



Proximate analysis of potato peel composite flour chapatti

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Abstract

The chemical composition of potato peel was calculated on dry basis as $6.20 \pm 0.20\%$ protein, $5.26 \pm 0.20\%$ ash, $12.4 \pm 0.40\%$ total fiber and moisture content $8.20 \pm 0.27\%$ of total weight. It was used to replace wheat flour on weight basis in the preparation of chapatti. The disc was used for the bake on cast iron to chapatti. Control group T₀ and three other treatments groups with replacement level 5%, 10% and 15% were prepared. Chapatti was assessed for chemical composition, rheological properties, texture and sensory evaluation. Chemical composition of potato peel composite flour chapatti was assessed through proximate analysis. The texture of chapatti was gain minimum marks in T₃ (15% potato peel powder) highest amount of fiber make chapatti harder. Moisture, fiber and ash contents increases as the peel powder increases in chapatti, while protein contents not increase with the addition of peel powder. Maximum water content was increased in T₃ (33.44%), fiber content maximum increase in T₃ (6.44%) and ash content increase in T₃ (3.13%) while protein content remains highest in control group, because peel powder has minimum amount of protein. It is concluded from that study with the addition of potato peel powder composite flour chapatti is acceptable at 5% peel powder addition. Research revealed that peel powder at 5% improve the texture properties.

Key words: sensory quality, potato peel, chapatti

Introduction

Potato is the fourth major staple food after wheat, rice and corn. Potato can grow in different kind of climatic conditions and different soil varieties (Mohammed and Meena, 2012). Every year potato production increasing 2.5% worldwide (Rahko, 2012). The comparison of potato with other vegetable represents that it is such a unique vegetable which is mostly processed and consumed all over the world. Approximately 60% fresh potato is used for processing in industry to make potato chips, French fries, potato sticks. The left over potato is sold in the market for home and fresh food services (Furrer *et al.*, 2017). The important processed forms of potato is chips, shoestrings 12% frozen french fries 30%, dehydrated items 12%, table stock 31% and remaining uses 15% (Pedreschi *et al.*, 2009). Moreover, one billion people consumed potato on the daily basis (Devaux *et al.*, 2014).

90 kilo calories energy gain from one hundred gram of potato, such as water 75.0 gram, protein 2.0 gram, carbohydrate 19.0 gram, fat 0.1 gram, riboflavin 0.03 milligram, vitamin B6 0.25 milligram, vitamin C 20.0 milligram, niacin 1.1 milligram, thiamin 0.08 milligram, Phosphorous 57.0 milligram, calcium 12.0 milligram, iron 1.8 milligram, magnesium 230 milligram and sodium 60 milligram. Potato is such crop which contains four to six important vitamin's which is required to our daily diet, such high nutritious profile gain from potato. Vitamin C, niacin, thiamin, riboflavin and ascorbic acids are major vitamins which are present in potato and also major dietary anti-oxidants, these are light and heat labile. Due to sensitive to light and heat quality losses are occurs during storage (Friedman and Levin, 2009).

It is acknowledge that food crops rice, wheat and potato just not contain carbohydrate for human being (King and Slavin, 2013) but these are also sources of protein, minerals, vitamins and multiple trace elements as well (Burlingame *et al.*, 2009). The outer covering of potato, which is known as potato peel consists of such these bioactive compounds e.g. carotenoids, phenolic acids and anthocyanin's. These bioactive compounds deals with anti-oxidants activity which may be helpful in curing cancer or atherosclerosis like diseases and play crucial role in research (McGill *et al.*, 2013). Along with different fruits like orange and apple, potato is another vegetable which contain total phenolic contents among different fruits and vegetables, according to recent study. Potato peel contains phenolic contents; these phenolic contents showed strong anti-oxidants activity and provide protection to the plant from biotic and abiotic stress. If they are present in human diet they protect the human body from degenerative diseases (Pourcel *et al.*, 2007).

