



Sensory quality evaluation of chapatti produced by utilizing potato peel powder

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Abstract

Potato peel is the major waste of the potato processing industry. This peel is rich source of phenolic contents which has the potential to compete the synthetic anti-oxidants. This peel is used in many food and pharmaceutical industries to get its benefits and replace the synthetic anti-oxidants and protect the body from cardiovascular diseases and stomach issues. Sensory evaluation was done through color, taste, texture, folding ability, chew ability and overall acceptability. Control group acquire highest hedonic scale score by sensory expert panel in all parameters as compared to other treatments of potato peel composite flour chapatti. It was clear that the addition of peel powder brownish the color and hard the texture. The addition of peel powder up to 5% was quite acceptable but 15% addition was disliked by sensory experts. More addition of potato peel powder more dark the color and stiff the texture.

Key words: sensory quality, potato peel, chapatti

Introduction

It is a rich source of Vitamin B₆, Vitamin C, phosphorus, manganese, copper, thiamin, pyridoxine, niacin and potassium. The nutritional profile of potato linked with dietary value which consist high-quality protein, starch, minerals and fiber (Ayvaz *et al.*, 2016). These compounds are rich in colored skin potatoes that contain red and purple pigments due to the presence of anthocyanin (Brown *et al.*, 2003). In the form of red and purple color anthocyanin is a natural source of fleshed potatoes that improve the health. Phytonutrients like flavonoids, carotenoids and phenolic compounds are present in potato tubers. Due to the presence of high nutritional profile, potato is more beneficial against number of diseases like cardiovascular disease (Crozier *et al.*, 2009), anti-oxidants, cytotoxic activity, anticancer and antitumor (Chung *et al.*, 2016), anti-inflammatory (Furrer *et al.*, 2017). Potato peel contains value able compounds including dietary fiber, phenols, amides and unsaturated fatty acids (Albishi *et al.*, 2013). Phenolic compounds from potato show anti-microbial, anti-glycemic, anti-carcinogenic, anti-cholesterol and anti-mutagenic activities (Friedman and Levin, 2009). It also used in the concentrate of livestock and as natural anti-microbial compounds. It contains protein 2.3 to 1.2%, ash contents 1.3 to 0.9%, dietary fiber 2.5%, total carbohydrates 12.4 to 8.7%, total lipid 0.4 to 0.1%, starch 7.8% and water 85.1 to 83.3% (Arapoglou *et al.*, 2009). The frequent use of synthetic anti-oxidants in our food are now diagnose as a health problem because it's uncontrolled cooperation with human metabolism. Excessive use of synthetic anti-oxidants can cause several health issues like mutations, atherosclerosis and cancer. The use of natural process food increases due to awareness about synthetic anti-oxidants. Now researchers are working on define food systems in which efficiently use of safe, healthy and natural anti-oxidants that cannot create health related problems. The peel of potato and fruits is a rich source of anti-oxidants of phenolic compounds which is usually waste during the processing of potato. Phenolic compound of potato peel are occurs in bounded forms and pass through the intestinal track and absorption occurs in colon that assist in the digestion process. Anti-oxidant activity of potato peel phenolic compound is better as compared to synthetic anti-oxidants in many food systems. The phenolic compounds of potato peel are natural extracts and do not create mutagenic, arthrosclerosis and cancerous types diseases. For the preservation of lamb meat, potato peel extract is successfully used (Kanatt *et al.*, 2005). 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. 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).

Materials and methods

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Procurement of raw materials

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.

Preparation of potato peel powder

Sorting and grading

Separation was doing on the basis of size and shape. Equal size and shape potatoes were selected for further operation.

Washing / cleaning

Potato was washed and cleaned with purified water to remove mud and dirt from the potato tuber, become free from pollutants then kept for dryness on room temperature.

Peeling of potato

Abrasive peeler was used for the peeling of potato. Peeling was done in processing hall of National Institute of Food Science and Technology. Peel was collected and then properly washed with purified water then kept for drying on room temperature.

Preparation of potato peel powder

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.

