Research Article

Development and sensory evaluation of potato (*Solanum tuberosum*) peel powder incorporated muffins for health

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Citation

Anum Nazir, Nizwa Itrat, Uswa Ahmad, Samina Allah Yar, Kaneez Fatima, Mehak Naeem and Nishat Zafar. Development and sensory evaluation of potato (*Solanum tuberosum*) peel powder incorporated muffins for health. Pure and Applied Biology. Vol. 11, Issue 1, pp129-134. <http://dx.doi.org/10.19045/bspab.2022.110014>

Received: 03/02/2021

Revised: 23/04/2021

Accepted: 03/05/2021

Online First: 21/05/2021

Abstract

Adequate intake of dietary fiber is very beneficial for the prevention of chronic diseases. Hence, the present research was planned to determine the health-associated benefits of dietary fiber from potato peel. Nowadays, Obesity and diabetes are the most common diseases due to change in dietary patterns and changing lifestyles. These diseases can be cured by adding an adequate amount of dietary fiber to the diet and by physical activities. Potato peel which is the waste material of potato products contains about 50% dietary fiber. Due to the strong nutritional profile of potato peel, it was used for the development of bakery products. Proximate analysis was done for the determination of the content of Moisture, Crude fat, Protein, Ash, Dietary fiber, and Nitrogen free extract (NFE). The present research was conducted to develop the potato peel powder incorporated muffins. Total four samples of muffins were prepared with the control group by using different concentrations of wheat flour and potato peel powder. The wheat flour was replaced by the potato peel powder according to the standard recipe of muffin at the different concentration levels 0, 5, 10, and 15 g/100g of wheat flour. Sensory evaluation of muffins was done by panelists by using 9 points hedonic scale. The taste of all samples was acceptable; T₃ had more dark color due to the high concentration of potato peel powder and overall acceptability observed in all samples. The results obtained by each parameter were observed statistically.

Keywords: Potato peel powder, Muffins preparation, proximate analysis, Sensory evaluation

Introduction

Obesity is characterized by the accumulation of fats in the body and increases the body weight beyond the desirable weight according to the personage, height, and bone structure [1]. In 2008, about 1.46 billion and 502 million adults are overweight and obese respectively [2]. The Pakistan National

Health Survey (NHS) documented that approximately 1% of the peoples are obese and 5% are overweight at a young age (15-24 years) in Pakistan [3]. The health consequences of obesity are hypertension, diabetes mellitus, atherosclerosis, CVD, osteoarthritis, cholelithiasis, and coronary heart disease [4].

Diabetes is caused due to disturbance in the body metabolism and long term of diabetes cause many complications like lowering eyesight and failure of kidney and heart [5, 6]. Fiber affects the secretion of several hormones and Insoluble dietary fiber improves the markers of insulin resistance, helps in weight loss and immune function [7]. Potato peel is a waste material that contains a wide range of nutritionally and pharmacologically active components such as phenolic compounds, polysaccharides, and glycoalkaloids which are used as dietary fiber and natural anti-oxidant [8]. Glycoalkaloids are important bioactive compounds of potato and potato peel [9]. The potato peel is the best source of different beneficial functional ingredients in which include natural antioxidants, phenolic compounds, and fibers. Potato peel demonstrates the anti-hyper-glycemic effect, protects from cardiovascular diseases, decreases the level of cholesterol, and intestinal glucose absorption [10].

By focusing on all these facts present study was planned to develop a potato peel powder incorporated muffins for high fiber content and nutrient-dense. This innovative product is nutritious and reduces economic losses by using waste material.

Materials and Methods

This research was conducted in the Food and Nutrition Laboratory of the University of Faisalabad. This study was carried out in three phases i.e. chemical analysis of potato peel powder, product development, and sensory evolution of the product.

Collection of material

Potatoes were collected from the local market of Faisalabad.

Procurement of raw material

After the collection of potatoes, the sample was washed and removes foreign debris. Then potatoes were peeled manually. After peeling, the potato peel was dried in the already preheated oven to about 80°C and the temperature regulated to about 700°C for 10 hours until proper drying. The dry sample was ground and form powder by using a grinder and stored in the airtight polythene bag [11].

Proximate analysis

The potato peel powder was analyzed for their moisture content by using Air Forced Draft Oven, crude protein by using Kjeldtech System, crude fat through Soxhlet Apparatus by using n-hexane as a solvent, crude fiber through Labconco Fibertech, the total ash content in Muffle Furnace at 500±50°C and nitrogen-free extract (NFE%) was measured by subtracting the values of moisture, fat, protein, ash and fiber from hundred according to their respective protocols mentioned in AOAC (2006) [12].

Treatment protocol

In the product development muffins with different levels of potato peel powder were prepared as shown in (Table 1) [13].

Muffins preparation

Muffins of different treatments as mentioned in the above table were prepared as shown in (Table 2) [14].

