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Development and quality evaluation of refined flour based cake supplemented with orange peel powder

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Abstract
Antioxidants and fiber, the non nutrient plant food constituents are potent to maintain good health status and prevent the onset of degenerative diseases. This study was conducted to utilize orange peel for the development of fiber and antioxidants rich cake. For the development of functional cake refined flour was replaced with 5 to 20 per cent of orange peel powder. Peels were cut into small pieces and oven dried (50±5 C). Developed cakes were organoleptically evaluated by 10 semi trained judges using 9-point hedonic scale. Proximate composition, dietary fiber and antioxidants were analysed using standard methods.

Mean, standard error and CD (critical difference) were calculated for analysis of data. The mean score of overall acceptability of the control cake was 8.00 which fell in the category of "liked very much" whereas that of orange peel powder fortified cake varied from 7.6 (liked moderately) to 6.2 (liked slightly). It was observed that carbohydrate, total insoluble and soluble dietary fibre contents of cake increased by increasing the level of orange peel powder and reached to 13.41, 7.17 and 6.24 per cent at level 20 per cent of supplementation with orange peel powder. The contents of protein and fat were decreased while the contents of ash and dietary fiber were increased in cake upon inclusion of orange peel powder. Total phenols and DPPH radical scavenging activity of orange peel powder fortified cake were significantly ($P \leq 0.05$) higher than that of control cake. These food to food fortified products should be commercialized and promoted so that of orange peels can be utilised up to their full potential rather to waste and people can be benefited of such functional food products.

Keywords: Antioxidants orange peel powder, fiber, functional, cake, sensory acceptability

Introduction
Non-nutrient plant food constituents like dietary fiber and antioxidants play significant role in maintaining good health and delaying the onset of degenerative diseases. Dietary fiber favour digestive performance, intestinal transit of food, haemorrhoids, constipation, and glucose absorption [1], maintenance of insulin level and rduction of pre-prandial cholesterol level [2-4] and hence, delay the onset of 70 per cent of health problems. Food to food fortification is a suitable strategy to add nutrient and functionality to the developed products. It is a way to grab the nutritional benefits of grouped raw material from different sources in a single product. In recent years, health professionals have been focused to add more dietary fiber and antioxidants to the people diets. Orange peel contains considerable amounts of dietary fiber, antioxidants like flavonoids and essential minerals [5]. Agricultural waste comes up more and more with the challenge to utilize it in an effective way to design products with added value and competitive enough for the global market. The oranges that are destined for input for the agro industry have become a substantial load for the environment as a waste. The use of this waste for the creation of new products of added value will help decrease another source of contamination for the environment [6]. It has been found that citrus by-products, if utilized fully, could be major sources of phenolic compounds. The peels, in particular, are an abundant source of natural flavonoids, and contain higher amount of phenolics compared to the edible portions [7]. The contents of total phenolics in peels of lemons, oranges, and grapefruit were 15 per cent higher than those in the peeled fruits. Flavonoids in citrus are a major class of secondary metabolites. The peel contains the highest amount of flavonoids than other parts and those flavonoids present in citrus fruits belong to six peculiar classes according to their structure i.e. flavones, flavanones, flavonols, isoflavones, anthocyanidins and flavanols [8].

The dehydration of plant material using oven with low and controlled temperatures generate very satisfactory dried material. The applied dehydration avoids biological deterioration of plant material without sacrificing its nutritional and functional properties, such as the fiber, carotenoid, protein, polyphenol and antioxidant content. Efforts have been made to develop

functional cake with high dietary fiber and antioxidants by utilizing orange peel as the demand of these are tremendously increasing day by day.

Materials and Methods

Oranges were procured in a single lot from fruit and vegetable market of Hisar. Other ingredients such as refined flour, milkmaid, baking powder and refined oil were procured from the local market of Hisar. Oranges were washed with distilled water for twice and peeled. Peels were cut into small pieces and oven dried (50±5 C). Dried peels were converted into fine powder and packed in plastic zipper bags which were further stored in airtight plastic container till further use. Eggless cakes were prepared using milkmaid and cut and fold method. Refined flour was replaced with 5, 10, 15 and 20 per cent of orange peel powder in experimental biscuits.

Developed cakes were organoleptically evaluated by 10 semi trained judges using 9-point hedonic scale. Average of scores for all sensory characteristics, viz., color, appearance, flavor, texture, taste was expressed in terms of overall acceptability.