Demand for low calories and high fiber products are increasing day by day. Potato peel is a source of dietary fiber and protein and checked the effect on the quality of dough and cakes. Potato peel powder showed good fat absorption and water binding capacity. Flour of potato peel are assemble in different concentration with wheat flour. The results showed that potato peel flour refine dough profile of Aveograph and appearance of the cakes. There is a remarkable difference among the control dough and the dough in which potato peel flour addition. Potato peel flour bring down cake hardness and the color of dough. Potato peel flour 5% replaced with wheat flour are rich in fiber and protein showed good sensory score. Elasticity to extensibility and dough strength are enhance with the addition of potato peel flour at the rate of 5% (Jeddou *et al.*, 2017).

Early spoiled of bread is a big problem for food industry. Fiber which is extracted from potato peel, has the better water holding capacity and increase the shelf life of bread, while potato peel extract are replaced with wheat flour in minimum amount. Frozen water, moisture,

amylopectin retrogradation and water activity all are these physico-chemical properties and nuclear magnetic resonance characteristics are examined when potato peel extract are added in bread and storage study seven days. Moisture content and water activity pretentious with the addition of potato fiber, enhance the frozen water content, these components become the bread soften. Potato fiber decrease the NMR mobility of molecules changes during storage study and enhance the shelf life of bread with the addition of potato fiber (Curti *et al.*, 2016). Potato peel extracts having bioactive molecules which shows anti-inflammatory activity. Give the dose of 100 mg of potato peel extract and the 200 mg dose of carrageenan and compare with the standard drug of diclofenac sod. Potato peel extracts significantly reduced on the paw thickness of rat (Verma *et al.*, 2017).

The composition of white wheat flour shows that it is deficient in fiber content as well as in anti-oxidants, so it is less digestible for consumer (Suliman *et al.*, 2014). In contrast to wheat, potato peel is a potential source of dietary fiber and anti-oxidants which tend to enhance digestion (Sepelev and Galoburda, 2015). The purpose of present research is to overcome the digestibility issues with the addition of potato peel as well as to enhance the quality attributes of wheat flour in the form of chapatti, because chapatti is the most common form of staple food in our country (Pakistan). On basis of above-mentioned facts, a present study was designed to assess the use of potato peel powder as a partial replacer of wheat flour in chapatti

Materials and methods **Materials and Methods** Mature potato (Leady Rosetta) *Solanum tuberosum* was obtained from United Snacks Manga Mandi Raiwind Road, Lahore. Then processed in fruits and vegetable laboratory of NIFSAT (National Institute of Food Science and Technology), University of Agriculture Faisalabad (UAF). Chemicals were procured from local market Faisalabad. Separation was doing on the basis of size and shape. Potato was washed and cleaned with purified water then abrasive peeler was used for the peeling of potato. Peel was collected and then properly washed with purified water then kept for drying on room temperature. Potato peel was kept in the de-hydrated for four hours at 70 °C. Then kept in air tight bag and grinding of the potato peel in the processing hall of the National Institute of Food Science and Technology. Fine potato peel powder was obtained and kept in air tight bag and store in refrigerator for further analysis. Flour, potato peel powder and water were mixed together to form a dough. Then it was placed in utensils, with the help of sprinkling of water and allowed to make it at room temperature for 30 minutes. Dough balls weighing of 100 grams were mixed and rolled into 60.5 cm diameter with the help of rolling pin. The dough was placed and mixed only one direction and then rolled at the direction angle 90°. The disc was used for baking on cast iron having a temperature 245 °C after 30 seconds the disc plate was used in opposite direction and compressed with soft cloth, for beneficial spread of stem which is used in puffing. After the disc is turn for a while for 30 seconds. Total baking time 90 seconds the product i.e. called chapatti was left to remain cool at 30 °C and packed for consumption.

Proximate analysis of the product

Moisture, crude fiber, fat, protein and ash contents of potato peel was determined by methods as described in AACC, (2010).

