

RESEARCH PAPER

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Studies on exploration of orange pomace powder on physical, sensorial and nutritional quality of cookies

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SUMMARY :

Processing of fruit and vegetable produces large quantity of waste particularly citrus processing produces waste in the form of peel, seeds and pomace which can be the major source of phytochemicals and dietary fibres. The objective of the research was to utilize the orange pomace in the form of powder in baked item. The orange pomace powder was used in various proportion viz., 0, 5, 10, 15 and 20 per cent levels for incorporation in cookies by replacing the maida. The orange pomace powder and maida were analyzed for the proximate composition. The cookies were prepared and analyzed for its physical (diameter, thickness, and spread ratio), chemical (moisture, protein, fat, ash, fibre) and sensorial characteristics (appearance, colour, flavour, taste, texture). On the basis of overall sensory attributes cookies prepared with 10 per cent of orange pomace powder was recorded higher acceptability as compared to other samples. The spread ratio of the cookies also decreased as the per cent of orange pomace powder was increased with the increase in powder concentration the protein, fat content was gradually, decreasing and the dietary fibre. Orange pomace powder can be substituted upto 10 per cent in wheat flour to prepare orange pomace powder cookies without adversely affecting overall quality attributes.

KEY WORDS : Pomace powder, Sensorial characteristics, Quality attributes

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Baking industry is considered to be one of the major segments of food processing in India. Baked products have popularities in the people because of their availability, ready to eat convenience and reasonably good shelf-life (Vijayakumar *et al.*, 2013). Orange is a fruit of the citrus species *Citrus sinensis* in the family Rutaceae. Orange is the world's most popular fruit with orange juice constituting a major portion of the

food industry. 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. The contents of total phenolics in peels of lemons, oranges, and grapefruit were 15 per cent higher than those in the peeled fruits (Gorinstein *et al.*, 2001).

The net impact by the revolution in agriculture is the

fast development of food processing industries all over the world. Food industrialization has generated a large quantity of the food products, provides employment to large number of people and uplifted the economic status, at the same time; it generated waste in huge quantities causing the environmental pollution, by products from the agriculture and food processing industries can become one of the most serious sources of pollution (Blasi *et al.*, 1997). The processing industry creates a large amount of waste by-product in the form of peel, seeds, rag (the membranes between the citrus segments) and pulp (juice sacs), representing 50-60 per cent of the whole fruit being discarded after juicing (Siles *et al.*, 2010).

In view of the impact and economy of waste, the present research investigation has been carried out to utilize the orange pomace powder in value added food products *viz.*, cookies and also evaluated their overall quality characteristics.

EXPERIMENTAL METHODS

The research work was carried out at Department of Food Engineering, College of Food Technology, Vasantarao Naik Marathwada Krishi Vidhyapeeth Parbhani-Maharashtra, in the year 2016. The Oranges (Var. Nagpur) were procured from the local market of the Nagpur, Maharashtra. Wheat flour and other ingredients used in cookies preparation were purchased from the local market of the Parbhani.

Preparation of orange pomace powder :

Orange pomace were obtained after extraction of juice from the orange fruit and obtained pomace was dried in an oven at 50°C for 24 h to improve citrus by-products shelf-life without addition of any chemical preservative. A grinder mill and sieves were used to obtain a powder particle size of less than 0.2mm.

Preparation of cookies :

Cookies were prepared by using the standardized

Ingredient quantity	(g)
Wheat flour	100.0
Sugar	35.00
Fat	25.0
Salt	1.0
Baking powder	1.5
Ammonium carbonate	0.5

recipe and method given by (Shaikh *et al.*, 2016) (Table A).

Blends were prepared by mixing Orange pomace powder, water and refined wheat flour in different ratios on dry weight basis as per the recipe. These blends were standardized for product's acceptable physical characteristics as well as better nutritive value in the final product. The dry ingredients *i.e.* composite flour, baking powder etc. were mixed together with the help of commercial sigma blender for 8 minutes with medium speed. A homogenous paste of fat and sugar was prepared in stainless steel pan. The dry mix and homogenous paste of sugar and fat was mixed thoroughly at high speed in commercial sigma blender to obtain uniformly mixed dough. The prepared dough was rolled in a uniform shape of 6 mm thickness and cut into round shape cookies with the help of cutter. These cookies were baked at 175°C for 15 min (Fig. A). Preparation of cookies was carried out using wheat flour samples replaced separately with 0, 5, 15 and 20 per cent orange pomace powder (Table B). The method of preparation of cookies is summarized