Sensory evaluation

Sensory evaluation of chapatti was depending on color, taste, texture, folding ability, chew ability and over all acceptability. The evaluation of chapatti on the basis of 9 points hedonic scale as describe by (Meilgaard *et al.*, 2010). The five judges' panel of NIFSAT was distributed with the Performa of sensory evaluation. As provided in appendix 1.

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

Sensory analysis

The sensory evaluation is a very significant quality standard in food production. So the sensory evaluation for color, taste, texture, folding ability, chew ability and overall acceptability in general suitability at 0%, 5%, 10% and 15% of potato peel

powder in chapatti was assessed. Graphical representation of hedonic scale score obtained by treatments and ANOVA table were used to analyze results. The results are discussed below.

Color:

Color is an important attribute which gives perception if food is good or not and it is directly related to flavor and aroma. Analysis of variance for the color of chapatti supplemented with different level of potato peel is given in table 1. Mean values are given in table 2. It is clear from data that hedonic scale score value for color is non-significantly different for each treatment. The maximum score (8) was obtained by control group chapatti T₀ while minimum score (6) was given to T₃ (15% potato peel). The color of chapatti was found darker with gradual increase of the potato peel powder content in each treatment. As the concentration of peel powder increases the color of chapatti darker. The findings of current study are in correlation with the results of Ibrahim Khalifa *et al.* (2015) who worked on cupcakes added with potato peel. The current study is also supported by the findings of Dhingra *et al.* (2012) who worked on potato peel added biscuits and observed that addition of potato peels caused darkness in color of cookies.

Table no 1 Analysis of variance for Color of composite flour chapatti

SOV	DF	SS	MS	F
Treatment	3	2.16000	0.72000	5.24 ^{NS}
Error	8	1.09880	0.13735	
Total	11	3.25880		

**Highly significant (p<0.01)

*Significant (p<0.05)

^{NS} Non-significant (≥0.05)

Table no 2 Mean values of Color of composite flour chapatti

Treatments	Mean values
T ₀	8 ± 0.4 ^a
T ₁	7.6 ± 0.38 ^b
T ₂	7 ± 0.35 ^c
T ₃	6 ± 0.30 ^d

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

Taste

Texture, flavor and composition have a great influence on taste that is determined by taste buds. Taste score was analyzed through analysis of variance. Results are presented in table 3. Mean values are given in 4. Results show that there was a significant difference (p ≤ 0.05) in all treatment means. The maximum likeness (8.5) for taste was given to control group

chapatti T₀ and then T₁ (05% potato peel powder), T₂ (10% potato peel powder), T₃ (15% potato peel powder) were given (7), (7), (4.5) respectively in decreasing order. The results found are in correlation with the work of Ibrahim Khalifa *et al.* (2015) who worked on cupcakes added with potato peel and Dhingra *et al.* (2012) work on potato peel added biscuits. Potato peel powder at higher concentration caused specific taste and strong aroma which decreased the hedonic scale score for taste.

Texture

Texture gives feeling on taste buds and plays important role in likeness of a product. There was non-significant difference in hedonic scale numbering of chapatti from each treatment as presented in ANOVA table 5. Mean values are given in table 6. T₀ (control group) was given hedonic scale score (7.4) and T₃ (15% potato peel powder) was awarded minimum (4.2). Texture of chapatti was disliked as the peel content was increased due to grains type feeling of peel powder on tongue. Chapatti was harder in texture and with more granular feeling with increased concentration of potato peel powder. Texture was directly affected as the potato peel powder was increased in treatment of chapatti. The present study results found are in correlation with the work of Ibrahim Khalifa *et al.*, (2015) and Dhingra *et al.*, (2012) work on potato peel added biscuits.

