

Functional, Antioxidant and Sensory Qualities of Ice-Cream from Pomegranate Seed Powder

MOHD NAYEEM ALI^{1,*}, SANDEEP G.M. PRASAD¹ and MAHENDRA SINGH²

¹Department of Dairy Technology, Sam Higginbottom Institute of Agriculture Technology & Science (Deemed to be University), Allahabad-211 007, India

²Department of Dairy Cattle Physiology, National Dairy Research Institute, Karnal-312 001, India

*Corresponding author: E-mail: mohdnayeemdt@gmail.com

Received: 22 January 2016;

Accepted: 30 April 2016;

Published online: 1 June 2016;

AJC-17934

The study on specific objective is to examine the various parameters tests of physico-chemical properties, sensory attributes, rheological quality, antioxidant activity, microbial load and cost analysis. The test of parameters was done of prepared ice-cream after freezing process. The present study is based upon the determining and collection of physico-chemical properties, sensory attributes, rheological quality, antioxidant activity and microbial load data of various parameters. Statistical analysis where analyzed by random block design and data checked out at $p < 0.05$ level. This study concentrates on experimental treatment of ice-cream manufactured by this method, is subjected to organoleptic properties of ice-cream. As per sampling pomegranate seed powder used in 1, 2, 3 and 4 % levels added respectively and determined the total solid, fat, protein, carbohydrate, acidity, ash, overrun, melting time, antioxidant, rheological properties and cost increases as added levels was increase in herbal ice-cream. The result founded that best score in sensory characteristics of pomegranate seed powder included ice-cream were @ 2 % followed by 1, 3 and 4 % used of herbs respectively in selected ice-cream sample and compared to control treatment also. The present study was carried out to find the functional properties quantitative of pomegranate seed powder included ice-cream. These herbs where used in making and enhancement of medicinal value in ice-cream.

Keywords: Pomegranate seed powder, Ice-cream, Antioxidant activity, Rheological properties, Sensory qualities.

INTRODUCTION

Ice-cream is very popular dairy frozen dessert among consumers of all ages in India, including many countries, mainly because of its refreshing coolness and flavour. The ice-creams consumption in India has over the years grown steadily [1]. Similar trend was also observed in other group of the population. The development of an herbal ice-cream could provide a good dietary alternative for such consumers. Several herbs native to India possess antioxidant properties and have been traditionally used as food ingredients in Ayurveda. Products have systemic activity, anticarcinogenic, antiatherogenic, anti-inflammatory and antiviral effects, as well as decreasing the capillary permeability and fragility, inhibiting platelets aggregation and stimulating immune's function [2]. However, negligible scientific information is available on nutritional as well as antioxidant potential of such food product. The pomegranate seed powder is also shown to be potent veridical agent [3] and has been used as constituent of antiviral and antifungal preparations [4]. A cursory survey of the literature reveals that the tannins from the pericarp of pomegranate exhibit antiviral activity against the genital herpes virus [5]. Pomegranate is also used as a part of fungicidal preparations [6]. There are

reports of the use of a water decoction of pomegranate peel powder as a multifunctional vaginal suppository [7] for contraception and for the prevention and cure of venereal disease. Pomegranate peel is reported as a part of a preparation used for treating the infection of male or female sexual organs, mastitis, acne, folliculated, pile, allergic dermatitis, timpanist's and scald for curing diarrhea and dysentery [8] and as part of the medicine for the treatment of oral diseases [9]. The pomegranate peel extract, when introduced into juice, improves the process intensity due to acceleration of deposit precipitation of the haze-forming substance [10]. The presence of antioxidants has been reported from pomegranate juice [11]. Therefore, the current experiment was designed to effect of pomegranate seed powder on quality parameters of ice-cream as pomegranate seed powder including in ice-cream for natural flavour and antioxidative health benefits. The pomegranate powder effects on physico-chemical, sensory, rheological, antioxidant and microbiological characteristics of ice-cream were also studied.

EXPERIMENTAL

Fully matured and dried seeds powder was procured from Raj Herbal Shop, Deoband. Whole milk, skim milk powder, cream and others additives procured from local market, Allahabad.