Nutritional evaluation

Proximate composition was determined by using standard methods of AOAC [9]. Total, soluble and insoluble dietary fiber constituents were determined by the enzymatic method given by Furda [10]. Finely ground sample were extracted with 80% methanol for the determination of antioxidant activity. The total phenolic content of the methanolic extracts was determined by the Folin-Ciocalteau colorimetric method [11]. The antioxidant activity of the extracts, on the basis of the scavenging activity of the stable DPPH free radical, was determined by the method followed by Brand-Williams *et al*. [12] as previously described by Tadhani *et al*. [13] .

Statistical analysis

The data obtained were subjected to analysis of variance in a complete randomized design by OPSTAT software developed by Sheoran and Pannu [14]. Mean, standard error and CD (critical difference) were calculated for analysis of data.

Results and Discussion

Sensory acceptability

The mean sensory scores given to control cake developed using 100 per cent refined flour were ranged from 7.8 to 8.3 for color, appearance, aroma, texture, taste and overall acceptability and this cake was adjudged as ‘liked very much’. With the increased level of fortification (5, 10, 15 and 20%) of orange peel powder in cake, a significant decrease in the scores was observed. The scores given to overall acceptability of orange peel powder incorporated cakes ranged from 6.2 to 7.6 and as a result, these biscuits were adjudged between ‘liked moderately’ to ‘liked slightly’ (Table-1).

