

## Peanut butter incorporation as substitute for shortening in biscuits: Composition and acceptability studies

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### Abstract

The present study was designed to evaluate the composition and acceptability of biscuits prepared by partially replacing hydrogenated vegetable shortening with peanut butter to reduce the fats and enhance the nutritional value. For this objective five different treatments of biscuits were prepared from peanut (*Arachis hypogaea*) butter and hydrogenated vegetable shortening (Banaspati) i.e. T<sub>1</sub>(0:100) T<sub>2</sub>(10:90) T<sub>3</sub>(20:80) T<sub>4</sub>(30:70) T<sub>5</sub>(40:60). T<sub>1</sub> (without peanut butter) was kept as control. Physicochemical studies showed that peanut butter incorporation in biscuits increased moisture content, crude fiber and crude protein content, while Crude fat and Nitrogen free extract (NFE) decreased significantly with the incorporation of peanut butter. Sensory studies showed that biscuits prepared with peanut butter had relatively harder texture and darker color than control. However, peanut butter gave palatable flavor and taste to biscuits. The treatment with peanut butter and hydrogenated vegetable shortening (40:60) was the most preferred of all the samples.

### Keywords

Biscuits

Incorporation

Peanut butter

Qual

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### Introduction

The term biscuit was derived from the Latin word biscoctus, meaning twice cooked (Macrae *et al.*, 1993). Biscuits are popular foodstuff, consumed by a large number of populations today, due to their pleasant taste, prolonged shelf life and easy availability at fairly low cost (Gandhi *et al.*, 2001). Biscuits occupy primary position, both for production and consumption as compared to other bakery products (Ahmad *et al.*, 2010). Fat is an essential part of diet. It imparts flavor, texture and appearance of the baked product (Pylar, 1988). On the other hand, excess intake of fat in diet may lead to higher risk of diseases like obesity, coronary heart disease and cancer (Akoh, 1998). As biscuits are typically higher in fat content, it becomes difficult to prepare biscuits by reducing fat contents in their formulation to lower the risk of such diseases. To reduce the quantity of fat in bakery products fat replacers like peanut butter are used (Sanchez *et al.*, 1995). Peanut is an important legume which has attracted researchers in recent times (Azeket *et al.*, 2005), food having peanut are highly accepted by consumers because of their divine flavor. Peanut butter is a dispersion of peanut oil in peanut solids which results, when roasted peanuts are ground. Peanut butter is a good source of protein and fiber, and low in fat. It is continually applied for the preparation of low calorie improved food products (Woodroof, 1983). The confectionery formulations

contain banaspati (hydrogenated fat), which lowers the nutritional value due to presence of large amount of saturated fatty acids. The biscuits can be used as a source of desirable and essential fatty acid supplementation by utilizing part of peanut butter in place of banaspati.

Keeping in view all the above facts the present research was designed to cut down the amount of fat in biscuits by reducing saturated fats with the peanut butter. Moreover, effect of incorporation of peanut butter on physicochemical and sensory quality was also investigated.

### Materials and Method

Straight grade flour, sugar, hydrogenated vegetable shortening (Dalda VTF Banaspati), eggs, baking powder, milk and roasted peanuts were purchased from local market of Islamabad, Pakistan. The purchased peanuts were graded and sorted to remove damaged and immature nuts along with dirt and dust.

#### Peanut butter preparation

200 g peanut (variety BARI-2000) were mixed with fine sand, heated at 165°C in oven for 5 minutes, cooled and red skin removed by rubbing the de shelled peanuts between the palms. Discolored nuts or other undesirable parts were removed; cleaned peanut kernels were subjected to grinding at medium

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speed in domestic mixer for 2 minutes. The ground product was spread on aluminum tray and left for 3 h followed by de-oiling, when oil separation was noticed on the surface of peanut butter. The peanut butter was packed in airtight glass container and stored in refrigerator (10°C) to prevent rancidity.