Preparation of different pomegranate ice-cream samples:

Ice-cream samples were prepared as incorporated different levels of pomegranate powder *viz.* 1, 2, 3 and 4 % respectively. Preparation process of the ice-cream was specification and standard methods of FSSAI-2006. The best treatments/combinations of different ice-creams were selected on the basis of sensory evaluation and evaluated for their functional, nutritional and organoleptic qualities.

Physico-chemical analysis: Fresh ice-cream samples prepared by different levels of pomegranate powder were analyzed for physico-chemical properties as per standard methods. Samples of four levels powder were selected for physical and chemical parameters. While total solid, fat, protein, carbohydrate, acidity, ash, melting time and overrun were measured according to standard [12].

Sensory analysis: Sensory evaluation of the ice-cream was conducted by a department panel of four semi-trained judges using in 9-point hedonic scale for different parameters like colour appearance, body texture, flavour taste and overall acceptability [13].

Texture profile analysis: Texture profile analysis of ice-cream samples analyzed to texture profile analysis device according by food product texture profile analysis. Analyzed parameter by texture profile analysis as: consistency, cohesiveness, index of viscosity [14].

Antioxidant activity: Antioxidant activity in ice-cream samples were analyzed to standard methods *viz.* diphenyl-picrylhydrazyl (DPPH) and Ferric reducing antioxidant power (FRAP) test. The ferric reducing antioxidant power (FRAP) test was conducted according to the method described [15]. Antioxidant activity of herbal ice-cream was determined using stable radical, 1,1-diphenyl-2-picrylhydrazyl (DPPH), as described [16].

Microbiological analysis: The microbiological analysis were recorded using selected standard methods *viz.* standard plat count, yeast and mould count and coliform count tests. The ice-cream samples were analyzed for standard plate count (SPC) using media nutrient agar, coliform count using media McConkey agar and yeast and mould count using media potato dextrose agar [17].

Cost analysis: Cost of ice-cream per Kg analyzed to all calculated amount of ingredients using for ice-cream samples. Ice-cream ingredients calculation was made according by Standard [18].

Statistical analysis: All analytical parameters were recorded in triplicates and the means value of each parameter were described. The data were assessed by random block design [19].

RESULTS AND DISCUSSION

The results indicate that the pomegranate seed powder based ice-cream showed physico-chemical properties, sensory attributes, rheological quality, antioxidant activity and microbial load. The ice-cream manufactured by different concentrations of *Punica granatum* L. powder in 1, 2, 3 and 4 % respectively and 0 % level as an control treatment.

Physico-chemical properties of pomegranate ice-cream:

The averages value of total solid, fat, carbohydrate, protein, ash, overrun and melting time of freshly manufactured ice-cream are presented in Table-1. The effect of included pomegranate seed powder in ice-cream was found to exercise significant ($p < 0.05$) influence in the total solid, fat, carbohydrate, protein, ash, melting time and overrun both being slightly but significantly for all experimental samples. There was proportionate increase in the total solid, fat, carbohydrate, protein, ash melting time and overrun in experimental samples with increasing level of incorporations of pomegranate seed powder ($p < 0.05$). The maximum chemical composition and physical properties of ice-cream samples were founded 4 % level inclusion of pomegranate seed powder followed by 3 %, 2 %, 1 %, 0 % level inclusion of pomegranate seed powder respectively. Further, addition of pomegranate seed powder significantly increased the chemicals characteristic of experimental ice-cream. The compositional attributes of all samples are well above maximum and minimum values specified for ice-cream by 'food safety standard authority of India' (2011).

Sensory attributes, texture profile analysis and antioxidant activity of ice-cream: The ice-cream of best sample *i.e.* 2 % pomegranate seed powder included ice-cream was evaluated for various sensory quality, rheological properties and antioxidant activity and were also other levels of powder included ice-cream and the data given in Table-2. The maximum score of overall acceptability was found in 2 % powder included ice-cream while minimum score was recorded of 4 % powder included ice-cream. Statistical analysis of overall acceptability data was found no significantly ($p < 0.05$). Rheological properties 2 % pomegranate powder included ice-cream were found averages and minimum consistency value of 1 % and maximum value of 3 % powder added ice-cream ($p < 0.05$). The maximum antioxidant activity were founded 4 % level inclusion of pomegranate seed powder followed by 3 %, 2 %, 1 %, 0 % level inclusion of pomegranate seed powder respectively. Statistical analysis of antioxidant activity data was found no significantly ($p < 0.05$).

