The Pharma Innovation Journal 2017; 6(10): 40-43

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating 2017: 5.03
TPI 2017; 6(10): 40-43

www.thepharmajournal.com
Received: 09-08-2017
Accepted: 10-09-2017

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Potential of raw banana peel as a source of polyphenol in muffins

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Abstract
Fresh banana contains about 40% (w/w) peels. Banana peels are a good source of dietary fibres, polyphelnols and some bioactive compounds. But in our society banana peels are considered as waste products. Even in banana processing industries banana peels are not utilized. As a waste material these peels can be hazardous to the environment as they can act as a medium of some harmful microorganisms. In the present study the nutraceutical properties of banana peels are utilized by using them in muffin production. Here banana peels are used as wheat flour substitute and it is added in different proportions (10%, 20%, and 30%) on the wet weight basis of the dough. The muffins were produced in microwave oven at different wattage (360W, 540W, 720W and 900W) as well as in baking oven at 110 ^{0}C temperature for 20 minutes. The polyphenol contents of all types of banana peel fortified muffins (10, 20 and 30% BPM) and control muffins, prepared in microwave oven and baking oven are determined in gm GAE/100 gm of samples by using five different extractions medium viz. acetone, methanol, ethanol, butanol and petroleum ether. It was observed that the polyphenols are mostly soluble in methanol for all types of BPMs as well as for control. For microwave processed 30% BPM the maximum polyphenols content is observed as 7.92 gm GAE/100 gm whereas this value is 7.77 gm GAE/100 gm for baking oven processed 30 % BPM in methanol. The sensory evaluations (by 9 point hedonic scale) of different BPMs are also carried out which showed the maximum overall acceptance for 30% BPM (microwave processed) and 20 % BPM (baking oven processed). Therefore raw banana peel can be utilized as a potent source of polyphenol in various foodstuffs.

Keywords: Banana peel muffin (BPM), polyphenol content, microwave processed, baking oven processed, sensory analysis

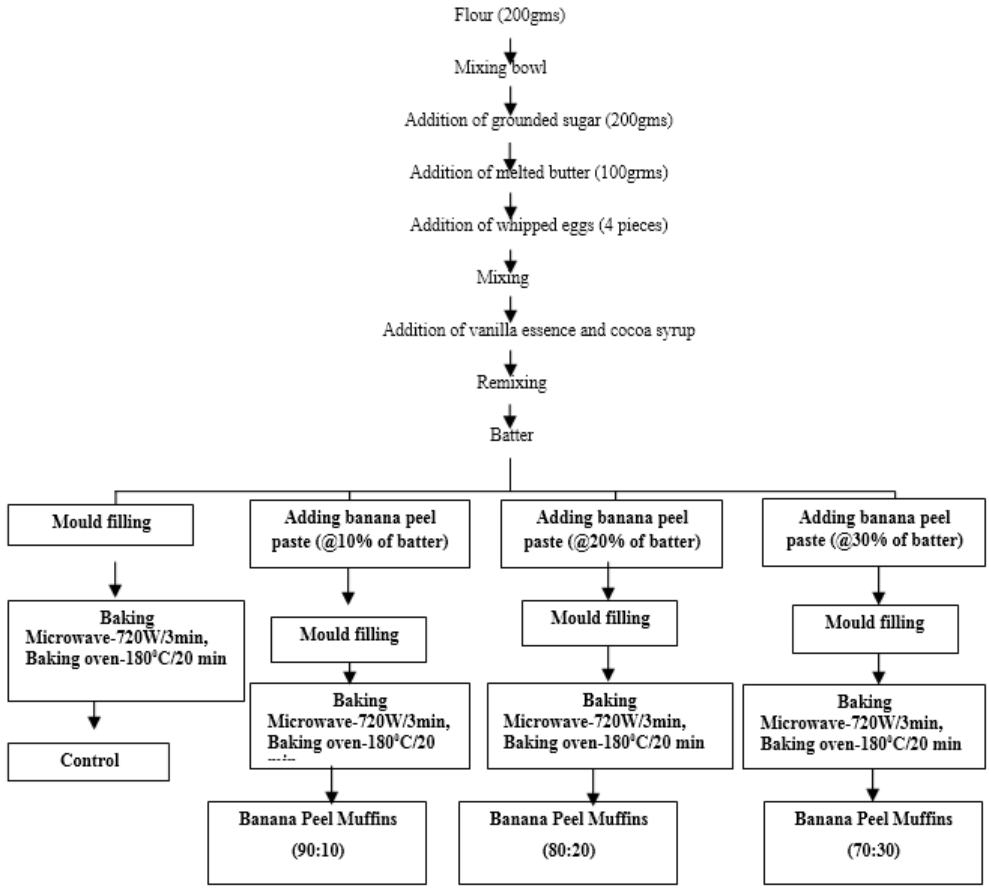
1. Introduction
The fruit and vegetable wastes (e.g. peels, seeds) are the non-product flows of raw materials whose economic values are less than the cost of collection and recovery for reuse; and therefore discarded as wastes. Phenolics are found in a plenty of plants and consist of an aromatic ring within the molecular structure (Singh *et al.*2012) [10]. The agro-residues cannot be regarded as the wastes but become an additional valuable resource to augment existing natural materials. Recycling, reprocessing and eventual utilization of food processing residues offer potential of returning these by-products to beneficial uses rather than their discharge to the environment which cause detrimental environmental effects. Banana fruits contain various antioxidants such as gallocatechin and dopamine. *Musa sapientum* which is commonly called banana is a herbaceous plant of the family *Musaceae*. Being as a tropical plant, banana protects itself from the oxidative stress caused by strong sunshine and high temperature by producing large amount of antioxidants. Interestingly, banana peel extracts have also been found to contain a high capacity to scavenge 2, 2-diphenyl-1-picrylhydrazyl (DPPH•) and 2,2′-azino-bis (3-ethylbenzothiazoline) -6-sulfonic acid (ABTS•+) free radicals (González-Montelongo *et al.*, 2010; Kedare and Singh, 2011) [4, 6]. Moreover, the extraction of antioxidants from banana peels is a great way for waste management because the main by-product from banana processing industry is its peel (Anal *et al*., 2014) [2].
Sundaram *et al*., 2011 [12], reported that the unripe banana peel sample had higher antioxidant potency than ripe and leaky ripe. Banana peel extract is classified as non-toxic to normal human cells criteria established by the National Cancer Standard Institute. (Anjum, *et al.* 2015), therefore, it can be safely utilized as a natural source of antioxidants and enzyme to cure disease.
Banana is a highly perishable and bulky fruit, which requires processing into a more stable and convenient form.