Table 1. Muffins with different levels of potato peel powder

Treatment	Grams of potato peel powder	Grams of wheat flour
T0	0	100
T1	5	90
T2	10	80
T3	15	70

Table 2. Muffins recipe

Ingredients	Quantity
Wheat flour	150g
Brown sugar	100g
Milk	100ml
Eggs	1 large
Baking powder	2g
Salt	½ tsp
Olive oil	150ml
Vanilla essence	2 drops
Potato peel powder	Varied amount

Preparation of muffins

It was made by beating egg and brown sugar in a bowl with mixer and olive oil, milk, the essence was well mixed. Then in a separate bowl mix the wheat flour, potato peel powder as the amount required, baking powder, and salt. Measured this mixture 80g 9 times. For control, treatment made a mixture with same procedure except don't add potato peel powder. This mixture was measured as 80g 3 times. Placed this in a preheated oven at 200C for about 15 minutes. Then remove from oven and let cool before serving [15].

Sensory evaluation

Sensory evaluation of all the samples was done in terms of appearance, flavor, chewing ability, proofing, color, taste, texture, and overall acceptability by presenting prepared muffins to the panel of judges by using nine-point Hedonic Scale described by Navarre *et al.* [16].

Statistical analysis

The data were subjected to statistical analysis and the level of significance was determined by using statistics [17]. The data collected were tabulated and then analyzed statistically through the Software "SPSS". The analysis of variance technique (one-way) ANOVA was applied to the results of proximate analysis and (one-way) ANOVA was applied to the results of sensory evaluation

Results and Discussion

The proximate composition of potato peels powder shown in (Table 3). Data in (Fig. 1)

demonstrated the proximate constituents of potato peel powder. Moisture content (39.5g), crude protein (9.6g), crude fat (5.3g), dietary fiber (7g), Ash content (9.9 g), and nitrogen-free extract (27.6g) were recorded. In (Fig. 2), the graph showed the overall acceptability of the potato peel powder incorporated muffins:

Proximate analysis of potato peels powder

The potato peel powder was analyzed for the proximate analysis and the result of proximate composition showed Moisture Content 43.3 ± 6.21 , Dietary Fiber 7.1 ± 0.10 , Crude Protein 9.8 ± 0.20 , Crude Fat 5.4 ± 0.10 , ASH Content 10.1 ± 0.32 and NFE 27.7 ± 0.15 . These results showed similarity to the study of Leo *et al.* [18].

Sensory evaluation

Sensory evaluation (appearance, flavor, chewability, proofing, adhesiveness, color, taste, texture, mouthfeel, and overall acceptability) is described in (Fig. 2) that shows the mean values in the range of color (6.80-7.80), appearance (7.00-7.60), flavor (6.60-7.60), proofing (6.80-7.80), softness (6.80-7.80), taste (6.80-7.80), chewability (7.20-7.80), texture (7.00-7.40), aroma (7.00-7.40) and overall acceptability (7.20-7.60). The color of T₃ is dark brown due to the gradually increasing concentration of potato peel powder.

According to Friedman *et al.*, [19] study, change in color due to the brown color of potato peel and because the taste of dietary

fiber has a bitter taste. That's why increasing the concentration of dietary fiber also gets a

better taste of muffins. All the treatments were acceptable.

Table 3. Means values for proximate analysis of potato peel powder

Proximate composition	Means $\pm$ SD
Moisture Content	43.3 $\pm$ 6.21
Dietary Fiber	7.1 $\pm$ 0.10
Crude Protein	9.8 $\pm$ 0.20
ASH Content	10.1 $\pm$ 0.32
Crude Fat	5.4 $\pm$ 0.10
NFE	27.7 $\pm$ 0.15

Figure 1. Proximate Composition of potato peel powder

Figure 2. Means plot of overall acceptability for all treatments

Conclusion

The present research revealed that potato peel had natural antioxidants and high nutrient content. Potato peel has an anti-hyperglycemic effect, protects from cardiovascular diseases, and decreases the level of cholesterol and intestinal glucose absorption. The chemical characterization of potato peel powders showed a high fiber and protein content. The inclusion at different concentrations of potato peel flour from the market (which the potato cultivar was not indicated) improved the nutritional, technological, and stability of formulated foodstuffs. After potato peel flour addition, the hardness of muffins was significantly ($p < 0.05$) decreased compared to the control muffin, the crumb color became darker were observed. These studies have shown the potential of developing fiber-rich muffins to increase dietary fiber intake. Potato peel incorporation in muffins showed the best results. All treatments are acceptable but T₁ gains the highest score on the base of the 9-point hedonic scale.

Authors' contributions

Conceived and designed the experiments: A Nazir, Performed the experiments: N Itrat & U Ahmad, Analyzed the data: SA Yar, Contributed materials/ analysis/ tools: K Fatima & M Naeem, Wrote the paper: N Zafar

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