Texture analysis

Textural properties were measured by the using texture analyzer. The purpose of this apparatus to determine the texture of the product. First TAXT plus software was run from system. The texture apparatus was activated and acceptable probe was adjusted. Set the height of the apparatus. Place the sample and run the system. Within 30 seconds graph and hardness in number appear on the screen (Lara *et al.*, 2010).

Statistical analysis

The data from each parameters were statistically analyzed using different techniques of analyzed variance by determine (Montgomery, 2008). The SPSS 8.1 software was used for two way analysis of variance and Tukey test. Difference was consider to statically significant if p less than 0.05.

Treatment plan used in

study Table no 3.1

Treatments	WF (%)	PPP (%)
T ₀	100	0
T ₁	95	5
T ₂	90	10
T ₃	85	15

T₀ = Control sample

PPP = Potato Peel Powder

WF = Wheat flour

Results and discussion

Moisture percentage

Three samples from each treatment were selected, analyzed and moisture content results were compared. Analysis of variance results are shown in table 4.28. Graphical representation of mean values for each treatment is shown in figure 1. Mean values are given in table 2. Moisture content in different treatments differ significantly (p ≤ 0.05). There was non-significant difference in moisture content of T₀ (control group) and T₁. Moisture content seems to decrease constantly as peel is increased in treatment from 5% to 15%. Water retaining property of chapatti is decreased due to fiber present in peel powder of potato. Results are in correlation with Eva Ivanisova *et al.* (2015)

who found same changes in moisture contents when added potato peel powder in bread dough.

Table no 1 Analysis of variance for moisture content of potato peel composite flour chapatti

Source	DF	SS	MS	F
Treatments	3	14.2304	6.19027	2.18 ^{NS}
Error	8	0.1330	2.83762	
Total	11	14.3634		

**Highly significant (p<0.01)

*Significant (p<0.05)

^{NS} Non-significant (≥0.05)

Table no 2 Mean values for moisture content of potato peel composite flour chapatti

Treatments	Mean values
T ₀	35.7 ± 1.785 ^a
T ₁	32.33 ± 1.6165 ^d
T ₂	33.2 ± 1.66 ^c
T ₃	33.44 ± 1.672 ^b

T₀ = Control group

T₁ = 5% potato peel powder + 95 % white flour

T₂ = 10% potato peel powder + 90 % white flour

T₃ = 15% potato peel powder + 85 % white flour

Crude protein percentage

Crude protein was determined of triplicate samples from each treatment and mean values are graphically shown in fig 4. Analysis of variance is given in table no 3 shows statistical analysis of different treatments. Mean values are given in table 4 and graphically in figure 1. It was found that there was significant difference (p ≤ 0.05) in treatment mean values. Protein percentage was slightly increased in chapatti as the potato peel powder was increased. There was group wise difference in mean values of treatments. T₀, T₁ and T₂ were in different ranges. It was obvious as the gluten content decreased in quantity as peel powder quantity increased. Peel of potato don't contain much protein in it which could replace the gluten of wheat flour. Protein content variation in treatment found are in correlation with the findings of Ibrahim Khalifa *et al.* (2015) who worked on cupcakes added with potato peel.

Crude Fiber

Crude fiber was determined in fat free samples. Statistically analyzed results are shown in table 5 and graphically in figure 1. Mean values are given in table 6. The results calculated for fiber were significant highly (p ≤ 0.05). It shows that as the peel content was increased the fiber content was also increased in cookie. T₃ (15% potato peel powder) showed maximum fiber 6.44% and T₀ (control group) minimum of 0.015%. Statistical analysis findings are in correlation with the work of Sharoba *et al.* (2013), Ibrahim Khalifa *et al.* (2015) who worked on cupcakes added with potato peel.