Drying brings about a substantial reduction in weight and volume; thereby minimizing packaging, storage and transportation cost and also enable storability of the product under ambient temperature especially in developing countries (Senadeera *et al*., 2005) [9]. Dried fruits are unique, tasty and nutritious. They are easy to handle and can be easily incorporated during food formulation and preparation. Dried fruit can be eaten as a snack or added to cereals, muffins or ice cream (Etsey *et al*., 2007) [3].

Therefore, the principal objectives of this study is to develop muffins by utilizing banana peel, a common banana byproduct, and to evaluate its sensory and polyphenol content.

2. Materials and methods

2.1 Muffin Preparation: Flowchart for the production of microwave processed and baking oven processed control muffin and banana peel muffin.



2.2 Determination of Polyphenol Content

The polyphenol contents of all the prepared muffins were determined by using spectrophotometer method and expressed in terms of gallic acid equivalent (Mcdonald *et al*.,2001) [7].

2.3 Sensory Analysis of Muffins

Sensory analysis was done for all the prepared muffins by eight trained panel members of food technology department by using 9 point hedonic scale (Hooda and Jood, 2005) [5].

3. Result and Discussion

3.1 Polyphenol Content of Banana Peel Fortified Muffins

Polyphone content of BPMs (100:0, 90:10, 80:20 and 70:30) prepared in microwave oven and in baking oven are represented in table 1 and table 2 respectively.

The samples of muffins showed a considerable change in retention of polyphenolic content in different extracting solvents. The highest polyphenol content of both microwave processed and baking oven processed BPMs is found in methanolic extract and lowest extraction power is observed in petroleum ether. Microwave processed BPM (70:30) showed maximum polyphenol content of 7.92$\pm$0.028 gm GAE/100gm compared to baking oven processed BPM (70:30) 7.77$\pm$0.078 gm GAE/100gm. The prolonged heat treatment in baking oven is might be the cause of reduction in polyphenol content compared to microwave treatment.

Polyphenol extraction power by different solvents is observed as

Methanol > Acetone > Ethanol > Butanol > Petroleum Ether

This finding is also supported by Stahl *et al*., (2009) [11] who estimated the total phenolics of chocolate cake.

3.3 Sensory Analysis of Muffins

Results of sensory analysis of both microwave oven processed and baking oven processed muffins are shown in figure 1 and figure 2 respectively.

Sensory evaluation of all types of muffins constituting of different compositions is done by 9 point hedonic scale. Among the all microwave processed BPMs, the best result is found for 70:30 BPM variety with an average overall acceptance value of 8.5. In case of baking oven processed muffin the best result is obtained for 80:20 varieties with an average overall acceptance value of to be 8.4. From the body and textural point of view the microwave processed BPMs are preferred more as the baking oven processed BPMs produced a harder texture. This observation is quite similar to that of the findings of Rudrawar *et al.*, (2015) [8].

