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Development of Phytochemical Rich Ice Cream Incorporating Kinnow Peel

By Simran Mann & K S Minhas Poonam Aggarwal
Agricultural University

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Development of Phytochemical Rich Ice Cream Incorporating Kinnow Peel

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Abstract - The present study was carried out to develop ice cream using frozen Kinnow peel; both unblanched and blanched, at the levels of 1, 3 and 5%, each. The ice cream samples were analyzed for sensory and chemical parameters. The addition of Kinnow peel improved the appearance, flavour and overall acceptability of the ice cream samples. The total solids (TS), ascorbic acid and flavonoids (naringin) content of the ice cream samples were found to increase with increased level of addition of peel. Based on sensory evaluation, the best levels of frozen Kinnow peel in ice cream were: unblanched-3% and blanched-5%. When compared, ice cream with 3% unblanched-frozen kinnow peel was found to be the best.

I. PRACTICAL APPLICATIONS

This research would have practical applications in the ice-cream industry in terms of providing added value for an otherwise overlooked by-product of kinnow juice industry. The peel of the fruit, which is generally considered a waste is more nutritious than juice can be processed into candies that may be further used in the baking industry in the preparation of cakes, cookies, steamed puddings, sweet breads, mixed candied fruits and in marmalades. (Mehta and Bajaj 1984)

II. INTRODUCTION

Ice-cream is a leading product in the global market among innovative dairy products, as consumers increasingly associate the segment as being more of an everyday, year-round household grocery (Soukoulis *et al* 2009). It is considered as a food of high nutritional and caloric density, but poor in dietary fibers and some of the natural antioxidants. Nowadays, the consumers' trends has been towards foods with more natural antioxidants, dietary fibers, natural colourants, minerals, vitamins, low calories, low cholesterol and low fat and free of synthetic additives, etc. (El-Samahy *et al* 2009).

Citrus possess many beneficial components that are located in the parts that most consumers would throw away. The amount of residue obtained from citrus fruits, account for 50% of the original amount of whole fruit. Citrus fruits are mainly used for juice, oil and pectin production and are under utilized sources for dietary fibre and antioxidants (Nassar *et al* 2008). The industry of fruit juices produces significant amounts of by-products which could cause problems in their disposal.

In citrus fruits, about three-fourth of the vitamin C is present in the peel, pulp and seed, that goes waste (Nagy 1980). As an antioxidant, vitamin C can protect LDL cholesterol from oxidation to help reduce the incidence of heart disease and can also block the formation of carcinogenic nitrosamines in the body (www.foodproductdesign.com). Citrus peel is also an interesting source of phenolic compounds which include phenolic acids and flavonoids. The citrus flavonoids which include Hesperidin and Naringin, have been found to have antioxidant as well as other health related properties like anticancer, antiviral and anti-inflammatory activities, etc. (Bocco *et al* 1998).

Kinnow mandarin (*Citrus reticulata*), a hybrid of King & Willow leaf, is one such citrus fruit with a production of 4,14,090 tonnes in Punjab (Anon 2007). While processing, it yields 50 percent juice, 25 percent peel, 23 percent residue and 2 percent seeds (Aggarwal and Sandhu 2006). These figures clearly show that a major portion of the fruit is going waste during processing, which can be utilized for many value added products. On an average, Kinnow peel contains 22.45 percent total solids, 12.500 B TSS, 1.38 percent acidity, 41.57 mg/100g ascorbic acid, 6.23 percent total sugars, 5.99 percent reducing sugars, 0.67 percent ash, 13.65 mg/100g carotenoids, 7.43 mg/100g β -carotene, 1.85 percent pectin & 0.77 percent fat (Aggarwal & Sandhu 2003). It also contains naringin (0.420 mg/g, approx) and limonin (4.69 mg/g approx) (Premi *et al* 1994).

Keeping in view the increasing demand of ice cream and increased consumer awareness about healthier eating habits, this research project was designed to develop phytochemical rich ice cream incorporating Kinnow peel and studying the chemical and sensory characteristics of the final product.

III. MATERIAL AND METHODS

a) Preparation of different forms of Kinnow peel

Kinnow peels were washed and white portion (albedo) was removed from inside the peels. The cleaned peels were then cut into shreds and were used for the preparation of frozen Kinnow peels i.e.

Unblanched-frozen Kinnow peel – Kinnow peel shreds were packed in polyethylene pouches and frozen at -18°C.

Blanched-frozen Kinnow peel – Kinnow peel shreds were kept in boiling water for 4 mins, air-dried, packed in polyethylene pouches and frozen at -18°C.

Author ^α ^σ : Department of Food Science & Technology Punjab Agricultural University, Ludhiana-141004.

These forms were added to ice cream at the levels of 1, 3 and 5%, each.

b) Preparation of ice cream

A plain ice cream mix having a composition of fat 10%, SNF 11%, sugar 15%, stabilizer 0.3% and emulsifier 0.1% was prepared using buffalo milk, cream, skim milk powder, sugar, sodium alginate and glycerol monostearate (GMS). The mix ingredients were calculated using the formula given by Arbuckle (1977). The prepared ice cream samples were stored at -18 to -20°C.

c) Chemical and sensory evaluation

Ice cream samples were analysed for chemical and sensory quality. Total solids and ascorbic acid were estimated according to AOAC methods (2000). Flavonoids (naringin) were determined by the Davis method (Ting and Rouseff 1986). Sensory evaluation was carried out using 9-point hedonic scale. The results obtained were statistically analysed with the help of CRD using the software CPCS-1 (Singh et al 1991).

