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AK Solanki
Dairy Technology,
Department, College of Dairy
Science, Kamdhenu
University, Amreli, Gujarat,
India

Dr. Kunal Kumar Ahuja
Dairy Technology,
Department, College of Dairy
Science, Kamdhenu
University, Amreli, Gujarat,
India

Dr. Tanmay Hazra
Dairy Chemistry Department,
College of Dairy Science,
Kamdhenu University, Amreli,
Gujarat, India

Radhika Govani
Dairy Business Management
Department, College of Dairy
Science, Kamdhenu
University, Amreli, Gujarat,
India

Dr. PS Prajapati
(Retired), Dairy Technology
Department, MIDFT,
Kamdhenu University,
Mehsana, Gujarat, India

Corresponding Author:
AK Solanki
Dairy Technology,
Department, College of Dairy
Science, Kamdhenu
University, Amreli, Gujarat,
India

Consumers acceptance and cost analysis of spices-based ice cream: A proto type study

AK Solanki, Kunal Kumar Ahuja, Tanmay Hazra, Radhika Govani and PS Prajapati

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Abstract

A consumer study was carried out involving 124 participants consist of 96 male and 28 females, evaluated the acceptability of spices-based reduced-calorie ice cream. The experimental ice cream received an "excellent" rating from 86% of participants and "good" rating from 14% participants. This result demonstrating strong consumer preference, particularly for its spiced flavour. Cost aspects of the control and experiment ice cream was also evaluated and found that the cost of 1 liter of spices-based ice cream mix was Rs. 148.27 that was 7.52 Rs. higher than the control (vanilla flavoured) ice cream (Rs. 140.76).

Keywords: Bay leaves, cinnamon, consumer acceptance, cost, ice cream, spices

Introduction

Ice cream contains about min. 10% milk fat and 15% sucrose, which plays an important role in ice cream in terms of sensory and physical qualities (Akbari *et al.*, 2019) ^[1]. Consumption of such high calorie diet can lead to increase the occurrence of diseases like diabetes, obesity and cardiovascular disease conditions. However, fat plays an important role on the sensory attributes, body and texture as well as on appearance of the ice cream. Hence, low-fat ice cream formulation poses few complications in flavour and textural issues, which indirectly reduces the consumer acceptance (Zoulias *et al.*, 2002) ^[14].

To overcome these problems, some researchers have used hydrocolloid-based fat replacer in low-fat dairy products. Other than hydrocolloid-based fat replacers, polysaccharides, proteins and their combination successfully used to mimic the organoleptic and physical properties of fat molecules in ice cream (Zhao *et al.*, 2023) ^[13]. Also, many workers attempted to formulate reduced calorie ice cream for calorie conscious consumers using suitable bulking agents, fat replacers and reduced calorie sweeteners (Arora *et al.*, 2001; Limsuwan *et al.*, 2014) ^[2, 12]. Ice cream, also serve the purpose for a good carrier of functional components considering its ability to mask the off taste/ flavour of functional ingredient, if any, up to some extent. Furthermore, people now a days are shifting towards consumption of healthy food over conventional food products. To increase the functional properties of ice cream, some spices such as black pepper, cinnamon and ginger have been used by several researchers (Khawsud *et al.*, 2020; Chamchan *et al.*, 2017) ^[10, 5]. Cinnamon and bay leaves have a close relationship with Indian culinary culture as well as it has traditional "Ayurveda Shastra" proved the health benefits of these two spices. Moreover, few researchers proved cinnamon and bay leaves have couple of functional and nutraceutical benefits like antidiabetic, anticarcinogenic and anti-oxidants (Cheng, *et al.*, 2012; Singh *et al.*, 2007) ^[6, 8]. Considering all the facts present study was designed to evaluate the consumer acceptability and cost of spices-based ice cream using cinnamon and bay leaves powder.