4. Conclusion

Therefore it can be concluded that incorporation of banana peel in refined wheat flour with appropriate proportions will not only enhance the overall acceptability of final product of muffins but also increase its nutritional value in respect of polyphenol content which may increase upto 1.35 times than control muffin.

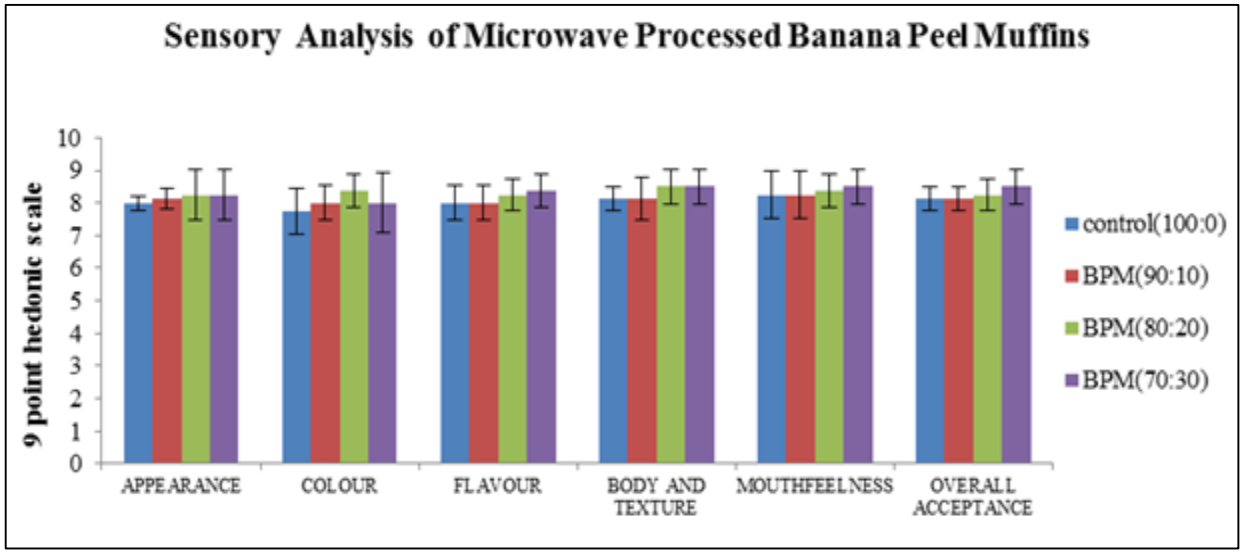


Fig 1: Sensory Analysis of Microwave Processed Banana Peel Muffins by 9 Point Hedonic Scale

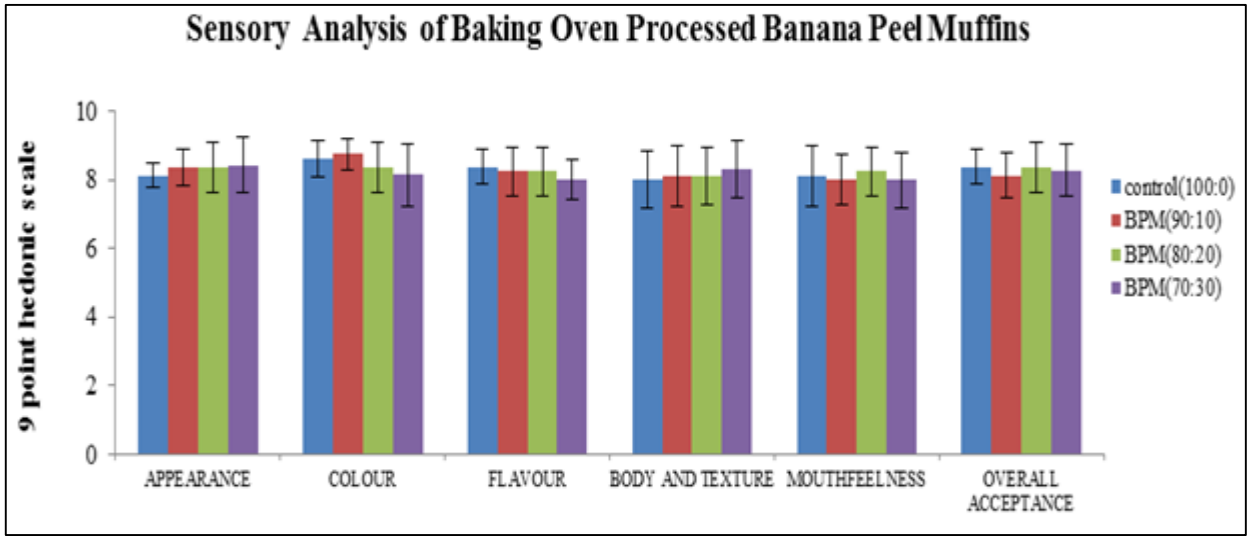


Fig 2: Sensory Analysis of Baking Oven Processed Banana Peel Muffins by 9 Point Hedonic Scale