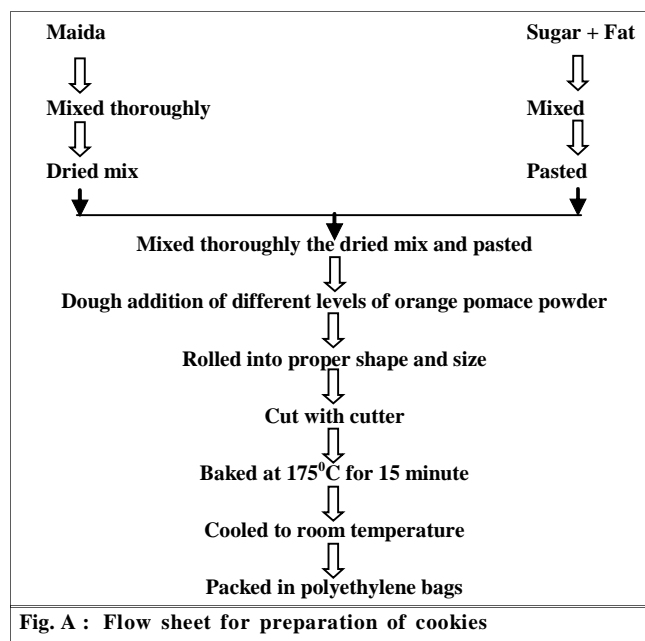


Fig. A : Flow sheet for preparation of cookies

Sample	Fortification levels of orange peel powder
OPP5	Orange pomace powder 5%
OPP10	Orange pomace powder 10%
OPP15	Orange pomace powder 15%
OPP20	Orange pomace powder 20%

OPP: Orange pomace powder

in flow sheet as follows:

Physical properties:

The physical properties of the prepared cookies *viz.*, width, thickness and spread ratio were carried out by the process given by the AACC (2000).

Analytical methods:

Proximate composition *viz.*, moisture, protein, fat, carbohydrate and ash were determined by the method given by AOAC (1999).

Water and oil holding capacity:

The water and oil holding capacity was measured by the method given by Nassar *et al.* (2008).

Organoleptic quality of biscuits:

The sensory evaluation of prepared cookies was carried out by a 25 member trained panel comprising of postgraduate students and academic staff members of faculty who had some previous experience in sensory evaluation of bakery products. The panel members were requested in measuring the terms identifying sensory characteristics and in use of the score. Judgments were made through rating products on a 9 point Hedonic Scale with corresponding descriptive terms ranging from 9 'like extremely' to 1 'dislike extremely' as per the methods describe by Hooda and Jood (2005).

EXPERIMENTAL FINDINGS AND ANALYSIS

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Proximate composition of refined wheat flour :

Compositions of refined wheat flour were determined to signify its suitability in preparation of cookies. The obtained results are summarized in Table 1. The refined wheat flour contained 11.87 per cent of crude protein while 8.72 per cent of gluten content was observed. The other results with respect to moisture, fat, ash and total carbohydrate were found to be 13.20, 1.38, 0.53 and 68.17 per cent, respectively. The obtained results for the proximate composition and gluten content of wheat flour were similar to that of earlier results by (Gopalan *et al.*, 2004).

Table 1 : Proximate composition of refined wheat flour (g/100g DW)

Sr. No.	Parameter	Refined wheat flour
1.	Moisture	13.20
2.	Protein	11.87
3.	Crude fat	1.38
4.	Total ash	0.53
5.	Total carbohydrate	68.17
6.	Gluten content	8.72

*Each value is average of 3 determinations

Proximate composition of orange pomace powder:

Proximate composition of orange pomace powder presented in Table 2 revealed that it contain 8.91 per cent moisture, 6.18 per cent protein, 60.33 per cent total dietary fibre and 5.51 per cent fat, these results are comparable with findings reported by Humaira *et al.* (2013). The results of the water and oil holding capacity are found comparable with findings reported by Nassar *et al.* (2008).

