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## Studies on utilization of orange peel powder in the preparation of cookies

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#### Abstract

The present investigation on “Studies on utilization of orange peel powder in the preparation of cookies” was undertaken to explore the underutilized or neglected but highly nutrient rich orange peel powder in bakery products. Orange peel powder is a rich source of crude fibre, phenolic compounds,  $\beta$ -carotene and can be utilized in bakery products such as cookies. The prepared cookies were analyzed for nutritional composition. The changes occurred during storage of cookies were also studied.

Preliminary experiments were conducted to find out optimum level of orange peel powder for preparation of quality cookies. The quality cookies were prepared from 2% orange peel powder and 98% refined wheat flour. Chemical composition of orange peel powder showed that the moisture content was 7.53%, carbohydrates 80.27%, protein 5.34%, fat 2% and crude fiber 14.87%, vitamin C 45 mg/100g and iron 0.8 mg/100g. The physical properties of orange peel powder has light orange colour, bulk density 0.45g/ml. The fresh cookies had 4.2% moisture, 10.8% protein, 23.1% fat, 0.35 mg/100g crude fibre, 76.9% carbohydrates, 35.8 mg/100g calcium, 2.7 mg/100g iron and 650.3  $\mu$ g/100g  $\beta$ -carotene. The sensory evaluation of cookies was carried out regularly at a interval of one month. The mean score for colour and appearance was 8.53, texture 8.53, flavour 8.52, taste 8.53 and overall acceptability was 8.53 on 9 point hedonic scales. Storage study of cookies showed that the cookies prepared by incorporation of 2% orange peel powder and 98% refined wheat flour packed in polypropylene (PP) and low density polyethylene (LDPE) can be stored up to 3 months in good condition with minimum losses in sensory, nutritional and textural characteristics.

**Keywords:** Utilization, orange, preparation, cookies

#### Introduction

Bakery products have become more popular in India since the earlier times. Among the different bakery products cookies constitutes the most popular group. Cookies were invented very early. They could be kept for long time because their moisture content is very low. Cookies are chemically leavened bakery product containing high percentage of fat and sugar (Navy 1980) [6]. Fruits are commonly consumed in India and most often consumed as fruit juice. The wastes of fruits and vegetables are inexpensive, abundantly available and are a good source of dietary fiber (Serena and Knudsen, 2007) [9]. It is note-worthy to clarify that orange peel: the waste by-product of the citrus factories is reckoned as a valuable functional food. So, citrus peels may provide a health benefit beyond the traditional nutrients they contain, as well as prevent diet-related diseases, e.g. metabolic syndrome, type II diabetes, coronary heart disease, obesity, hypertension, certain types of cancer, gastrointestinal diseases and osteoporosis (Block *et al.*, 1992) [4].

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 (Gorinstein *et al.*, 2001) [5]. In the studies reported above, orange peel can be used either fresh or in powder form. The utilization of orange peel powder in bakery products particularly in cookies can be done. Therefore an attempt has been made to utilize characteristics of cookies, identifying maximum level of incorporation without adversely affecting the quality of cookies and improving the nutritional characteristics of cookies.

## Materials and Methods

The experiment was conducted in the laboratory of Department of Food Science and Technology, Post Graduate Institute at Mahatma Phule Krishi Vidyapeeth, Rahuri during the year 2019-2020. Orange peel powder was prepared in laboratory.

### Packaging material

The packaging materials like polypropylene (PP) and low density polyethylene (LDPE) were purchased from the local market.