TABLE-1
AVERAGE VALUE OF CHEMICAL AND PHYSICAL ATTRIBUTE OF POMEGRANATE ICE-CREAM

Treatment	Pomegranate seed powder (%)	Chemical attributes (%)					Physical attribute		
		Total solids	Fat	Protein	Carbohydrate	Ash	Acidity	Overrun (%)	Melting time (mL/min)
T ₀	0	37.64	10.02	3.64	23.32	0.66	0.19	67.74	0.66
T ₁	1	38.54	10.27	3.78	23.82	0.67	0.22	68.79	0.65
T ₂	2	39.43	10.58	3.91	24.25	0.69	0.24	69.45	0.63
T ₃	3	40.23	10.88	4.05	24.60	0.70	0.25	70.13	0.63
T ₄	4	41.12	11.17	4.17	25.06	0.72	0.27	70.84	0.61

TABLE-2
AVERAGE VALUE OF SENSORY ATTRIBUTES, TEXTURE PROFILE ANALYSIS & ANTIOXIDANT ACTIVITY OF ICE-CREAM

Treatment	Pomegranate seed powder (%)	Sensory attributes (Score)				Rheological properties (\pm SD)			Antioxidant activity	
		Flavour and taste	Body and texture	Colour and appearance	Overall acceptability	Consistency	Cohesiveness	Index of viscosity	DPPH (%)	FRAP (μ M)
T ₀		7.24	7.56	7.36	7.32	2596.167	-125.71	-349.34	00.0	00.0
T ₁	1	7.68	7.76	7.56	7.54	3097.791	-190.23	-422.14	22.93	0.20
T ₂	2	7.64	7.92	7.72	7.65	3347.944	-203.27	-438.19	29.33	0.24
T ₃	3	7.24	7.80	7.76	7.56	4084.330	-238.42	-522.45	38.46	0.28
T ₄	4	6.72	7.56	7.92	7.44	3994.713	-233.36	-514.64	41.83	0.31

Standard plate count, yeast & mould count and coliform count in ice-cream at different days: The above result indicates that initially there was an increase of 4×10^3 to 6.4×10^3 CFU/g. Standard plate count in all the samples during the first day of storage. Thereafter gradual increase was observed in samples ranging from $(4$ to $76.20) \times 10^3$ CFU/g within 91 days of storage data value presented in Table-3. The minimum standard plate count in ice-cream prepared by 4, 3, 2 and 1 % level of pomegranate seed powder at 0 to 91 day was found @ 4 % followed by 3, 2, 1 and 0 % inclusion pomegranate seed powder in ice-cream. Statistical analysis of standard plate count of 4 % inclusion of pomegranate seed powder in ice-cream 0 to 91 day was found high significantly difference ($p < 0.05$). The standard of the standard plate count with progressive storage may be attributed to the use of dairy ingredients that might have contributed to the microbial load of the ice-cream not more than 250×10^3 CFU/mL [18,20,21].

Yeast and mould count analyzed at different level of pomegranate seed powder used in ice-cream gives high antifungal value which was confirmed by method used for the yeast and mould count. Result at 0 and 7 day was nil yeast and mould count in total treatment. The minimum yeast and mould count of ice-cream were found at 14 to 91 day was found 4 % level of pomegranate seed powder followed by 3, 2, 1, 0 % used of pomegranate seed powder in ice-cream. Statistical analysis factorial design of yeast and mould count of 4 % inclusion of pomegranate seed powder in ice-cream at 14 to 91 day was found high significant difference ($p < 0.05$). Reported that yeast and mould with progressive storage may be attributed to the use of dairy ingredients that might have contributed to the

microbial load of the ice-cream was yeast 1×10^3 CFU/mL and mould 1×10^2 CFU/mL [22] and also yeast and mould count in ice-cream of yeast 1.5×10^5 CFU/mL and mould 1.2×10^3 CFU/mL [23].

Coliform count of ice-cream was recorded at different 7 days interval (0 to 91 days). The coliform count is used as an index of sanitation during the handling and processing of milk products. Coliforms are killed by pasteurization, thus when present in milk product, they are regarded as post pasteurization contaminants resulting from poor sanitation. In the present investigation coliforms were found to be absent in all the samples (fresh & stored). This indicates that proper hygienic precautions had been taken during the production, packaging and storage of ice-cream.