Table no 3 Analysis of variance for crude protein of potato peel composite flour chapatti

Source	DF	SS	MS	F
Treatments	3	25.9170	8.63900	31.38*
Error	8	2.2022	0.27528	
Total	11	28.1192		

**Highly significant (p<0.01)

*Significant (p<0.05)

^{NS} Non-significant (≥0.05)

Table no 4. Mean values for crude protein of potato peel composite flour chapatti

Treatments	Mean values

T₀	12.9 ± 0.645 ^a
T₁	9.22 ± 0.461 ^d
T₂	9.53 ± 0.4765 ^c
T₃	9.91 ± 0.4955 ^b

T₀ = Control group

T₁ = 5% potato peel powder + 95 % white flour

T₂ = 10% potato peel powder + 90 % white flour

T₃ = 15% potato peel powder + 85 % white flour

Table no 5. Analysis of variance for Fiber content of potato peel composite flour chapatti

Source	DF	SS	MS	F
Treatments	3	90.6500	30.2167	398.34**
Error	8	0.6069	0.0759	
Total	11	91.2569		

**Highly significant (p<0.01)

*Significant (p<0.05)

^{NS} Non-significant (≥0.05)

Table no 6 Mean values of Fiber contents of potato peel composite flour chapatti

Treatments	Mean values
T₀	0.015 ± 0.00075 ^d
T₁	6.24 ± 0.312 ^c
T₂	6.4 ± 0.32 ^b
T₃	6.44 ± 0.322 ^a

T₀ = Control group

T₁ = 5% potato peel powder + 95 % white flour

T₂ = 10% potato peel powder + 90 % white flour

T₃ = 15% potato peel powder + 85 % white flour

Ash contents

Mean values of treatments were analyzed through ANOVA shown in table 7. The graphical representation is in fig 1. Mean values are given in table 8. All treatment means has significant difference (p ≤ 0.05) in increment of ash content. As the potato peel content increased the ash content of the chapatti also increased. Peel contains much more mineral contents in it as compared to white flour with which it was replaced. T₃ (15% potato peel powder) showed maximum ash contents 3.13% and minimum were observed in T₀ (control group) 0.46%. The results calculated followed the same pattern which was observed by Ibrahim Khalifa *et al.* (2015) who worked on cupcakes added with potato peel powder in range of 5% to 20% on weight basis, Sharoba *et al.* (2013) work on potato peel added biscuits who worked on biscuits made with potato peel powder in place of wheat flour at different concentrations.

Table no 7 Analysis of variance for Ash contents of potato peel chapatti

Source	DF	SS	MS	F
Treatments	3	14.2304	4.74348	285.33**

Error	8	0.1330	0.01662	
Total	11	14.3634		

**Highly significant (p<0.01)

*Significant (p<0.05)

^{NS} Non-significant (≥0.05)

Table no 8 Mean values of Ash contents of potato peel chapatti

Treatments	Mean values
T₀	0.46 ± 0.023 ^d
T₁	2.85 ± 0.1425 ^c
T₂	2.91 ± 0.1455 ^b
T₃	3.13 ± 0.1565 ^a

