

Chemical Characteristic and Sensory Evaluation of Biscuit Enriched with Wheat Germ and the Effect of Storage Time on the Sensory Properties for this Product

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Abstract

This work aimed at determining the maximum acceptable level of wheat germ that can be added to one of homemade biscuits in Jordan, studying some chemical and sensory properties of this product, moreover, studying the effect of storage time after two months at room temperature on the sensory parameters of this product. The results showed that the addition of wheat germ in biscuit making at level of 20% (w/w) enhanced the nutritional value by increasing protein and total mineral content, as well as decreasing fat, total carbohydrates and total calories. The acceptability of sensory characteristics was improved by this fortification immediately after preparation and during storage.

Keywords

Biscuit, Wheat Germ, Enriched, Storage Time

1. Introduction

The word Biscuit derived from Latin word Biscoctum means twice baked. Biscuits are one of the low cost processed foods, which are most widely consumed. It, amongst many snack items, has certain advantages, such as being cheaper than the conventional snack items, easy to use at home or even during travel, easily being available in massive variety of shapes, sizes, tastes, and packs, and appeals to all age groups. Apart from the good taste, these foods with substantial energy having wholesome and nutritious quality are available at reasonable price. They have good shelf life at ambient temperature. Besides being a very palatable vehicle of nutrition and energy, these biscuits convey the goodness of flour, fat

and sugar in most acceptable and economical term [1].

Consumption of biscuit and bread appears in the list of top ten daily consumed foods, and they are easily available and convenient to be enjoyed as snack [2]. Attempts were being made in recent days to improve the nutritional qualities and functionalities of cookies, due to competition in the market for more healthy, natural and functional products [3].

Biscuit requires a balanced nutritional value which can be enhanced by fortification and supplementation with a wide variety of protein rich cereal and pulses [1].

Wholegrain buckwheat and rye flours were used to partially replace wheat flour in honey biscuit formulation. The produced enriched biscuits used to develop more nutritional end-product especially if adequate processing methods to improve its suitability in food applications are additionally considered [4].

Studies indicated that addition of pomegranate peel powder or juice in cookies preparation could enhance its nutritional quality without affecting the rheological, sensorial and antioxidant properties [4] [5].

Wheat flour was replaced with soy flour and Mushroom was added in biscuits. The results indicated that protein, fat content, fiber, iron and energy value of soy flour-supplemented biscuits increased. Ash content also increased but not significantly [6].

Youssef (2015) studied fortification of wheat biscuit with wheat germ at two levels: 15% and 20%. She found that biscuits with added 20% wheat germ had the best chemical, nutritional and sensory characteristics than 15%. The effect of other added wheat germ concentrations and storage time on this product was not studied [7].

Biscuits are widely produced in Jordan both in home and industrial scale. Moreover, this product is widely consumed by different ages due to cheapness, ease of handling and its nutritional value, however, this product suffers protein and dietary fiber deficiency. Wheat germ is one of the most efficient protein sources of vegetable origin containing good quantity of protein and dietary fiber, in addition to other nutrients like carbohydrates, reasonable quantity of minerals and vitamins. Therefore, this study aimed at:

- 1) Determining of the maximum acceptable level of wheat germ that can be added to one of homemade biscuits in Jordan.
- 2) Studying some chemical and sensory properties of this product (biscuit enriched with germ wheat).
- 3) Evaluating the effect of storage time after two months at room temperature on the sensory parameters for this product.

2. Materials and Methods

2.1. Biscuits Preparation

Raw materials including wheat flour (65% extraction rate), butter, egg, salt, sugar, baking powder and vanilla were purchased from local markets. Ingredients were mixed together in ratios of about 100% wheat flour, 50% butter, 7% egg, 20%

sugar, 0.2% salt, 1.5% vanilla and 0.7% baking powder, then manually kneaded. Dough was sheeted and cut into round shape with same sizes of about 5 mm in thickness and 50 mm in diameter. Biscuits were baked at 180°C for about 15 minutes and left to cool at room temperature.