#### *Biscuits preparation*

The biscuits were prepared as per standard recipe of AACC (2000). For the preparation of 45 biscuits 400 g of refined wheat flour and 2.0 g baking powder were mixed and sieved twice together. Powdered sugar (200 g) and hydrogenated vegetable shortening /peanut butter (as per treatment) were creamed in a dough mixer. The egg (40 g), sieved flour and baking powder were mixed together at slow speed for 10 minutes and then 20 ml milk was also added, mixed with other ingredients at high speed for 20 minutes. The mixing of the dough was continued until it reached the full development. The biscuits dough was sheeted on a wooden platform to a thickness of 3 mm using wooden rolling pin. The dough was cut into circular shape using a metallic cutter and arranged on a baking tray for baking. The biscuits were baked at 180°C for 25 minutes. Then biscuits were cooled and packed in polypropylene (40 µ thickness) pouches and quality evaluated after 24 h. The treatment plan used in the preparation of biscuits is given in Table 1.

#### *Chemical analysis*

Moisture, crude protein, crude fat and crude fiber of peanut butter and biscuits were determined in triplicate by the standard methods of AACC (2000). Nitrogen free extract was calculated by difference.

#### *Sensory evaluation*

The samples were subjected to sensory evaluation to determine consumer preferences among the different samples, for color, texture, flavor and overall acceptability by the method described by Meilgaard *et al.* (2007). A panel of 10 judges was involved in the sensory evaluation exercise. The samples were presented in coded identical transparent polyethylene bags and were tested individually. The order of presentation of samples was completely randomized. The panelists rinsed their mouth thoroughly with water after testing each sample and waited for a minute before proceedings to test the next sample. The sensory evaluation was based on a 9-point hedonic scale, where (9) represented “liked extremely” and (1) is “disliked extremely”.

#### *Statistical analysis*

The research was designed in completely randomized design (CRD). Data were analyzed with

Table 1. Treatment plan: Peanut butter to hydrogenated vegetable shortening (Banaspatti) ratio in standard recipe of biscuits

Treatments	Peanut butter: Bansspati
T <sub>1</sub>	0:100
T <sub>2</sub>	10:90
T <sub>3</sub>	20:80
T <sub>4</sub>	30:70
T <sub>5</sub>	40:60

Analysis of variance (ANOVA) and LSD was used to assess the location of the significant differences among the mean values by the method of steel *et al.* (1997).

## **Results and Discussion**

Chemical composition of peanut butter was: moisture (1.8%), crude fiber (6%), crude protein (25%), crude fat (45%) and NEF (20 %).

### ***Effect of peanut butter incorporation levels on physicochemical characteristics of biscuit***

#### *Moisture*

The data indicated that moisture progressively increased with increasing levels of peanut butter in biscuits (Table 2). Highest moisture (2.62%) was recorded in T<sub>5</sub> followed by T<sub>4</sub> (2.04%) in biscuits having peanut butter and hydrogenated vegetable shortening (30:70) which was statistically similar with T<sub>3</sub>. The lowest moisture (1.26%) was observed in T<sub>1</sub> (biscuits prepared without peanut butter). Sudha *et al.* (2007) reported that gradual increase in moisture content of biscuits with the increase of peanut butter supplementation might be attributed to higher amount of fiber in peanut butter and fiber has strong affinity for water and products containing fiber.

#### *Crude fiber*

High amount of crude fiber is beneficial for their role in the regulation of intestinal transit, lower the serum cholesterol level, constipation, diabetes, colon and breast cancer (Ishida *et al.*, 2000). The data about crude fiber indicated that crude fiber gradually increased with increasing levels of peanut butter (Table 2). Highest crude fiber (6.48%) was recorded in T<sub>5</sub>, while lowest fiber (1.23%) was found in biscuits prepared without peanut butter (T<sub>1</sub>). The data was comparable to that of Alozie *et al.* (2009), who reported that peanut butter has high fiber content, however, crude fiber increased in peanut butter supplemented cakes.