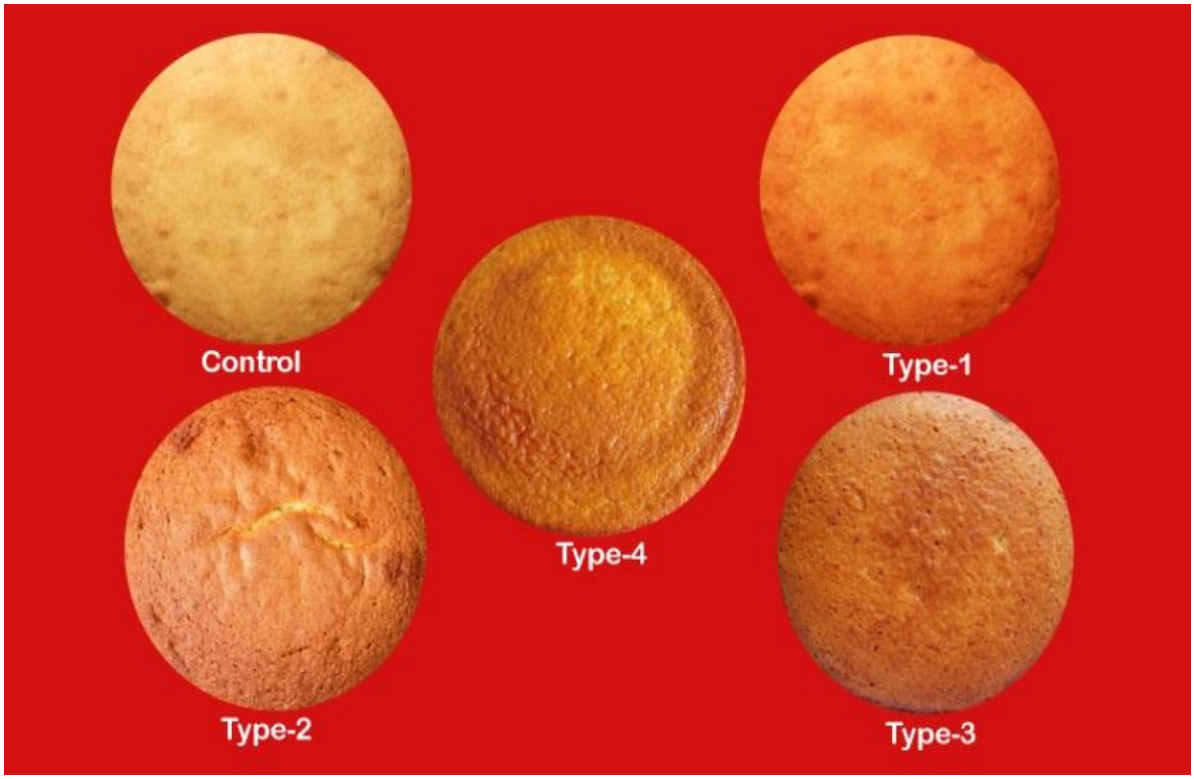

Plate 1: Orange peel powder supplemented cake

Table 1: Mean sensory scores of orange peel powder supplemented cake

	Colour	Appearance	Aroma	Texture	Taste	Overall Acceptability
Control	8.2±0.2	8.3±0.2	7.9±0.3	7.8±0.3	8.0±0.2	8.0±0.248
Type-I	7.9±0.2	7.7±0.3	7.5±0.1	7.3±0.2	7.6±0.2	7.6±0.236
Type-II	7.5±0.2	7.6±0.3	7.5±0.1	7.2±0.2	7.1±0.3	7.5±0.244
Type-III	6.9±0.2	6.7±0.3	7.0±0.3	6.5±0.4	5.0±0.6	6.4±0.411
Type-IV	6.3±.0.3	6.7±0.4	6.7±0.4	6.3±0.3	4.9±0.6	6.2±0.449

Values are mean ± SE of ten observations

Control (RF=100), RF:OPP: Type-I (95:5), Type-II (90:10) Type-III (85:15) Type-IV(80:20)

RF = Refined Flour, OPP = Orange peel powder

Nutritional quality

Results shown in Table 2 depicted that moisture content in control cake was 14.00 per cent while that of Type-I, Type-II, Type-III and Type IV cake ranged from 15.33 to 20.00 per cent. The protein and fat contents in control cake were 9.50 and 18.66 per cent, respectively which were decreased significantly at each level of supplementing orange peel powder. The ash and crude fibre contents in control cake prepared with refined flour were 0.90 and 0.75 per cent, respectively which increased significantly ($P \leq 0.05$) in all types (Type-I to Type-IV) of cake from 1.23 to 1.36 per cent and from 2.16 to 2.70 per cent, respectively as the level of incorporation of orange peel powder was increased in cake formulation.

Table 2: Proximate composition of orange peel powder supplemented cake (%, DM)

	Moisture*	Protein	Fat	Ash	Crude fibre
Control	14.00±0.057	9.50±0.173	18.66±0.882	0.90±0.058	0.75±0.067
Type-I	15.33±0.882	8.43±0.393	18.66±0.333	1.23±0.033	2.16±0.033
Type-II	17.00±0.577	8.13±0.536	17.00±0.577	1.30±0.058	2.33±0.033
Type-III	17.00±1.155	7.26±0.968	16.00±0.577	1.40±0.058	2.43±0.033
Type-IV	20.00±0.577	7.03±1.087	15.66±0.333	1.36±0.033	2.70±0.058
CD ($P \leq 0.05$)	2.021	1.658	1.481	0.178	0.169

Values are mean ± SE of three independent determinations; Control (RF=100), RF:OPP: Type-I (95:5), Type-II (90:10) Type-III (85:15) Type-IV (80:20); RF = Refined Flour, OPP = Orange peel powder

Dietary fibre

Result presented in Table 3 showed that total and soluble dietary fibre content of refined flour cake was 3.13 and 1.04 per cent, respectively which was increased to 8.20 to 13.20 and 2.80 to 6.24 per cent in orange peel powder fortified cake. Maximum total and soluble dietary fibre was observed in Type-IV cake i.e 13.20 and 6.24 per cent and minimum was observed in Type-I cake. Control cake contained 2.16 per cent of insoluble dietary fibre which was ranged from 5.41 to 7.02 per cent in orange peel powder fortified cake. There was a significant increase in the total, insoluble and soluble dietary fibre content of cake as the level of incorporation with orange peel powder increased from 5 to 20 per cent.

Table 3: Dietary fibre content of orange peel powder supplemented cake (%, DM)

	Dietary fibre		
	Total	Soluble	Insoluble
Control (RF 100%)	3.13±0.033	1.04±0.006	2.16±0.088
Type-I	8.20±0.058	2.80±0.058	5.41±0.049
Type-II	10.03±0.088	3.82±0.010	6.16±0.017
Type-III	11.53±0.273	5.05±0.006	6.00±0.050
Type-IV	13.20±0.115	6.24±0.006	7.02±0.012
CD ($P \leq 0.05$)	0.486	0.090	0.160

Values are mean ± SE of three independent determinations; Control (RF=100), RF:OPP: Type-I (95:5), Type-II (90:10) Type-III (85:15) Type-IV(80:20); RF = Refined Flour, OPP = Orange peel powder

Antioxidants

Total phenols and DPPH radical scavenging activity of control and fortified cake has been presented in Table 4. Control cake had49.19mgGAE/100g of total phenols and 12.47mgTE/100g of DPPH radical scavenging activity.