2.2. Preliminary Study

Preliminary study was carried out for determination of the highest sensorially acceptable level of the added wheat germ to biscuits. Blends were carried out using concentrations of 5%, 10%, 15%, 20% and 25% (w/w) added wheat germ as described in 2.1. Then the prepared biscuits were sensorially evaluated by 5 trained panelists chosen from the teaching staff and technicians of the Department of Nutrition and Food Technology, Al-Huson University College. The samples were evaluated for overall acceptability using a 9-hedonic scale test as described by Larmond 1991, varying from 9, which means like extremely to 1, which means dislike extremely [8]. Water was used to neutralize the taste between samples testing.

2.3. Final Preparation of Biscuit Treatment

After determination of the best sensorially acceptable added level of wheat germ as described in section 2.2, the final treatment of biscuit was prepared as mentioned in section 2.1 by addition of 20% wheat germ. Control treatment was prepared without addition of wheat germ to conduct subsequent comparisons.

2.4. Proximate Composition

Biscuits were analyzed for proximate composition including moisture, fat, protein and ash following AOAC (1995) [9] procedures (analyses were carried out in duplicate). Total carbohydrates were calculated by difference.

2.5. Sensory Evaluation

The sensory characteristics of the two prepared biscuits blends (with 20% added wheat germ and control without added wheat germ) after baking and storage for two months at room temperature were assessed by 25 panelists chosen from the teaching staff, graduated students and technicians of the Department of Nutrition and Food Technology, Al-Huson University College. The panelists were from both sexes, and from different ages, they were requested to taste each sample separately without comparing it with another sample. The samples were evaluated for desirability in appearance, color, crispiness, texture, taste, flavor and overall acceptability using a 9-hedonic scale test as described by Larmond (1991), varying from 9, which means like extremely to 1, which means dislike extremely [8]. Water was used to neutralize the taste between samples testing.

2.6. Statistical Analyses

Data were subjected to standard deviation, means, and ANOVA followed by multiple comparisons at $\alpha = 0.05$ using statistical package for social science [10].

3. Results and Discussion

3.1. Preliminary Study and Final Treatment Preparation

Overall acceptability of the preliminary biscuits blends (Table 1) with wheat germ (GB) showed that treatment with 20% WG had the best evaluation that fall within the range of like moderately. Concentrations higher than 20% had lower scores that ranged from “neither like nor dislike” to “dislike slightly”. Therefore, the chosen final treatment was prepared with 20% added WG. This result coincides with that of Youssef [7].

3.2. Proximate Composition

Proximate analyses (Table 2) of biscuit treatments indicated that fortification of biscuit (B) with 20% WG significantly ($p \leq 0.05$) increased protein and total minerals, while decreased moisture, fat and total carbohydrates.

Protein and total minerals increased by about 29% and 49%, respectively. On the other hand, fat and total carbohydrates decreased by 14% and 0.6%, respectively. This increment in protein and total minerals as well as decrement in fat and total carbohydrates is beneficial from nutritional point of view, since it increases the quantity and quality of amino acids and minerals, while decreases the total calories that acquired from this product. Total calories of biscuit without germ were 477.84 kc/100 g, while those for biscuit with WG were 462.13 kc/100 g in difference of 15.71 kc/100 g in comparison with the control one. These results agreed with Youssef (2015) who found that wheat biscuits supplemented with wheat germ proved to be nutritious and healthful food by increasing crude protein and crude fiber, while lowest fat and caloric values [7].

Also these results agreed with Mousa, 2014, who found that the simultaneous substitution with germinated sweet white lupin flour at 25% and sweet white lupin oil at 35% raised significantly the values of protein and fiber [11]. However,

Table 1. Overall acceptability of preliminary blends.

Treatments	Control	5%	10%	15%	20%	25%
Overall acceptability	6.62	6.75	6.91	7.33	7.74	4.95

Table 2. Proximate analyses of biscuits*.