Table no 3 Analysis of variance for Taste of composite flour chapatti

SOV	DF	SS	MS	F
Treatment	3	6.75000	2.25000	17.18**
Error	8	1.04760	0.13095	
Total	11	7.79760		

**Highly significant ($p < 0.01$)

*Significant ($p < 0.05$)

^{NS} Non-significant (≥ 0.05)

Table no 4. Mean values of Taste of composite flour chapatti

Treatments	Mean values
T ₀	8.5 ± 0.42 ^a
T ₁	7. ± 0.35 ^b
T ₂	7 ± 0.35 ^b
T ₃	6.5 ± 0.32 ^c

SOV	DF	SS	MS	F Value
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Treatment	3	1.40250	0.46750	3.50 ^{NS}
Error	8	1.06800	0.13350	
Total	11	2.47050		

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 Texture of composite flour chapatti

**Highly significant (p<0.01)

*Significant (p<0.05)

^{NS} Non-significant (≥0.05)

Table no 6 Mean values of Texture of composite flour chapatti

Treatments	Mean values
T ₀	7.5 ± 0.37 ^b
T ₁	7.8 ± 0.39 ^a
T ₂	7 ± 0.35 ^c
T ₃	6 ± 0.30 ^d

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

Folding ability

Folding ability is another quality feature that was used for studying the organoleptic attributes of chapatti. Analysis of variance is given in table no 7. Mean values are given in table 8. The results of variances among different treatments are significant. Normally chapatti should be foldable and soft in texture. In present study chapatti prepared from composite flour which become brittle, when potato peel powder percentage increases. In present study T₀ gain maximum score (8), T₁ (7.4), T₂ (7.0) and T₃ minimum score (4.2).

Chew ability

Chewiness is duration to masticate the sample at constant level to low down its uniformity for swallowing. Analysis of variances is given in table no 9. Mean values are given in table 10. The results were highly significant. Chapatti chews ability suitable at 5% potato peel powder incorporation, then chew ability score decreased. Highest score T₀ gain (8.5) and lowest score gain T₃ (4.5). Present study results are matching (Rehman *at el.*, 2006). He prepared chapatti from British wheat cultivar.

Table no 7 Analysis of variance for Folding ability of composite flour chapatti

SOV	DF	SS	MS	F
Treatment	3	6.56250	2.18750	17.18*
Error	8	1.01880	0.12735	
Total	11	7.58130		

**Highly significant ($p < 0.01$)

*Significant ($p < 0.05$)

^{NS} Non-significant (≥ 0.05)

Table no 8 Mean values of Folding ability of composite flour chapatti

Treatments	Mean values
T ₀	8 ± 0.4 ^a
T ₁	7.5 ± 0.37 ^b
T ₂	7 ± 0.35 ^c
T ₃	6 ± 0.30 ^d

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 9 Analysis of variance for Chew ability of composite flour chapatti

SOV	DF	SS	MS	F Value
Treatment	3	7.50000	2.50000	17.82**
Error	8	1.12260	0.14033	
Total	11	8.62260		

**Highly significant ($p < 0.01$)

*Significant ($p < 0.05$)

^{NS} Non-significant (≥ 0.05)

Table no 10 Mean values of Chew ability of composite flour chapatti

Treatments	Mean values
T ₀	8.5 ± 0.42 ^a
T ₁	8 ± 0.4 ^b
T ₂	7 ± 0.35 ^c
T ₃	6.5 ± 0.32 ^d

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

Overall acceptability

Overall acceptability covers all characteristics of a product which makes it acceptable for consumers. Analysis of variance table is shown in table 11. Mean values are given in table 12. Results were highly significant ($p \leq 0.05$). Maximum hedonic scale score (8.5) and (8.50) was given to T₀ (control group) and (8) T₁ (5% potato peel powder). Then T₂ (10% potato peel powder), T₃ (15% potato peel powder) were liked by sensory evaluators in decreasing order. The current study findings are in correlation with the results calculated by Ibrahim Khalifa *et al.*, (2015) who worked on cupcakes added with potato peel and Dhingra *et al.*, (2012) work on potato peel added biscuits.

Table no 11 Analysis of variance for Overall acceptability of composite flour chapatti

SOV	DF	SS	MS	F
Treatment	3	11.0625	3.68750	26.87*8
Error	8	1.0978	0.13723	
Total	11	12.1603		

**Highly significant ($p < 0.01$)

*Significant ($p < 0.05$)

^{NS} Non-significant (≥ 0.05)

Table no 12 Mean values of Overall acceptability of composite flour chapatti

Treatments	Mean values
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T ₀	8.5 ± 0.42 ^a
T ₁	8 ± 0.40 ^b
T ₂	7 ± 0.35 ^c
T ₃	6 ± 0.30 ^d

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

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