

Formulation and Quality Evaluation of Fruit Peel Powder Incorporated Cookies

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Abstract

The study aims to develop Lemon peel, Orange peel and Pomegranate peel incorporated cookies and to analyse selected nutrients in the product. The Lemon peel powder, Orange peel powder and Pomegranate peel powder were prepared and incorporated in cookies in varying proportions by replacing maida. The standard along with the variations were subjected to sensory evaluation. Organoleptic evaluation showed 2% level of incorporation of lemon and orange peel powder and 5% level of pomegranate peel powder were acceptable in cookies. Fruit peels improved the nutritional properties of the cookies. From the study, it is concluded that the Lemon peel, Orange peel, Pomegranate peel powder can be incorporated in cookies at 2, 2 and 5 percent levels respectively without adversely affecting the quality attributes. Food use of fruit peel is a way to address food security and waste management issues.

Keywords: Cookies, Formulation, Lemon Peel, Orange Peel, Pomegranate Peel, Quality Assessment

1. Introduction

The convenience food segment is rapidly increasing, with the global ready-made foods market expected to grow by over 3% from about \$1 trillion in 2011 to nearly \$1.5 trillion in 2016¹. Consumers have less time to shop, cook or prepare their foods due to urbanization and industrialization resulting in rapid expansion of convenience foods².

Moisture content of cookies is comparatively lesser than cakes and bread, hence has longer shelf life and has lesser chance for microbial infestation³.

Roberts and Barnard⁴ reported a direct association between unbalanced diets and rising incidences of chronic health-related issues, including cardiovascular disease, diabetes and obesity. The consumption of low-fat, high-fibre foods has been advocated by health and

nutrition agencies⁵.

Nowadays, demand for foods products with ingredients which contain bioactive compounds that provide additional health benefits are increasing⁶.

Fruits and vegetable processing in India generates substantial quantities of waste. It had been previously reported that these wastes and by-products of fruits are an abundant source of antioxidant polyphenols⁷. These peels and pomace are a source of sugars, minerals and organic acids, dietary fibers and phenolics which have a wide range of actions which includes antioxidants, antimutagenic, cardio preventive, antibacterial and antiviral activities⁸. Use of waste as a source of polyphenols and antioxidants may have considerable economic benefit to food processors⁹.

Globally, India is the leading producer of fruits. Fruit Peel is a valuable source of bioactive compounds, which can be converted into value-added products. Fruit Peel can

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be utilised as a substrate to bioactive compounds, phenolic antioxidants, organic acids, enzymes, biofertilizer, energy production and adsorbents¹⁰.

In view of the impact and economy of waste the present research investigation was carried out to utilize the fruit peel powder in value added food products viz: cookies and also evaluated for their quality characteristics. The utilization of these bioactive rich fruit residues can provide an efficient, inexpensive, and environment friendly platform for the production of novel nutraceuticals or for the improvement of older ones.

2. Materials and Methods

2.1 Procurement of Ingredients

Good quality refined wheat flour and other ingredients necessary for cookies preparation were procured from the local departmental stores.

Lemon peel, Orange peel and pomegranate peel were collected from fruit shops and dried (at 60°C) and powdered in a grinder mill and sieved the sample particle size less than 0.2mm.

Pomegranates were initially cleaned, peeled and peel was dried for two or three days in a hygienic manner. The skin was ground into powder form¹¹.

Pomogranate peels were cleaned and dried for 2 or 3 days in a hygienic condition and ground to a fine powder.

2.2 Incorporation and Product Development

Standard cookies were prepared with 100 g of refined wheat flour. Lemon peel powder and orange peel powder were incorporated at 2%, 4%, 6%, 8% while pomegranate peel powder was incorporated at 5%, 10%, 15%, 20% in preparation of fruit peel powder incorporated cookies.

The formulated and standard products were analyzed by 30 semi trained panel members from the Department of Foods and Nutrition, Rathnavel Subrmaniam College of Arts and Science based on the parameters like appearance, color, texture, flavor and taste for the selection of the best product. The best product of each incorporation was further analysed for nutrient content.

2.3 Nutrient Analysis

Iron and dietary fiber were estimated for standard and selected proportion of fruit peel incorporated cookies by AOAC method¹².

2.4 Statistical Analysis

The data collected was statistically analysed using mean and standard deviation.