Characteristics %	Average		Its Significant differences between**
	B	GB	
Moisture	4.12	3.77	B & GB to B
Protein	10.57	13.68	B & GB to GB
Fat	19.80	16.85	B & GB to B
Ash	1.18	1.76	B & GB to GB
Total CHO	64.34	63.94	B & GB to B

*Readings were presented as an average of duplicates; **Significant differences at $\alpha = 0.05$.

the proposed substitution showed marked reductions in the values of fat, carbohydrate, and calories. El-Sharnouby *et al.* (2012) studied the effect of partial replacement of wheat flour with a 1:1 mixture of wheat bran and date palm fruit powder on nutritional quality of biscuit. They found that protein, ash and fiber contents gradually increased as the mixture levels increased [12].

3.3. Sensory Evaluation

Table 3 illustrates the sensory characteristics of biscuit treatments (control and with 20% WG) at zero time and after storage for two months at room temperature. As shown from this table addition of 20% WG significantly enhanced all the sensory characteristics of wheat biscuit. These results agreed with [13] who concluded that incorporation of maize bran and carrot extract into wheat flour in biscuit production enhanced consumer's acceptance of the product.

Appearance and color of GB were evaluated in the range of "like moderately" that touch "like very much" in comparison to "like slightly" and the beginnings of "like moderately" of control sample. This means that the yellowish color of WG improved these two sensory parameters of biscuit. These results agreed with Chioma and Chizoba (2015) who reported that incorporation of African yam bean flour with wheat flour at ratio of 10:90 enhanced the color and aroma of wheat biscuit [14].

Texture and crispness are of the most important sensory characteristics of biscuits evaluated by consumers. Fortification of biscuit with 20% WG enhanced these characteristics from "like slightly" to "like moderately". This could be due to increasing fiber content of biscuit by addition of WG that modified these two parameters. Increasing crude protein also maybe had positive effect on texture and crispness of biscuits, this is self educating seen from many researches fortified

Table 3. Sensory characteristics of biscuits.

Characteristic	Average			Its significant differences between**
	B	GB	GB 2 months	
Appearance	6.72	7.88	7.64	B & GB to GB B & GB 2 months to GB 2 months
Color	7.00	7.80	7.48	B & GB to GB
Texture	6.44	7.80	7.52	B & GB to GB B & GB 2 months to GB 2 months
Crispness	6.32	7.76	7.68	B & GB to GB B & GB 2 months to GB 2 months
Taste	5.91	7.62	7.75	B & GB to GB B & GB 2 months to GB 2 months
Flavor	5.83	7.77	8.08	B & GB to GB B & GB 2 months to GB 2 months
Overall acceptability	6.76	7.84	7.81	B & GB to GB B & GB 2 months to GB 2 months

**Significant differences at $\alpha = 0.05$.

wheat biscuits with high source of protein such as legumes or soy when the texture was enhanced.

Taste and flavor significantly were enhanced by addition of WG, it were evaluated “like moderately” in comparison to “neither like nor dislike” of control sample. This could be due to the distinguishable taste and flavor of WG itself that appeared clearly at added level of 20%. These results agreed with Usman *et al.* (2015) who concluded that incorporation of maize bran and carrot extract into wheat flour in biscuit production enhanced consumer’s taste and flavor [13].

Overall acceptability of GB, as a result of the effect of all other sensory characteristics, evaluated as “like moderately” in comparison to “like slightly” of biscuit without added WG, indicating that addition of WG in biscuit making had positive effect on its acceptability preference. These results agreed with [5] [15].

4. Conclusion

Addition of wheat germ in biscuit making at the level of 20% (w/w) enhanced its nutritional value by increasing protein and total mineral contents, as well as decreasing fat, total carbohydrates and total calories. Moreover, the acceptability of sensory characteristics was improved by this fortification. Therefore, it is recommended to utilize this valuable byproduct in production of biscuits to gain more nutritional and sensorial properties of this product.

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