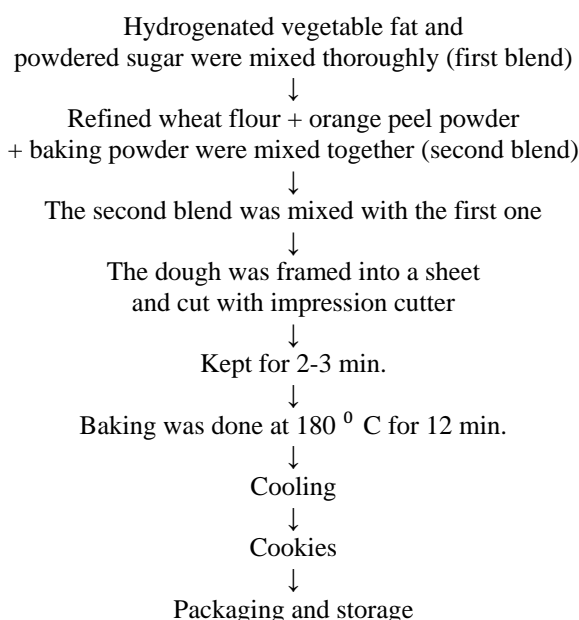
### Ingredients

The major ingredients for the preparation of cookies such as refined wheat flour, sugar and Vanaspati ghee were purchased from local market.

### Method

#### Procedure for preparation of cookies by incorporating orange peel powder

The procedure for preparation of cookies by incorporating orange peel powder is shown in Fig. 1.



**Fig 1:** Flow sheet for preparation of cookies

**Table 1:** Treatment details

Treatment	Orange peel powder %	Refined wheat flour %
T <sub>0</sub>	0	100
T <sub>1</sub>	1	99
T <sub>2</sub>	2	98
T <sub>3</sub>	3	97
T <sub>4</sub>	4	96
T <sub>5</sub>	5	95

### Physico-chemical analysis of raw material and cookies

The method described in A.A.C.C. (2000) [1] for determining moisture was used. The protein content of cookies was estimated by determining total nitrogen content using standard Micro-Kjeldhal method and fat content of the cookies estimated by the soxhlet method A.A.C.C (2000) [1]. The crude fiber content in the product was estimated by A.A.A.C. (2000) [1]. The carbohydrate content in the selected cookies were obtained by subtracting from 100, the sum of values of moisture, protein, fat, ash and crude fiber content per 100 g of the sample (Raghuramulu, *et al.*, 1993) [7].

Calcium and iron were analyzed using atomic absorption spectrometry (AAS).  $\beta$ -carotene content of the selected samples was determined by the method of A.O.A.C. (1980) [3].

### Packaging and storage of cookies

The selected treatment (T<sub>2</sub>) i.e. 2% of orange peel powder and 98% refined wheat flour blended cookies was packed in polypropylene (PP) and low density polyethylene (LDPE) and stored for 90 days. The cookies were drawn at an interval of 30 days and evaluated for chemical and sensory quality.

### Sensory evaluation of cookies prepared by incorporation of orange peel powder

Sensory evaluation of cookies prepared by incorporation of orange peel powder was carried on by 9 point hedonic scale. The average scores of the ten judges for different quality characteristics *viz.* Colour and appearance, flavour, texture, taste and overall acceptability were recorded.

### Statistical analysis

All experiments were carried out by using Factorial Completely Randomized Design (FCRD). The data obtained in the present investigation were analyzed for the statistical significance according to the procedure given by Rangaswamy (2010) [8].

### Results and Discussion

**Table 2:** Physico-chemical composition of raw materials used in the preparation of cookies

Sr. No.	Physical and Chemical constituents	Mean value (Orange peel powder)	Mean value (Refined wheat flour)
1.	Color	Light orange	White
2.	Bulk density (g/ml)	0.45	0.48
3.	Moisture (%)	7.53	10.30
4.	Protein (%)	5.34	12.47
5.	Fat (%)	2.00	0.99
6.	Crude fiber (%)	14.87	0.37
7.	Carbohydrates (%)	80.27	74.85
8.	Ash (%)	4.80	1.02
9.	Calcium (mg/100 g)	161	23.00
10.	Iron (mg/100 g)	0.8	2.60