IV. RESULTS AND DISCUSSION

The data obtained for the effect of addition of different levels of unblanched frozen Kinnow peel on the mean sensory scores of ice cream is given in Table 1. It can be seen that as the level of peel increased from 1 to 5%, the appearance scores also increased significantly from 7.9 to 8.6, due to increased intensity of natural orange colour in the ice cream. The taste scores also differed significantly among all the samples, the highest being ice cream with 3% unblanched frozen Kinnow peel (8.2), as bitterness could be perceived at 5% level. The aroma scores (8.2) were higher for both the ice creams with 3 and 5% Kinnow peel. Non-significant difference was observed for the body and texture scores of all ice cream samples. Overall acceptability scores (8.1) were significantly higher for ice cream with 3% Kinnow peel.

Table 1 : Effect of Addition of Different Levels of Unblanched-Frozen Kinnow Peel on the Mean Sensory Score of Ice Cream

Level (%)	Appearance	Flavour		Body & texture	Overall acceptability
		Taste	Aroma		
0	7.3	7.2	7.1	8.0	7.0
1	7.9	7.7	7.8	8.1	7.8
3	8.2	8.2	8.2	8.0	8.1
5	8.6	7.9	8.2	7.9	7.9
LSD(p < 0.05)	0.3	0.3	0.3	0.0	0.3

The effect of addition of different levels of blanched-frozen Kinnow peel on the mean sensory scores of ice cream is shown in Table 2. The appearance scores increased significantly from 7.4 to

8.4 for all the ice cream samples as the level of peel addition in ice cream increased from 1 to 5%. This could be attributed to an increased intensity of natural orange colour in the ice cream samples with increasing level of peel. The taste (8.3) and aroma (8.4) scores were found to be significantly higher for ice cream with 5% blanched-frozen Kinnow peel as the heat treatment given to the peels decreased their bitterness due to which a higher percentage of these peels was found to be acceptable in ice cream. The body and texture scores (8.2) were significantly higher for ice cream with 3% peel. Overall acceptability scores (8.4) were higher for ice cream with 5% peel but in close proximity to the sample with 3% peel (8.3).

Table 2 : Effect of Addition of Different Levels of Blanched-Frozen Kinnow Peel on the Mean Sensory Score of Ice Cream

Level (%)	Appearance	Flavour		Body & texture	Overall acceptability
		Taste	Aroma		
0	7.2	6.9	6.7	7.6	7.1
1	7.4	7.9	7.9	7.9	7.7
3	8.1	8.1	8.3	8.2	8.3
5	8.4	8.3	8.4	8.0	8.4
LSD(p < 0.05)	0.3	0.3	0.3	0.3	0.3

The chemical analysis of ice cream containing different levels of unblanched and blanched frozen Kinnow peel is given in Table 3. The total solids (TS) content of ice cream with unblanched-frozen Kinnow peel ranged from 36.8 to 37.7% and for ice cream with blanched-frozen Kinnow peel from 36.7 to 37.4%, as the levels increased from 1 to 5%. Ascorbic acid and flavonoids (naringin) content of both types of ice cream increased with increasing level of addition of peel. Ascorbic acid content increased from 3.7 to 6.0 mg/100g for ice cream with unblanched-frozen Kinnow peel and from 2.9 to 5.1 mg/100g for ice cream with blanched-frozen Kinnow peel, as the level of addition increased from 1 to 5%. Similarly, as the level of addition of peel increased from 1 to 5%, the flavonoids (naringin) content also increased from 63.3 to 81.1 µg/g for ice cream with unblanched peel and 46.6 to 74.4 µg/g for ice cream with blanched-frozen Kinnow peel.

Table 3 : Chemical Analysis of Ice Cream Containing Different Levels of Unblanched and Blanched Frozen Kinnow Peel

Kinnow peel form	Level (%)	Total solids (%)	Ascorbic acid (mg/100g)	Flavonoids naringin (µg/g)
Unblanche	1	36.8	3.7	63.3

d-frozen	3	37.2	5.4	78.3
	5	37.7	6.0	81.1
	LSD (p<0.05)	0.05	0.40	0.40
Blanched -frozen	1	36.7	2.9	46.6
	3	36.9	4.5	68.1
	5	37.4	5.1	74.4
	LSD (p<0.05)	0.03	0.40	0.40

When the ice creams with the best levels of unblanched (3%) and blanched (5%) frozen Kinnow peel were compared among themselves on the basis of their sensory characteristics (Table 4), it was observed that the ice cream with 3% unblanched-frozen Kinnow peel had better mean sensory scores with an overall acceptability score of 8.1.

Table 4 : Comparative effect of addition of unblanched and blanched-frozen kinnow peel on the mean sensory score of ice cream

Kinnow peel form	Appearance	Flavour		Body & texture	Overall acceptability
		Taste	Aroma		
Unblanched (3%)	8.3	8.0	8.2	8.0	8.1
Blanched (5%)	7.9	8.1	8.0	7.8	7.8
LSD(p<0.05)	0.2	0.0	0.0	0.0	0.2

V. CONCLUSION

The addition of frozen Kinnow peel (unblanched and blanched) to ice cream improved the appearance and flavour of ice cream, giving it a good natural orange colour and flavour. Both forms of frozen Kinnow peel were added to ice cream at the levels of 1, 3 and 5%, each. The TS, ascorbic acid and flavonoids (naringin) contents of both the ice cream types increased with increased level of peel addition. Based on sensory evaluation, the best levels of frozen Kinnow peel in ice cream were: unblanched – 3% and blanched – 5%. When compared, ice cream with 3% unblanched-frozen Kinnow peel was found to have better sensory scores than ice cream with 5% blanched peel. So, ice cream can be prepared by the addition of frozen Kinnow peel with improved colour, flavour and enriched with phytochemicals.

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