

Studies on Preparation of Apple Pomace and Orange Peel Incorporated Cookies

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Abstract - Studies were conducted for incorporation of apple pomace and orange peel powder in cookies. The apple pomace and orange peel powder were used in various proportions viz 0, 5, 10 and 15 per cent levels respectively for incorporation in cookies by replacing the refined wheat flour. The apple pomace, orange peel powder and maida were analyzed for the proximate composition. The cookies were prepared and were analyzed for its physical (diameter, thickness, and spread ratio), chemical (moisture, protein, fat, ash, fiber) and sensorial characteristics (appearance, color, flavor, taste, texture). On the basis of overall sensory attributes, cookies prepared with 10 per cent of orange peel powder were recorded higher acceptability as compared to other samples. It was also found that the spread ratio of the cookies was decreased as the per cent of apple pomace and orange peel powder was increased. The increase in powder concentration, the protein, and fat content was decreased while the dietary fiber was increased. It was concluded that apple pomace and orange peel powder can be substituted up to 10 per cent in refined wheat flour to prepare apple pomace and orange peel powder without adversely affecting quality attributes.

Key Words: Citrus fruits, Apple pomace, Orange peel powder, Sensory evaluation and quality attributes.

1. INTRODUCTION

An apple is a round, edible fruit produced by an apple tree (*Malus domestica*). Apple trees are cultivated worldwide and are the most widely grown species in the genus *Malus*. The tree originated in Central Asia, where its wild ancestor, *Malus sieversii*, is still found. There are more than 7,500 Different cultivars are bred for various tastes and uses, including cooking, eating raw, and cider or apple juice production. Orange is a fruit of the citrus species *Citrus sinensis* in the family Rutaceae. Important orange varieties cultivated in India are Nagpur Santra, Coorg Santra, Khasi Santra, Mudkhed, Shringar, Butwal, Dancy, Kara (Abohar). Brazil, America, China, India, Mexico, Spain and Egypt are the countries having significant production of oranges. Brazil is the world's leading orange producer, with an output of 36 million tons in 2013, similar in total

to the next three countries combined (United States, China and India). With approximately 16 million tons produced in 2013, the United States is the second largest producer. Other countries with significant production of oranges are China, India, Mexico, Spain and Egypt. Citrus is grown in more than 26 states in the country. The important states producing major citrus fruits in the country are Punjab, Rajasthan and Maharashtra (FAO Statistics 2013).

Citrus peel, remaining after juice extraction, is the primary waste fraction amounting to almost 50 per cent of the fruit mass (Braddock, 1995). It is note-worthy to clarify that citrus 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) 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). 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. They are: flavones; flavanones; flavonols; isoflavones; anthocyanidins and flavanols (Senevirathne *et al.*, 2009).

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. Cookies are different from other baked products like bread and cakes because of their low moisture content which ensures less chance of microbial spoilage to provide a longer shelf life, making large scale production and distribution possible.

In view of the impact and economy of waste the present research investigation was carried out to utilize the

orange peel powder in value added food products viz: cookies and also evaluated for their overall quality characteristics.

1.1 Materials and Methods

The research work was carried out at Department of Food Processing Technology, College of Food Technology, Yavatmal, M.S., Maharashtra. The apples and oranges (Nagpur variety) were procured from the local market of Yavatmal, Maharashtra. Refined wheat flour and other ingredients used in cookies preparation were obtained from the local market of the Yavatmal, Maharashtra.

1.2 Preparation of Apple Pomace Powder

The fresh apples of uniform size were selected and cleaned for removal of any traces of residuals. The apples were then pulped and juice filtered for processing. The apple pomace was extracted and cleaned with muslin cloth twice for separation of sediments. Drying of pomace was done in the cabinet drier at 50°C for 24 h to remove excess moisture. Grinder mill and sieves are used to obtain a powder having particle size of less than 0.4 mm for incorporation purpose.