Table 4: Anti-oxidant activity of orange peel powder supplemented cake (%, DB)

	Total phenols (mgGAE/100gm)	Antioxidant activity by DPPH(mgTE/100gm
Control	49.19±1.14	12.47±0.87
Type-I	85.73±1.17	19.64±1.75
Type-II	122.27±1.16	26.92±1.10
Type-III	148.81±1.16	34.22±0.57
Type-IV	199.55±0.60	41.10±0.87
CD ($p \leq 0.05$)	0.822	1.993

Values are mean ± SE of three independent determinations; Control (RF=100), RF:OPP: Type-I (95:5), Type-II (90:10) Type-III (85:15) Type-IV(80:20); RF = Refined Flour, OPP = Orange peel powder

Total phenols and DPPH radical scavenging activity of orange peel powder fortified cake were significantly ($P \leq 0.05$) higher than that of control cake. Type-I and Type-II cake contained polyphenols 85.75 and 122.27 mgGAE/100g, and radical scavenging activity was 19.64 and 26.92mgTE/100g, respectively while Type-III and Type-IV value added cake contained polyphenols 148.81.40 and 199.55mgGAE/100g, and radical scavenging activity 34.22 and 41.10mgTE/100g, respectively.

Discussion

The mean score of overall acceptability of the control cake was 8.00 which fell in the category of "liked very much" whereas that of orange peel powder fortified cake varied from 7.6 (liked moderately) to 6.2 (liked slightly). Results of sensory acceptability observed in present study are in close agreement with the findings of Zaker *et al.* [15] who reported that incorporation of orange peel powder in preparing cake upto the level of 10 per cent substitution was superior to all other treatments and hence 10 per cent peel powder incorporation in preparation of cake could be considered optimum with respect to sensorial quality characteristics.

The protein and fat content of value added cake reduced with the increase of orange peel powder supplementation due to lower protein and fat contents in orange peel powder compared to refined flour [16-17]. Cake developed using orange peel powder in various proportions viz., 0, 5, 10, 15 and 20 per cent levels replacing the refined flour. They exhibited that protein and fat contents decreased with increasing orange peel powder concentration which was due to replacement of refined wheat flour and vegetable fat with peel powder and were major source of the protein and fat [15]. It was found that carbohydrate, total insoluble and soluble dietary fibre contents of cake increased by increasing the level of orange peel powder and reached to 13.41, 7.17 and 6.24 per cent at level 20 per cent of supplementation with orange peel powder.

Citrus peel is rich in nutrients such as soluble sugars, proteins and minerals. It contained antioxidants such as flavonoids (2.685±0.062 g/100 g) and vitamin C (0.105±0.003 g/100 g) [17-19]. Orange peel powder fortified cake had significantly ($P \leq 0.05$) higher content of polyphenols and radical scavenging activity compared to control cake. As the level of supplementation with orange peel powder increased in cake formulation significant ($P \leq 0.05$) increase was observed in the level of total polyphenols, and radical scavenging activity of cake. The differences in the total anti-oxidant activity of control and value added cake were due to higher contents of anti-oxidants present in orange peel powder. The results of present study are in agreement with those of other workers [20-21].

Conclusions

Antioxidants and fiber, the non nutrient plant food constituents are potent to maintain good health status and prevent the onset of degenerative diseases. Fiber and antioxidant rich cake could be developed by incorporating orange peel powder up to 10 per cent without compromising the sensory acceptable. The developed cake was found to be rich in minerals interpreted from higher ash content, antioxidants and soluble and insoluble dietary fiber. These food to food fortified products should be commercialized and promoted so that of orange peels can be utilised up to their full potential rather to waste. Such value added products also serve to manage the problem of hidden hunger.