3. Results and Discussion

3.1 Sensory Analysis

The details regarding mean sensory scores obtained

Table 1. Mean Sensory Scores for Standard and Varying Proportions of Lemon Peel Powder Incorporated Cookies

CRITERIA	MAXIMUM SCORE	STANDARD MEAN ± SD	SAMPLE MEAN ± SD			
			A _L (2%)	B _L (4%)	C _L (6%)	D _L (8%)
Appearance	5	4.8±0.48	4.8±0.48	4.26±0.49	3.66±0.43	2.96±1.06
Colour	5	4.7±0.53	4.6±0.49	4.3±0.61	3.83±0.83	3±1.11
Texture	5	4.8±0.37	4.6±0.47	4.46±0.62	3.83±0.79	2.63±1.03
Flavor	5	4.8±0.34	4.7±0.44	4.4±0.67	3.93±0.86	2.83±0.94
Taste	5	4.66±0.62	4.6±0.49	4.5±0.82	4.03±0.80	2.8±1.09
Overall acceptability	5	4.72±0.50	4.6±0.76	4.4±0.82	3.85±0.59	2.84±1.05

by standard and lemon peel incorporated cookies is given in (Table 1).

On incorporation of lemon peel powder, sample AL had a highest mean score of 4.6 ± 0.76 and sample DL, had a lowest mean score of 2.84 ± 1.05 , whereas the sample BL, CL had values of 4.4 ± 0.82 and 3.85 ± 0.59 respectively. Slight bitterness and colour change was observed on increasing the quantity of lemon peel powder in the cookies.

Srivastava et al.¹³ concluded that highly nutritious biscuits may be prepared by incorporating a level of 3% of lemon peel powder without adversely affecting the overall acceptability of the product. In the present study 2

% incorporation in cookies was acceptable.

The details regarding mean sensory scores obtained by standard and orange peel incorporated cookies is given in (Table 2).

On incorporation of Orange peel powder sample Ao had a highest mean score of 4.48 ± 0.62 and sample Do, had a lowest mean score of 3.32 ± 0.99 , whereas the sample Bo, Co have moderate values of 4.19 ± 0.71 and 3.32 ± 0.99 respectively. Due to bitterness and the strong flavor of peel, sample with low level of incorporation was highly acceptable than samples with higher level of incorporation of orange peel. Similar trend was observed in the study reported by Zaker et al (2016)³.

Table 2. Mean Sensory Scores for Standard and Varying Proportions of Orange Peel Powder Incorporated Cookies

CRITERIA	MAXIMUM SCORE	STANDARD MEAN \pm SD	SAMPLE MEAN \pm SD			
			A _o (2%)	B _o (4%)	C _o (6%)	D _o (8%)
Appearance	5	4.8 \pm 0.48	4.66 \pm 0.54	4.13 \pm 0.77	3.9 \pm 0.84	3.56 \pm 0.97
Colour	5	4.7 \pm 0.53	4.5 \pm 0.57	4.06 \pm 0.69	3.73 \pm 0.73	3.36 \pm 0.99
Texture	5	4.8 \pm 0.37	4.5 \pm 0.50	4.3 \pm 0.70	3.83 \pm 0.74	3.23 \pm 1.00
Flavor	5	4.8 \pm 0.34	4.3 \pm 0.79	4.26 \pm 0.69	3.76 \pm 0.77	3.23 \pm 0.97
Taste	5	4.5 \pm 0.82	4.46 \pm 0.68	4.2 \pm 0.71	3.86 \pm 0.77	3.2 \pm 1.06
Overall acceptability		4.72 \pm 0.50	4.48 \pm 0.62	4.19 \pm 0.71	3.82 \pm 0.65	3.32 \pm 0.09

Table 3. Mean Sensory Scores for Standard and Varying Proportions of Pomegranate Peel Powder Incorporated Cookies

CRITERIA	MAXIMUM SCORE	STANDARD MEAN \pm SD	SAMPLE MEAN \pm SD			
			A _p	B _p	C _p	D _p
Appearance	5	4.8 \pm 0.48	4.56 \pm 0.56	4.1 \pm 0.71	3.43 \pm 0.85	2.80 \pm 1.03
Colour	5	4.7 \pm 0.53	4.43 \pm 0.56	4.13 \pm 0.68	3.33 \pm 0.89	2.80 \pm 1.20
Texture	5	4.8 \pm 0.37	4.46 \pm 0.50	4.06 \pm 0.73	3.36 \pm 0.92	2.73 \pm 1.04
Flavor	5	4.8 \pm 0.34	4.53 \pm 0.53	3.93 \pm 0.82	3.33 \pm 0.95	2.7 \pm 0.95
Taste	5	4.66 \pm 0.62	4.5 \pm 0.50	3.96 \pm 0.80	3.36 \pm 0.80	2.62 \pm 1.06
Overall acceptability	5	4.72 \pm 0.50	4.5 \pm 0.53	4.03 \pm 0.89	3.36 \pm 0.88	2.73 \pm 0.78

The details regarding mean sensory scores obtained by standard and orange peel incorporated cookies is given in (Table 3).