1.3 Preparation of Orange Peel Powder

Orange peel was obtained after peeling and further washed with tap water and scalded in a water bath to remove possible potential pathogenic microorganisms (vegetative cells). Drying of peel was carried out in an oven at 50°C for 24 h to improve shelf life of citrus by-products without addition of any chemical preservative. Grinder mill and sieves are used to obtain a powder having particle size of less than 0.2 mm.

1.4 Preparation of Cookies

Cookies were prepared by using the standardized recipe and method given by (Shaikh Ishaque *et al.*, 2016).

Table 1. Standardized recipe for Cookies

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

Blends were prepared by mixing orange peel powder, water and refined wheat flour in different ratios on dry weight basis as per the recipe. These blends were standardized for products 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 homogeneous paste of fat and sugar was prepared in stainless steel pan. The dry mix and homogeneous 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. Preparation of Cookies was carried out using wheat flour samples replaced separately with 0, 5, 10 and 15 per cent powders of apple pomace and orange peel respectively.

Process flowchart of Cookies:

- i. Selection of Refined wheat flour, Sugar and Fat.
- ii. Thorough Mixing of all ingredients.
- iii. Drying mix Paste.
- iv. Mixed thoroughly the dried mix and pasted
- v. Dough Addition of different levels of Orange peel powder Rolled into proper shape and size.
- vi. Cutting with cutter
- vii. Baking at 175°C for 15 minute
- Viii. Cooling to room temperature Packed in polyethylene bags

Table 2. Different levels of addition of Apple pomace and Orange peel powder in cookies

Samples	Apple Pomace %	Orange powder %
T ₁	0	0
T ₂	5	5
T ₃	10	10
T ₄	15	15

2. Physical Properties:

The water and oil holding capacity was measured.

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

2.1 Analytical Methods:

Proximate composition and dietary fiber were estimated by the methods given by AOAC (1999).

Water and Oil holding capacity:

Analyzed by the method given by Nassar et al., (2008).

2.2 Organoleptic quality of cookies:

The sensory evaluation was done on point hedonic scale as per the method given by Hooda and Jood (2005). The sensory evaluation of prepared herbal cookies was carried out by a 25 member trained panel comprising of postgraduate students and academic staff members of

faculty who had plenty previous experience in sensory evaluation of bakery products. The panel members were requested to measure 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.

3. RESULTS AND DISCUSSION

Proximate composition of refined wheat flour

Table 3. Proximate Composition of Refined Wheat flour (g/100g DW)

Sr. No.	Parameters (%)	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

Compositions of refined wheat flour were determined to signify its suitability in preparation of Cookies. The obtained results are summarized in Table 3. 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 results reported by other scientist Gopalan *et al.*, (2004).

Table 4. Proximate Composition of Apple pomace

Sr. No.	Parameters (%)	Apple Pomace
1.	Moisture	10.4
2.	Protein	4.50
3.	Crude Fat	2.14
4.	Total Ash	1.59
6.	Total Dietary Fiber	62.67
7.	Soluble Dietary Fiber	8.55
8.	Insoluble Dietary Fiber	54.12
9.	Water holding capacity (g/g)	5.9

Proximate composition of apple pomace in table 4 revealed that it has moisture content (10.04%), protein (4.50%), ash content (1.59%), and fat content (2.14%). Chemical composition of the dietary fiber of apple pomace was 62.67% total dietary fiber, 8.55% soluble dietary fiber and 54.12% insoluble dietary fiber. Candrawinata *et al.*, (2015).

Table 5. Proximate Composition of Orange peel powder

Sr. No.	Parameters (%)	Orange peel powder
1.	Moisture	9.5
2.	Protein	5.17
3.	Crude Fat	4.41
4.	Total Ash	2.53
5.	Sugar	9.20
6.	Total Dietary Fiber	74.14
7.	Indigestible Dietary Fiber	55.47
8.	Digestible Dietary Fiber	19.1
9.	Water holding capacity (g/g)	5.9

Proximate composition of orange peel powder presented in table-5 revealed that it contain 9.5 per cent moisture, 5.17 per cent protein, 74.14 per cent total dietary fiber and