References

1. Whitney E, Rolfes S. Understanding Nutrition, Belmont, Ca., USA, West/Wadsworth. Eighth ed., 1999.
2. Ángel ZC, Molina DR, Rodríguez MC. Vegetable products as source of dietary fiber in the food industry. Revista Facultad Nacional de Agronomía Medellín. 2011; 64(1):6024-35.
3. Cha JY, Cho YS, Kim I, Anno T, Rahman SM, Yanagita T. Effect of hesperetin, a citrus flavonoid, on the liver triacylglycerol content and phosphatidate phosphohydrolase activity in orotic acid-fed rats. Plant Foods for Human Nutrition. 2011; 56(4):349-58.
4. Fuentes-Zaragoza E, Riquelme-Navarrete MJ, Sanchez-Zapata E, Perez-Alvarez JA. Resistant starch asfunctional ingredient: A review. Food Research International. 2010; 240(4):931-42.
5. Gorinstein S, Martın-Belloso O, Park Y, Haruenkit R, Lojek A. Comparison of some biochemical characteristics of different citrus fruits Food Chemistry. 2001a; 74:309-15.
6. Espinosa-Garza G, Antonyan N, Loera-Hernández I. Orange Peel Dehydration and Creation of New Edible Products. International Journal of Food Engineering. 2018; 4(4):327-31.
7. Gorinstein S, Zachwieja Z, Folta M, Barton H, Piotrowicz J, Zemser M *et al*. Comparative contents of dietary fiber, total phenolics, and minerals in persimmons and apples. Journal of agricultural and food chemistry. 2001b; 49(2):952-957.
8. Senevirathne M, Jeon YJ, Ha JH, Kim SH. Effective drying of citrus by-product by high speed drying: A novel drying technique and their antioxidant activity. Journal of Food Engineering. 2009; 92(2):157-63.
9. AOAC. Official Method of Analysis. Association of official Analytical chemist. Washington, D.C, 2010.
10. Furda I. Simultaneous analysis of soluble and insoluble dietary fibre. In W.P.T. James, and O. Theander (Eds.), The Analysis of Dietary Fibre in food. Marcel dekker, New York, 1981, 163-172.
11. Singleton VL, Orthofer R, Lamuela-Raventos RM. Analysis of total phenols and other oxidation substrates and antioxidants by means of Folin-Ciocalteu reagent. Methods. Enzymol. 1999; 299:152-78.
12. Brand-Williams W, Cuvelier ME, Berset C. Use of a free radical method to evaluate antioxidant activity. Lebensm. – Wiss. Technol. 1995; 28:25-30.
13. Tadhani MB, Patel VH, Subhash R. *In vitro* antioxidant activities of *Stevia rebaidiana* leaves and callus. J. of Food Compos. Analy. 2009; 20:323-29.
14. Sheroan OP, Pannu RS. Statistical Package for agricultural workers. O.P. Stat College of Agriculture, Kaul, CCS Haryana Agricultural University, Hisar. India, 1999.
15. Zaker MA, Sawate AR, Patil BM, Sadawarte SK, Kshirsagar RB. Utilization of orange (*Citrus sinesis*) peel powder as a source of dietary fibre and its effect on the cake quality attributes. International Journal of Agricultural Sciences. 2017; 13(1):56-61.
16. Younis K, Islam R, Jahan K, Kundu M, Ray A. Investigating the effect of mosambi (*Citrus limetta*) peel powder on physicochemical and sensory properties of cookies. Quality Assurance and Safety of Crops & Foods. 2016; 8(3):393-98.
17. Okpala LC, Akpu MN. Effect of Orange Peel Flour on the Quality Characteristics of Bread British Journal of Applied Science & Technology. 2014; 4(5):823-30.
18. Raj A, Masih D. Physico chemical and rheological properties of wheat flour bun supplemented with orange peel powder. International Journal of Science and Research. 2014; 3(8):391-94.
19. Hiri NMH, Ioannou I, Ghoul M, Mihoubi-Boudhrioua N. Proximate chemical composition of orange peel and variation of phenols and antioxidant activity during convective air drying. Journal of New Sciences. 2015; 9:2286-2294.
20. Abd El-aal HA, Halaweish FT. Food preservative activity of phenolic compounds in orange peel extracts (*Citrus sinensis* L.). *Lucari stiintifice- seria* Zoothehnie. 2010; 53(15):233-240.
21. Awad AM, Magda RA, Selim KA. Evaluation of mandarin and navel orange peels as natural sources of antioxidant in biscuits. *Alex.* J Fd. Sci. & Technol. 2008; 12:75-82.