#### *Crude protein*

It has been observed from the data that protein content gradually increased with increasing levels of

Table 2. Mean values (%) of chemical constituents of biscuits

Treatments	Moisture (%)	Crude Fiber (%)	Crude Protein (%)	Crude Fat (%)	NFE (%)
Peanut butter+ Hydrogenated vegetable shortening (0:100)	*1.26±0.07 <sup>d</sup>	1.23±0.05 <sup>e</sup>	6.56±0.0 <sup>e</sup>	30.44±1.17 <sup>a</sup>	60.04±1.5 <sup>a</sup>
Peanut butter+ Hydrogenated vegetable shortening (10:90)	1.93±0.03 <sup>c</sup>	2.43±0.05 <sup>d</sup>	7.20±0.5 <sup>d</sup>	29.35±1.28 <sup>b</sup>	58.48±1.2 <sup>b</sup>
Peanut butter+ Hydrogenated vegetable shortening (20:80)	2.03±0.05 <sup>b</sup>	3.58±0.07 <sup>c</sup>	7.92±0.0 <sup>c</sup>	29.00±1.73 <sup>bc</sup>	56.83±0.9 <sup>c</sup>
Peanut butter+ Hydrogenated vegetable shortening (30:70)	2.04±0.04 <sup>b</sup>	4.90±0.36 <sup>b</sup>	8.02±0.1 <sup>b</sup>	28.53±2.51 <sup>c</sup>	55.86±1.1 <sup>d</sup>
Peanut butter+ Hydrogenated vegetable shortening (40:60)	2.62±0.06 <sup>a</sup>	6.48±0.05 <sup>a</sup>	9.15±0.0 <sup>a</sup>	28.26±1.9 <sup>c</sup>	52.82±1.1 <sup>e</sup>

\*Average of triplicate determination ± SD (standard deviation)

Means across the rows with different superscripts are significantly different ( $p \leq 0.05$ ).

peanut butter in biscuits (Table 2). The highest protein (9.15%) was observed in T<sub>5</sub> having peanut butter and hydrogenated vegetable shortening (40:60). Lowest protein content (6.56%) was recorded in control treatment. The results are in line with the results of Banureka and Mehendran (2009), who reported that pulses and nuts have high amount of protein, when these protein rich sources are added to biscuits they add protein to it.

#### Crude fat

Peanut butter has around 75% – 80% unsaturated fats, which is good for heart. Being low calorie diet it helps to lose weight and is beneficial for the patients of hypertension. Effect of different levels of peanut butter supplementation in biscuits was significant (Table 2). Fat content decreased progressively with the increasing levels of peanut butter. Highest fat content (30.44%) was recorded in biscuits prepared with peanut butter and hydrogenated vegetable shortening (0:100), which was statically different from other treatments. Biscuits with lowest fat content (28.26%) were produced when peanut butter and hydrogenated vegetable shortening (40:60) were incorporated. These findings are in accordance with the findings of Wekwete and Narder et al. (2009), who observed that peanut butter, had lower fat content than hydrogenated vegetable shortening. Hence, with increasing levels of peanut butter as a substitute for hydrogenated vegetable shortening the fat content of biscuit decreased, which is good for health.

#### NFE

The carbohydrate composition (NFE) decreased significantly in biscuits with the supplementation of peanut butter (Table 2). It ranged from 52.91-60.04%. The highest NFE content (60.04%) was recorded in control treatment (T<sub>1</sub>), which was statically dissimilar with all the other treatments. Lowest fat content (52.91%) was recorded for T<sub>5</sub>, followed by (55.86%) in T<sub>4</sub>. No previous study has been reported

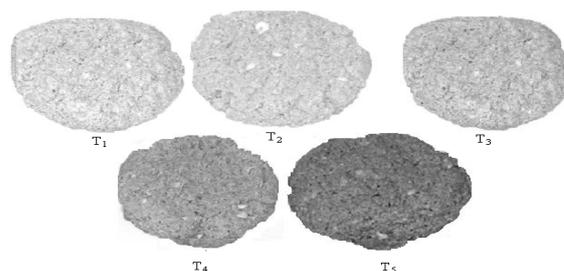


Figure 1. Effect of hydrogenated vegetable shortening substitution with peanut butter on color of biscuits

on effect of peanut butter supplementation on NFE in baked products. The reason of increase in NFE value of peanut supplemented biscuits might be higher protein, fiber, ash and moisture content in peanut butter in comparison with hydrogenated vegetable shortening.

#### Effect of peanut butter incorporation levels on organoleptic characteristics of biscuit

Significant ( $P \leq 0.05$ ) variations were found among biscuits prepared with different levels of peanut butter with respect to their color, texture, flavor and overall acceptability.