On incorporation of pomegranate peel powder, sample AP had a highest mean score of 4.5 ± 0.53 and sample DP, had a lowest mean score of 2.62 ± 1.06 , whereas the sample BP, CP had moderate scores of 3.96 ± 0.80 and 3.36 ± 0.88 respectively. Samples with higher concentration of pomegranate peel are less acceptable than samples with low concentration because of the bitterness and dark discoloration when compared with standard.

The organoleptic properties of idli were evaluated for Aroma, Appearance, Fluffiness, Compactness, Sponginess, Taste, Firmness, Springiness, Stickiness and overall acceptability. The overall acceptability and rating scale score was higher for the 10% level of incorporation after which increasing the level of pomegranate skin powder affected the sensory qualities¹¹. In the present study, cookies prepared with 5% level of pomegranate peel was more acceptable and overall acceptability of the cookies decreased as the percentage of incorporation of the pomegranate peels increased.

3.2 Nutrient Analysis

The details regarding iron content of Lemon peel, Orange peel and Pomegranate peel incorporated cookies (per 100g) is given in (Figure 1).

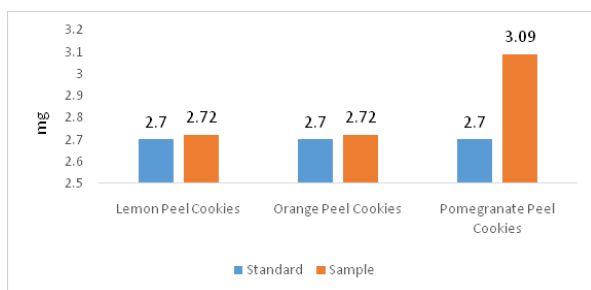


Figure 1. Iron content of standard and selected variation of fruit peel powder incorporated cookies.

There is an increase in iron content of Lemon peel and orange peel cookies by 0.02 mg and Pomegranate peel cookies by 0.39. The negligible increase in iron content is contributed by the substitution of fruit peel instead of Maida.

The details regarding fibre content of Lemon peel, Orange peel, Pomegranate peel incorporated cookies (per 100g) is given in (Figure 2).

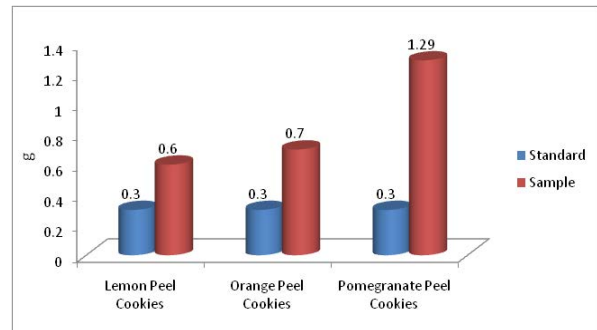


Figure 2. Fiber content of standard and selected variation of fruit peel powder incorporated cookies.

The fibre content of Lemon peel cookies increased by 0.3g, Orange peel cookies by 0.4g and Pomegranate peel cookies by 0.99g. Fiber content of sample cookies increased because of addition of fruit peel. The study by Obafaye and Omoba showed that there was significant increase in antioxidant properties and dietary fiber with increase in Orange Peel. Pomegranate Peel powder supplementation significantly ($p < 0.05$) improved dietary fibers (0.32-01.96g/100g), total phenols (90.7-161.9mg GAE/100g) and inorganic residues (0.53-0.76g/100g) of cookies¹⁴.

4 Conclusion

Fruit peels are agricultural waste generated during the production of fruit juice and are valuable natural sources of antioxidants and dietary fiber. They have the potential to be an effective tool in managing chronic degenerative diseases related to oxidative stress. The Peels can be exploited to produce functional snacks and exposing consumers to new source of antioxidants and dietary fiber. It will also minimize waste and provide value addition to byproducts that are considered as waste in agricultural processing.

5. References

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