5	5.5	5.5

The members were requested to measure the sensory characteristics and use the score. Judgments were made through rating products on a five point Hedonic Scale with corresponding descriptive terms ranging from 5 'like extremely' to 1 'dislike extremely'

2.6. Statistical Analysis

For the comparison of different parameters among groups, One way anova followed by dunnett's test was performed

using graphpad prism software (version 7.0).

3. Results and Discussions

3.1. Proximate Composition of Biscuits

Table 2 represents proximate composition of biscuits and shows significant difference ($p < 0.05$) among different groups.

Table 2. Proximate composition of biscuits.

Properties	Control	T ₁ (Whole Wheat)	T ₂ (Chickpea)	T ₃ (Barley)
Moisture (%)	1.66±0.08 ^a	1.97±0.09 ^b	1.42±0.10 ^c	1.69±0.13 ^a
Fiber (%)	3.05±0.09 ^a	4.46±0.045 ^b	5.32±0.08 ^c	5.84±0.04 ^d
Protein (%)	7.74±0.15 ^a	8.14±0.10 ^b	9.11±0.04 ^c	8.40±0.08 ^b
Fat (%)	18.25±0.13 ^a	19.93±0.15 ^b	20.47±0.12 ^c	19.16±0.05 ^d
Ash (%)	0.18±0.01 ^a	0.23 ±0.07 ^a	0.23±0.06 ^a	0.26±0.08 ^a
CHO (%)	67.37±0.152 ^a	65.97±0.32 ^b	66.67±0.15 ^c	67.32±0.18 ^a

Results are presented here as means±SD (n=3). Means bearing different superscripts in the same rows varied significantly ($P < 0.05$)

Moisture content of biscuits from different groups except T₃ varies significantly compared to control group. Moisture content was higher in T₁ group (1.97±0.09%) and lower in T₂ group (1.42±0.10%). The fiber content varied significantly in all groups compared to control group and it was highest in T₃ (5.84%) and lowest in control group (3.04%) These results are different from some of the previous studies [22, 23, 24, 25, 26]. They used different fiber sources and evaluated dietary fiber but this study analyzed total fiber. May be these are the reasons behind this variation. Protein and Fat content also varied significantly compared to control groups. Protein (9.11%) and fat (20.47%) content were recorded higher in T₂

group and lower in Control group that is comparable to a previously reported study [22]. There was no significant difference in case of ash content in all groups. However ash content was highest in T₃ group and lowest in control group. The Carbohydrate contents in all groups except T₃ varied significantly and it was highest in control group (67.37%) and lowest in T₁ group (65.97%) which was nearly similar to a previous report [27] but different from some studies [22, 28].

3.2. Sensory Evaluation

Table 3 represents the results of sensory evaluation or organoleptic test.

Table 3. Mean scores of sensory (organoleptic) parameters in different group of biscuits.

Properties	Points			
	Control	T ₁ (Whole Wheat)	T ₂ (Chickpea)	T ₃ (Barley)
Appearance	4.05±0.40	3.93±0.45	3.73±0.80	3.86±0.63
Taste	4.08±0.17	4.17±0.05	4.14±0.57	4.17±0.05
Sweetness	3.93±0.45	3.80±0.56	3.52±0.70	3.73±0.80
Saltiness	4.05±0.40	4.08±0.17	3.93±0.45	4.08±0.17
Color	4.20±0.56	4.17±0.05	3.80±0.56	3.93±0.45
Flavour	4.08±0.17	4.14±0.57	4.08±0.17	4.17±0.05
Texture	4.17±0.05	4.08±0.17	3.80±0.56	3.93±0.45

Results are presented here as mean±SD (n=15)

Appearance and color of biscuits depends on appearance of raw ingredients and other ingredients used as well as processing technique For Appearance and color, control group obtained highest score and it was 4.05±0.40 and 4.20±0.56 respectively where as group T₂ obtained lowest score and it was 3.73±0.70 and 3.80±0.56 respectively. According to the appearance and color acceptability test using Hedonic scale, control group was liked very much (>4) by the Judges. However, score for taste was highest in group T₃ and T₁ and lowest in control group. In case of sweetness and saltiness, hedonic scale showed that

control group and group T₃ were respectively more acceptable than other groups. Among all groups, Acceptability of flavor was highest in group T3 whereas acceptability of texture was highest in control group.

4. Conclusion

Addition of whole wheat, chickpea barley and wheat bran into the formulation of biscuits exhibited considerable effects on the physicochemical and sensory properties of biscuits.

Addition of barley in preparing biscuits led to increase the fiber concentration at highest rate in comparison with other groups. Sensory properties of this group were also acceptable. Therefore, high fiber biscuits might be developed using the formulation used in group T₃. In addition, further study will explore the possibility of developing high-fiber-biscuits from the blend of these fiber sources used in this study and the degree of immune boosting effects of the developed biscuits supplemented with selective natural immune boosters.

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