Material and Methods

All ingredients (Fresh milk, skimmed milk powder (SMP), maltodextrin, polydextrose, maltitol, Whey Protein Concentrate (WPC), stabilizer and emulsifier blend, low-calorie sweetener and spices (cinnamon bark and bay leaves), paper cups and lids, wooden ice cream spoon available for ice cream production was purchased from the local market of Amreli or purchase from the authenticate suppliers.

Polydextrose, maltitol, WPC-80, stabilizer and emulsifier blend were procured from Ice cream ingredient supplier Gujarat Enterprise, Ahmedabad, Gujarat. Ice cream was prepared using the method described by Kumar *et al.* (2018) [11].

Cost analysis

Cost analysis was performed as per the method described by Gohil (2021) [7].

Consumer acceptance analysis

A total of 124 respondents from Amreli, representing various segments of society, participated in the survey. A questionnaire form as shown in table 1, was provided to collect feedback and comments on the product. The demographic profiles of the participants, particularly age and gender, were considered.

Statistical analysis

The consumer acceptance data was analyzed in percentage term to interpret and compare datasets by expressing values as proportions of a whole group and standardized to a base of 100%. The percentage was calculated by multiplying the number of respondents by 100 and dividing by the total sample size.

Results and discussion

The commercial feasibility of any new flavouring ingredient is largely determined by consumer response. Consumer Acceptance Trials (CAT) are critical in the introduction of newly developed product varieties to the market. In this context, a cinnamon and bay leaves added spiced ice cream prepared using 0.48% cinnamon and 0.39% bay leaves powder and processed to achieve approximately 90% overrun in a batch freezer, was assessed for market acceptance through a consumer survey conducted at Amreli, Gujarat. Responses of the consumers is given in Table 2.

A total of 124 respondents from Amreli, representing various segments of society, participated in the survey. A multilingual questionnaire, as shown in Table 1, was provided to collect feedback and comments on the product. The demographic profiles of the participants, particularly age and gender, were considered. Several respondents shared their viewpoints on the sensory attributes of the ice cream, describing it as unique, vibrant, appealing and exotic or possessing a novel taste.

The cinnamon flavour was particularly well-received, with many participants expressing appreciation for its taste. Respondents also indicated a keen interest in exploring new varieties of ice cream, with some demonstrating awareness of the health benefits associated with spices and raw materials used.

Out of total 124 consumers, 96 were male and 28 were female consumers. Total 107 consumers have given “excellent” rating to the prepared ice cream and 17 consumers have given “Good” rating. The spiced flavour was particularly well-received, with many participants expressing appreciation for its taste. Respondents also indicated a strong interest in exploring new varieties of frozen desserts, with some demonstrating awareness of the health benefits associated with the cinnamon and bay leaves. These factors suggest a promising potential for marketing the cinnamon and bay leaves added ice cream to a broader consumer base. From the survey it was observed that the prepared ice cream was innovative approach and consumers have appreciated the product and had a strong potential for commercialization.

Brnawi *et al.*, 2018 [4] conducted consumer survey for the prepared cinnamon bark and cinnamon leaf extract strawberry shake. He found that the consumer participants liked and wanted to purchase strawberry shakes with CEO from bark more than those with CEO from leaf.

The cost analysis of a product is mostly determined by the raw materials required in its production. An attempt is made to estimate the cost of the product. Prices are based on the raw material price incurred during present investigation (Table 3). Cost of 100 ml vanilla flavoured ice cream was found to be Rs. 14.07 and spices based reduced calorie ice cream was Rs. 14.82. From the calculated price it was observed that the control ice cream was Rs. 0.75 or 5.34 percent cheaper than the experiment ice cream. However, in case of the large-scale production of spices-based reduced calorie ice cream; the cost can be reduced by efficient minimization of overhead as well as utilities expenses.