#### Color

There was a significant effect of peanut butter on color of biscuits (Table 3). The results showed that the biscuits became darker as levels of peanut butter increased (Figure 1). Highest score (8.3) was recorded for T<sub>2</sub>, which was statistically akin with the treatments; T<sub>1</sub> and T<sub>3</sub>. Lowest score (7.0) was recorded in T<sub>3</sub> where 60% Banaspati and 40% peanut butter were used as raw materials to prepare biscuits. The results are in line with the results of a number of researchers; Siddiqui (2000); Cloughton and Pearce (1989) and Kailasapathy et al. (1985), who observed the similar trends. The reason of darker color of the biscuits was might be high level of protein present in the peanut butter. As protein reacts with carbohydrates during baking, Maillard reaction takes place which imparts darker color to biscuits.

Table 3. Effect of Hydrogenated vegetable shortening substitution with peanut butter on sensory attributes of biscuits

Treatments	Color	Taste	Texture	Flavor	Overall acceptability
Peanut butter + Hydrogenated vegetable shortening (0:100)	8.0±0.7 <sup>a</sup>	7.0±0.6 <sup>d</sup>	8.5±0.3 <sup>a</sup>	7.0±0.2 <sup>d</sup>	7.62±0.6 <sup>a</sup>
Peanut butter + Hydrogenated vegetable shortening (10:90)	8.33±0.5 <sup>a</sup>	7.5±0.5 <sup>cd</sup>	8.0±0.1 <sup>ab</sup>	7.0±0.3 <sup>d</sup>	7.70±0.11 <sup>a</sup>
Peanut butter + Hydrogenated vegetable shortening (20:80)	8.0±0.6 <sup>a</sup>	8.0±0.2 <sup>bc</sup>	7.5±0.6 <sup>bc</sup>	7.16±0.2 <sup>c</sup>	7.66±0.13 <sup>a</sup>
Peanut butter + Hydrogenated vegetable shortening (30:70)	7.33±0.9 <sup>b</sup>	8.5±0.4 <sup>ab</sup>	7.33±0.4 <sup>bc</sup>	8.0±0.28 <sup>b</sup>	7.79±0.9 <sup>a</sup>
Peanut butter + Hydrogenated vegetable shortening (40:60)	7.0±0.7 <sup>b</sup>	9.0±0.3 <sup>a</sup>	7.0±0.15 <sup>c</sup>	9.0±0.5 <sup>a</sup>	8.0±0.15 <sup>a</sup>

<sup>a</sup>Average of triplicate determination ± SD (standard deviation)

Means across the rows with different superscripts are significantly different ( $p \leq 0.05$ ).

### Flavor

Flavor of biscuits progressively increased with increasing levels of peanut butter (Table 3). The highest score (9) was recorded for T<sub>5</sub>, while lowest score (7) was recorded for control treatment. Similar results were observed by Siddiqui (2000), who found that peanut butter imparted delicious flavor to biscuits which was liked.

### Texture

The data revealed that score for texture of biscuits was significantly decreased with increasing levels of peanut butter supplementation (Table 3). Highest score (8.5) was recorded for biscuits formulated with peanut butter and hydrogenated vegetable shortening (0:100), while lowest score (7) was recorded for the samples made up of peanut butter and hydrogenated vegetable shortening (40:60). Siddiqui (2000); Claughton and Pearce (1989) observed the similar results. They observed that the decrease in texture score of biscuits was due to the higher protein present in peanut butter which resulted in poor entrapment of air during dough mixing and made the biscuits harder.

### Overall acceptability

The results revealed that all the treatments were in acceptable range (Table 3). The highest score (8) was recorded for biscuits prepared with peanut butter and hydrogenated vegetable shortening (40:60), while lowest score (7.62) was recorded for samples prepared with peanut butter and hydrogenated vegetable shortening (0:100). Siddiqui (2000) also reported similar trends.

### Conclusion

It has been concluded from the present study that biscuits produced with the incorporation of peanut butter to reduce the quantity of hydrogenated vegetable shortening have shown acceptable quality characteristics. This substitution of peanut butter for

hydrogenated vegetable shortening of the biscuits not only increased the protein content but it also reduced the fat contents. The most acceptable formulation was peanut butter and hydrogenated vegetable shortening (40:60). Peanut butter also imparted better flavor to biscuits. Biscuits with this formulation should be made and marketed on large scale to provide nutritious, healthy confectionary to consumers.

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