T₀ = Control group

T₁ = 5% potato peel powder + 95 % white flour

T₂ = 10% potato peel powder + 90 % white flour

T₃ = 15% potato peel powder + 85 % white flour

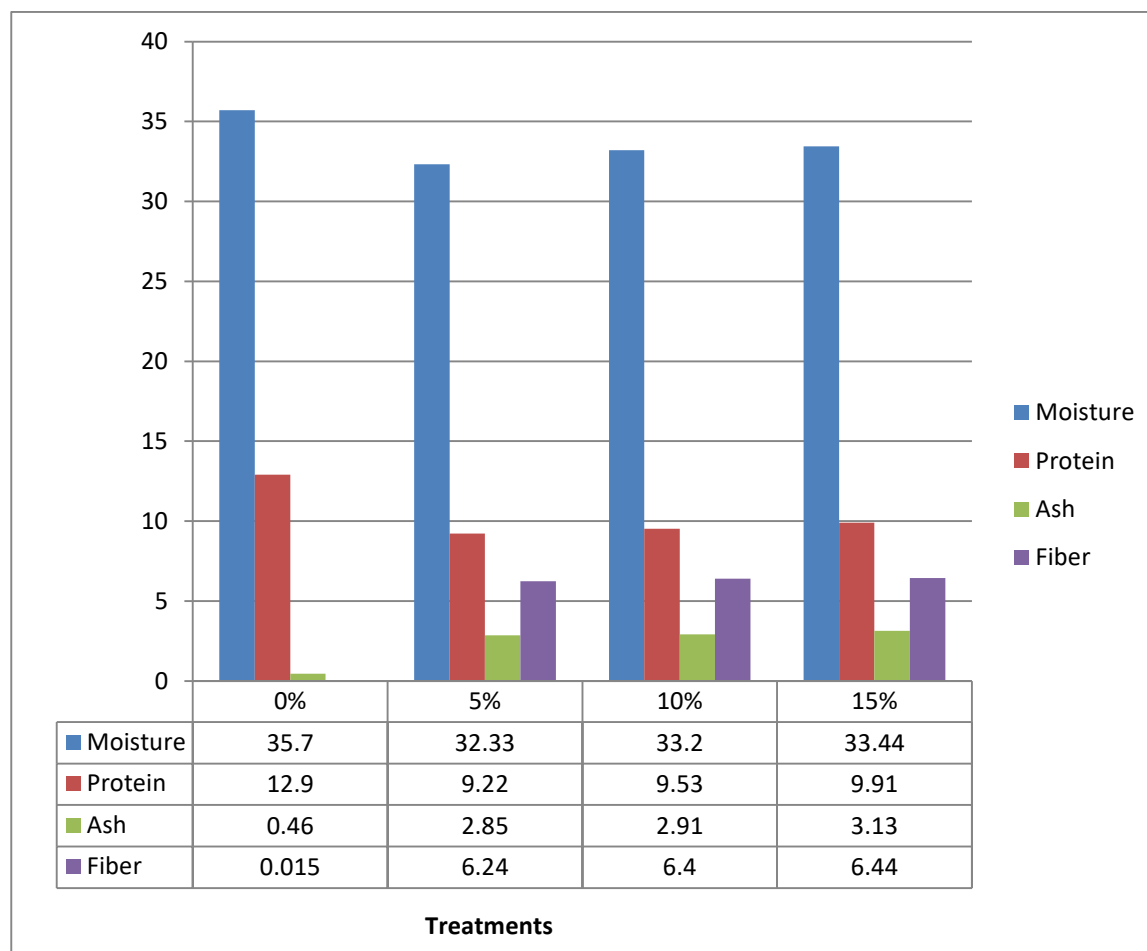


Figure no 1. Graphical representation of chemical composition of potato peel composite flour chapatti

Texture of composite flour chapatti

Hardness is a term which is measured by using texture analyzer. Maximum force which is required to break the structure is called hardness. Analysis of variance for texture of different treatments is given in table 9. Mean values are given in table 10. The results of hardness of chapatti were highly significant. Maximum value of hardness was observed in T₃ with 15% potato peel powder and 85% processed flour (56.116 g). T₀ control group showed least hardness (28.024 g). The results showed that as the concentration of potato peel powder increases in chapatti the texture of chapatti becomes harder and harder. The presence of fiber becomes harder of chapatti. The present study is supported by (Lara *et al.*, 2011). He worked on structural and modifications of corn biscuits during baking process.

Table no 9 Analysis of variance for texture of composite flour chapatti

Source	DF	SS	MS	F
Treatments	3	1329.55	443.182	107.80**
Error	8	32.89	4.111	
Total	11	1362.43		

**Highly significant (p<0.01)

*Significant (p<0.05)

^{NS} Non-significant (≥0.05)

Table no 10 Mean values of texture of composite flour chapatti

Treatments	Mean values
T ₀	28.024 ± 1.4012 ^d
T ₁	33.538 ± 1.6768 ^c
T ₂	38.97 ± 1.9485 ^b
T ₃	56.117 ± 2.8058 ^a

T₀ = Control

T₁ = 5% potato peel powder + 95 % white flour

T₂ = 10% potato peel powder + 90 % white flour

T₃ = 15% potato peel powder + 85 % white flour

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