\*Each value represents the average of three determinations

**Table 3:** Sensory evaluations of fresh cookies prepared by incorporation of orange peel powder

Treatments	Colour and appearance	Texture	Flavour	Taste	Overall acceptability
T <sub>0</sub>	8.5	8.5	8.5	8.5	8.5
T <sub>1</sub>	8.7	8.6	8.6	8.7	8.7
T <sub>2</sub>	9.0	9.0	9.0	9.0	9.0
T <sub>3</sub>	8.2	8.2	8.2	8.2	8.3
T <sub>4</sub>	7.9	7.7	7.7	7.7	7.9
T <sub>5</sub>	7.6	7.3	7.4	7.5	7.5
Mean	8.31	8.22	8.22	8.26	8.32
SE $\pm$	0.036	0.047	0.043	0.041	0.045
CD@5%	0.111	0.145	0.133	0.126	0.139

The organoleptic evaluation of cookies prepared by different combination of orange peel powder and refined wheat flour were carried out. The cookies were prepared and presented to panel of ten judge for assessing the quality and acceptability of product. Organoleptic evaluation of cookies was carried out using a 9 point hedonic scale of sensory characteristics such as colour, texture, taste and overall acceptability.

Treatment T<sub>2</sub> i.e. 2% orange peel powder and 98% refined wheat flour was selected and kept for 3 months for storage

study. Chemical analysis and sensory evaluation was done at interval of 30 days.

**Table 4:** Chemical analysis of orange peel powder and refined wheat flour blended cookies during storage

Parameters	Initial				Final			
	T1P1	T1P2	T2P1	T2P2	T1P1	T1P2	T2P1	T2P2
Chemical constituent								
Moisture (%)	4.14	4.14	4.19	4.19	4.23	4.24	4.27	4.28
Protein (%)	12.05	12.05	10.82	10.82	11.91	11.88	9.60	9.43
Fat (%)	25.86	25.86	23.06	23.06	25.76	25.74	22.97	22.96
Crude fiber (%)	0.27	0.27	0.35	0.35	0.203	0.20	0.29	0.28
Carbohydrate (%)	73.87	73.87	73.89	73.89	73.80	73.79	76.83	76.82
Calcium (mg/100g)	22.97	22.97	35.97	35.97	22.91	22.90	35.91	35.87
Iron (mg/100g)	2.67	2.67	2.71	2.71	2.60	2.59	2.65	2.65
β-carotene (µg/100g)	379.62	379.62	650.31	650.31	379.42	379.40	650.22	650.20
Total polyphenol (mg/100g)	9.72	9.72	19.40	19.40	9.53	9.52	19.23	19.22

Where: T<sub>1</sub> -(100% maida)

T<sub>2</sub> -(98% maida and 2% orange peel powder)

P<sub>1</sub> – Low density polyethylene (LDPE), P<sub>2</sub> - Polypropylene bag (PP)

The data in Table 4 shows that protein, fat and carbohydrate contents decreased in T<sub>2</sub> with increasing orange peel powder concentration, this is due to replacing the refined wheat flour which is major source of the protein and fat. On the other side, moisture, crude fibre, calcium, iron, β-carotene and total polyphenol contents increased in T<sub>2</sub> by increasing the level of orange peel powder, as from the proximate composition of the orange peel powder it is clear that peel powder is a major source of the dietary fibres, calcium, iron, β-carotene and total polyphenol. Except moisture all other parameters found decreased in final analysis as compared to initial analysis. Cookies stored in low density polyethylene (LDPE) shows better quality than polypropylene (PP).

#### Changes in sensory parameters of orange peel powder and refined wheat powder blended cookies during Storage

Orange peel powder and refined wheat flour blended cookies (2% orange peel powder and 98% refined wheat flour) remained in good condition at ambient temperature during the entire storage period of 3 months. The cookies stored in low density polyethylene bags (LDPE) showed good quality than polypropylene (PP) during 3 months of storage. The overall acceptability score of orange peel powder and refined wheat flour blended cookies was decreased from 9 to 8.23 in PP and 9 to 8.46 in LDPE.

#### Conclusion

Orange peel powder and refined wheat flour blended cookies prepared with combination of 2% orange peel powder and 98 percent refined wheat flour was best and it was fairly stable to storage period for chemical composition. The cookies remained in good condition during storage period of 3 month. The cookies stored in LDPE bags showed good quality than polypropylene (PP) during 3 month storage.

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