Gohil (2021) [7] reported that the cost of spice-based frozen yoghurt was comparable to that of control frozen yoghurt, differing by only a 7.11% increase in the spice-based frozen yogurt. According to Baria (2021) [3], estimated selling price for the control frozen dessert was Rs. 58.21 per liter brick and Rs. 5.82 per 100 ml cup, while for CR frozen dessert, it was Rs. 59.51 per liter and Rs. 5.95 per 100 ml cup.

Table 1: Consumer acceptability form of spices based reduced calorie ice cream

Parameter	Options / Responses
Name of the Consumer	
Designation (Please tick (✓) appropriate option)	☐ Student ☐ Academician ☐ Service Businessman ☐ Home maker
Gender	☐ Male ☐ Female
Age (Years) (Please tick (✓) appropriate option)	☐ 15-20 ☐ 21-35 ☐ 36-50 ☐ >50
Income per month (Please tick (✓) appropriate option)	☐ < 10,000 ☐ 10,000-40,000 ☐ 41,000-80,000 ☐ > 80,000
Rate the ice cream	☐ Excellent ☐ Good ☐ Fair

Please rate the ice cream by placing tick mark (✓) against the choices given below:

If you were to purchase this ice cream variety from the market at a price same as prevailing in the market (same serving size), would you buy it?

Yes ☐ No ☐ Please tick (✓) against the appropriate box

Comments (If any): _____

Signature: _____

Date: _____

Table 2: Consumer acceptance response of spices based reduced calorie ice cream

Age group	Male consumers (N=96)		Female consumers (N=28)		Total respondents in specific age group (N=124)	
	Number	(%)	Number	(%)	Number	(%)
15-20 years	11	11.46%	2	7.14%	13	10.48%
21-35 years	41	42.71%	15	53.57%	56	45.16%
36-50 years	34	35.42%	8	28.57%	42	33.87%
> 50 years	10	10.42%	3	10.71%	13	10.48%
Total	96	100%	28	100%	124	100%
Rating of Spices based reduced calorie ice cream given by consumers						
Excellent			107		86.29%	
Good			17		13.71%	
Fair			0		0	
Opinion of the respondents to our query - ‘If you were to purchase this ice cream variety from the market at a price same as prevailing in the market (same serving size)?’						
Yes				124 consumers		
No				0 consumers		

Table 3: Manufacturing cost for spices based reduced calorie ice cream and control ice creams

Particulars	Quantity used	Rate	Total cost (₹) per 100 kg	
			Control ice cream	Spice-based reduced calorie ice cream
Raw materials cost	-	-	14973.1	16186
Steam (For Heating)	150 kg	₹5/kg	750.0	750.0
Electricity charge	125 units	₹12/unit	1200.0	1200.0
Packaging cost	1900	₹ 1.2 per 100 ml cup	2280.0	2280.0
Labour charges	10	₹350/ 8 hrs.	3500.0	3500.0
Total cost for 100 kg batch (₹)			22703.1	23916.0
Cost per litre of ice cream (85 percent overrun) (₹)			140.76	148.28
Cost per 100 ml of ice cream (₹)			14.07	14.82

Large-scale production may further reduce costs due to higher capacity and multi-product processing. Kumar (2018) ^[11] calculated the final cost of a 100 ml serving of lemongrass-pista ice cream (with 90% overrun) at Rs. 13.50, compared to Rs. 9.00 for vanilla ice cream. The higher cost of lemongrass-pista ice cream was attributed to the addition of pistachio nuts, comprising 8% of the mix by weight.

Conclusion

The cost per 100 ml of vanilla-flavored ice cream was Rs. 14.07 compared to Rs. 14.82 for the spice-based reduced-calorie variant. These calculations indicated that the control ice cream (vanilla-flavored) was Rs. 0.75 less expensive than the spice-based reduced-calorie ice cream. The consumer study showed strong preference for the spice-based reduced calorie ice cream, with 86% rating as "excellent" and 14% as "good". Despite being 5.55% more expensive than the control, the experimental ice cream demonstrated high acceptability, particularly for its spiced flavor, highlighting its potential for consumer satisfaction and market viability.

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