4.41 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 6. Physical characteristics of apple pomace and orange peel powder supplemented cookies

Sample	Width, W(mm)	Thickness, T(mm)	Spread Ratio (W/T)
Control	58.4	6.53	8.94
5 % AP-OPP	56.8	6.72	8.45
10 % AP-OPP	55.2	6.8	8.11
15 % AP-OPP	53.9	6.71	8.03

(AP- Apple Pomace, OPP- Orange Peel Powder)

Physical characteristics of cookies such as width, thickness and spread ratio are presented in Table 6. The average width of control cookies was 58.4 mm whereas that of substituted cookies was 56.8 to 53.9 mm for pomace - orange peel powder at 5-15% levels. On the other hand, the average thickness of control cookies was 6.53 mm and for other supplemented levels, it ranged from 6.72 to 6.71 mm. The changes in width and thickness are reflected in spread ratio which was 8.94 mm for control cookies, and further these values was decreased from 8.45 mm to 8.03 mm in pomace - orange peel powder cookies in 5-15% substituted cookies.

Table 7. Chemical composition of apple pomace and orange peel powder substituted cookies g/100g dry weight basis

Sample (%)	Protein	Fat	Ash	Carbohydrate
Control	9.88	20	0.8	69
5 % AP-OPP	8.41	18	1.0	72
10 % AP-OPP	7.01	17.1	1.24	73.4
15 % AP-OPP	6.71	16.4	1.39	74.8

(AP- Apple Pomace, OPP- Orange Peel Powder)

The values (Table-7) shows that Protein, Fat, Ash and Carbohydrate contents decreased with increasing orange peel powder concentration, this is due to replacing the refined wheat flour and vegetable fat which are major source of the protein and fat. The obtained results for the proximate composition and dietary fibers were similar to that of results reported by Nassar *et al.*, (2008) and Kakali Bandyopadhyay *et al.*, (2014).

4. Sensory Evaluation:

Sensory evaluation of cookies prepared with different levels of apple pomace and orange peel powder as compared to the control cookies is depicted in Table 8. The data revealed that incorporation of apple pomace and orange peel 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. With respect to appearance, it was observed that incorporated of apple pomace and orange peel powder resulted in grainy appearance of cookies which were preferred by panellist members up to 10 per cent while in case of 15 per cent incorporated cookies, excessive grainy appearance secured lower values. Textural profile plays an important role in justifying the overall acceptability of cookies, In case of apple pomace and orange peel powder incorporated cookies, slight improvement in crispiness of cookies were observed in samples up to 10 per cent of peel powder, secured better scores however in case of cookies containing 15 per cent of orange peel powder, the panelists reported dryness of mouth secured least scores. It was found that cookies containing 10 per cent of appl pomace and orange peel powder found to secure maximum score (8.22) followed by AP-OPP (8.09) and control (8.5) while least overall acceptability was observed in AP-OPP15. On the basis of overall acceptability of cookies, it can be concluded that incorporation of apple pomace and orange peel powder in preparing cookies up to the level of 10 per cent is superior to all other sample and also in control sample. Hence 10 per cent apple pomace and peel powder incorporation in preparation of cookies could be overall acceptable with respect to sensorial quality characteristics.

Table 8. Sensory evaluation of cookies

Sample Code	Sensory Attributes					
	Col our	Appear ance	Textur e	Tast e	Flavo r	Overall acceptabi lity
Control	8.2	8.53	8.31	8.48	8.42	8.5
AP-OPP 5%	7.20	7.17	8.19	8.13	8.10	8.09
AP-OPP 10%	7.37	7.28	8.31	8.25	8.23	8.22
AP-OPP 15%	6.39	6.98	7.82	7.52	7.86	7.10
Mean	6.82	6.931	7.52	7.63	7.745	7.734
S.E.+	0.549	0.615	0.640	0.482	0.429	0.341
C.D. at 5%	0.182	0.206	0.214	0.161	0.143	0.115

(AP- Apple Pomace, OPP- Orange Peel Powder)

*Each value represents the average of ten determinations

5. CONCLUSION

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

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