Table 2 : Proximate composition of orange pomace powder (g/100g DW)

Sr. No.	Parameter (%)	Orange pomace powder
1.	Moisture	8.91±0.05
2.	Protein	6.18±0.21
3.	Crude fat	2.51±0.15
4.	Total dietary fibre	60.33±0.15
5.	Indigestible dietary fibre	49.66±2.10
6.	Digestible dietary fibre	11.78±0.59
7.	Water holding capacity g/g	3.9
8.	Oil holding capacity g/g	2.2

Physical characteristics of cookies such as width, thickness and spread ratio are presented in Table 3. The average width of control cookies was 57.4mm whereas that of substituted cookies varied from 56.2 to 50.5 mm for orange pomace powder at 5-20 per cent levels. On the other hand, the average thickness of control cookies was 6.07 mm and for other supplemented levels, it ranged from 6.21 to 7.1mm. The changes in width and thickness are reflected in spread ratio which was 9.4 for control cookies, these values were decreased from 9.0 to 7.1 in orange pomace powder cookies. These results are comparable with findings reported by Humaira *et al.* (2013).

Chemical composition of pomace powder incorporated cookies g/100g dry weight basis :

The data in Table 4 shows that protein, fat decreased with increasing orange pomace powder this is because we are replacing refined wheat flour and vegetable fat which are source of protein and fat, with the orange pomace powder whereas ash, carbohydrate and total dietary fibre as well as soluble and insoluble dietary fibre increased with increasing orange pomace powder and reached to 12.36 at level 20 per cent for orange pomace, respectively. This is because pomace powder is rich in dietary fibre which can be seen from the proximate composition of the pomace powder. Dietary fibres play a major role in maintaining the healthy gastrointestinal tract, and also play a role in diabetic. These results are comparable with findings reported by Humaira *et al.* (2013).

Sensory evaluation:

Sensory evaluation of cookies containing different

levels of orange pomace powder as compared to the control cookies is shown in Table 5. The data revealed that incorporation of orange pomace powder has marked improvement in colour, appearance and textural profile of prepared cookies up to concentration of 10 per cent while further increase in concentration results in drastic reduction in appearance, color, flavour, and texture as well as taste characteristics. The overall acceptability of cookies was determined by taking average of all the values pertaining to appearance, colour, flavour, texture and taste. It was found that sample containing 10 per cent of pomace powder found to secure maximum score (7.6) followed by OPP5 (7.1) and control (8.0) while least overall acceptability was observed in sample containing 20 per cent of powder. On the basis of overall acceptability of cookies, it could be concluded that incorporation of orange pomace powder in preparing cookies up to the level of 10 per cent is superior to all other treatments and control sample and hence 10 per

Table 3 : Physical characteristics of orange pomace powder supplemented cookies

Sample (%)	Width, W(mm)	Thickness, T(mm)	Spread ratio (W/T)
Control	57.4	6.07	9.4
5 OPP	56.2	6.21	9.0
10 OPP	54.2	6.81	7.95
15 OPP	51.8	6.87	7.54
20 OPP	50.5	7.1	7.11

OPP: Orange pomace powder

Table 4 : Chemical composition of pomace powder incorporated cookies g/100g dry weight basis

Sample (%)	Moisture	Protein	Fat	Ash	Carbohydrate	TDF	IDF	SDF
Control	3.58	10.01	20	0.8	69	2.74	1.74	1.0
5 OPP	4.25	9.41	18	1.0	71	7.20	5.8	1.4
10 OPP	4.98	7.58	17.01	1.21	73.46	8.95	6.41	2.54
15 OPP	5.41	6.78	16.74	1.34	74.87	11.41	6.87	4.54
20 OPP	5.64	6.14	15.21	1.39	77.01	12.36	7.0	5.36

TDF: Total dietary fibre IDF: Insoluble dietary fibre SDF: Soluble dietary fibre

Table 5 : Sensory evaluation of cookies

Sample code	Sensory attributes						
	Colour	Appearance	Texture	Taste	Mouth feel	Flavour	Overall acceptability
Control	8.0	8.0	8.0	8.0	8.0	8.0	8.0
OPP5	8.0	7.6	8.0	6.9	6.1	6.4	7.1
OPP10	8.0	8.0	8.0	7.0	8.0	7.0	7.6
OPP15	7.4	7.0	5.9	6.5	6.0	6.0	6.5
OPP20	5.0	4.9	5.1	5.0	4.9	5.0	5.0
S.E. _±	0.166	0.0924	0.1314	0.120	0.1139	0.126	0.0742
C.D. (P=0.05)	0.522	0.2909	0.4133	0.377	0.358	0.397	0.233

*Each value represents the average of ten determinations

cent pomace powder incorporation in preparation of cookies could be considered optimum with respect to sensorial quality characteristics.

Conclusion :

It can be concluded that incorporation of orange pomace up to the level of 10 per cent in formulating cookies preparations enhanced the nutritional value particularly with respect to dietary fibre, physical quality characteristics and overall acceptability of cookies.

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