Table 1: Polyphenol content of banana peel fortified muffins prepared in microwave oven

Extraction Medium	Polyphenol Content (gm GAE/100gm sample) (Avg±S.D)			
	Control (100:0)	BPM(90:10)	BPM(80:20)	BPM(70:30)
Acetone	4.91± 0.062	5.02±0.048	5.15±0.035	5.53±0.51
Methanol	5.91±0.045	6.05±0.028	6.82±0.042	7.92±0.028
Ethanol	3.15±0.013	4.31±0.021	4.81±0.095	5.75±0.040
Butanol	2.96±0.017	4.42±0.092	4.93±0.056	5.53±0.021
P.E	1.48±0.015	2.44±0.011	2.59±0.021	2.88±0.013

Table 2: Polyphenol content of banana peel fortified muffins prepared in baking oven

Extraction Medium	Polyphenol Content (gm GAE/100gm sample) (Avg±S.D)			
	Control (100:0)	BPM(90:10)	BPM(80:20)	BPM(70:30)
Acetone	4.56±0.026	4.64±0.042	4.94±0.052	6.20±0.051
Methanol	5.76±0.046	5.92±0.089	6.72±0.042	7.77±0.078
Ethanol	3.44±0.025	3.71±0.021	4.13±0.035	5.55±0.045
Butanol	2.86±0.017	4.22±0.092	4.53±0.056	4.83±0.021
P.E	1.28±0.015	2.29±0.011	2.41±0.021	2.61±0.013

5. Acknowledgement
The authors are hereby acknowledging the Honorable Managing Director of JIS Group for financial support and inspiration.

6. References

1. Anjum S, Sundaram S, Rai GK. Application and value addition of banana (*Musa paradisica* l. variety "bhusawal keli") peel: a review. International Journal of Pharmacy and Pharmaceutical Sciences. 2014; 6(10):81-85.
2. Anal AK, Jaisanti S, Noomhorm A. Enhanced yield of phenolic extracts from banana peels (*Musa acuminat*a Colla AAA) and cinnamon barks (*Cinnamomum varum*) and their antioxidative potentials in fish oil. J Food Science and Technology. 2014; 51(10):2632-2639.
3. Etsey AN, Sakyi-Dawson E, Sefa-Dedeh S, Afoakwa EO, Tano-Debrah K, Annor GA. Effects of cowpea fortification and the level of ripeness of plantain on the nutritive value of plantain based snack foods, Afr. J. Biotechnol. 2007; 6(6):799-802.
4. Gonzalez-Montelongo RM, Gloria Lobo G, Gonzalez M. Antioxidant activity in banana peel extracts: Testing extraction conditions and related bioactive compounds. Food Chemistry. 2010; 119:1030-1039.
5. Hooda S, Jood S. Organoleptic and nutritional evaluation of wheat biscuits supplemented with untreated and treated fenugreek flour. Food Chem. 2005; 90:427-435.
6. Kedare SB, Singh RP. Genesis and development of DPPH method of antioxidant assay. J Food Sci. Technol. 2011; 48:412-422.
7. McDonald S, Prenzler PD, Autolovich M, Robards K. Phenolic content and antioxidant activity of olive extracts. Food Chem. 2001; 73:73-84.
8. Rudrawar BD, Jadhav VV. Development, Sensory and Analytical Study of Spicy Banana Muffins. International Journal of Science and Research. 2015; 4(10):1291-1294.
9. Senadeera W, Bhandari BR, Young G, Wijesinghe B. Modelling dimensional shrinkage of shaped foods in fluidized bed drying. J Food Processing and Preservation. 2005; 29:109-119.
10. Singh B, Sharma HK, Sarkar BC. Optimization of extraction of antioxidants from wheat bran (*Triticum spp.*) using response surface methodology. J Food Science and Technology. 2012; 49(3):294-308.
11. Stahl L, Miller KB, Apgar J, Sweaigart DS, Stuart DA, Mchale N *et al*. Preservation of cocoa antioxidant activity, total polyphenols, flavan-3-ols, and procyaniden content in food prepared with cocoa powder. Journal of food science. 2009; 74(6):C456- C461.
12. Sundaram S, Anjum S, Dwivedi P, Rai GK. Antioxidant activity and protective effect of banana peel against oxidative hemolysis of human erythrocyte at different stages of ripening. Appl Biochem Biotechnol. 2011; 164(7):1192-206.