Cost analysis: Cost of ice-cream was calculated by cost of ingredients using in ice-cream. Maximum cost was found 119.31 rupees per kg of 4 % pomegranate powder included ice-cream, 112.95 rupees per kg cost of 3 %, 106.72 rupees per kg 2 % and minimum cost 100.00 rupees per kg was 1 % pomegranate added ice-cream and control treatment as a plain ice-cream 93.28 per kg. The cost wise pomegranate ice-cream treatment combinations were also more economical as compared to the ice-cream available in present day market.

Conclusion

Among the different powder levels combination of ice-cream having 2 % level of pomegranate powder were found superior in terms of overall acceptability over the other levels combinations. It is concluded that for the overall improvement in sensory characteristics as well as improved body and texture,

TABLE-3
AVERAGE VALUE OF STANDARD PLATE COUNT AND YEAST & MOULD COUNT IN ICE-CREAM AT DIFFERENT DAYS

Treatment	Pomegranate seed powder (%)	Days													
		0	7	14	21	28	35	42	49	56	63	70	77	84	91
Mean of standard plate count $\times 10^3$ CFU/g															
T ₀	0	6.4	8.6	13.8	18.4	23.4	28.4	30.4	34.8	44.0	51.6	58.4	65.4	71.8	76.2
T ₁	1	6.0	7.4	12.4	15.8	23.0	25.6	29.8	33.8	43.2	50.8	56.8	64.8	70.4	75.0
T ₂	2	5.6	7.2	11.8	14.4	22.8	25.0	29.2	33.6	42.4	49.4	56.0	64.4	69.2	73.4
T ₃	3	5.2	6.8	11.6	12.8	22.6	24.8	28.6	32.8	42.4	48.6	53.6	64.4	68.0	72.2
T ₄	4	5.0	6.6	11.4	12.4	21.6	24.2	28.4	31.6	41.6	48.2	52.8	63.8	67.6	71.8
Mean of yeast & mould count $\times 10^3$ CFU/g															
T ₀	0	0.00	0.00	0.4	0.8	1.2	2.0	2.6	3.8	4.0	4.6	6.4	7.2	7.8	8.6
T ₁	1	0.00	0.00	0.2	0.8	1.0	1.4	2.4	3.6	3.6	4.2	4.8	5.2	5.8	8.2
T ₂	2	0.00	0.00	0.00	1.0	1.0	1.4	2.4	3.4	3.6	4.0	4.4	5.0	5.8	7.6
T ₃	3	0.00	0.00	0.00	0.8	0.8	1.2	2.2	3.2	3.4	3.8	4.4	4.6	5.2	7.6
T ₄	4	0.00	0.00	0.00	0.4	0.8	1.2	2.0	3.2	3.4	3.6	3.8	4.4	4.8	6.8

flavour and taste, colour and appearance, consistency in ice-cream having 2 % level of pomegranate powder could easily be incorporated to produce good quality herbal ice-cream. The qualities were found best in physico-chemical properties, sensory attributes, rheological quality, antioxidant activity and microbial load parameters. It is thus anticipated that pomegranate ice-cream will in future provide additional benefits to consumers with respect to convenience, price and health.

REFERENCES

1. N. Makarem, M. Scott, P. Quatromoni, P. Jacques and N. Parekh, *Br. J. Nutr.*, **111**, 2010 (2014).
2. M. Vadiveloo, M. Scott, P. Quatromoni, P. Jacques and N. Parekh, *Br. J. Nutr.*, **111**, 724 (2014).
3. G.S. Stewart, S.A. Jassim, S.P. Denyer, P. Newby, K. Linley and V.K. Dhir, *J. Appl. Microbiol.*, **84**, 777 (1998).
4. S.A.A. Jassim, S.P. Denyer and G.S.A.B. Stewart, Antiviral or Antifungal Composition Comprising an Extract of Pomegranate Rind or Other Plants and Method of Use, US Patent 5840308 (1998).
5. J. Zhang, B. Zhan, X. Yao and J. Song, *Zhongguo Zhongyao Zazhi*, **20**, 556 (1995).
6. C. Jia and C.A. Zia, Fungicide Made from Chinese Medicinal Herb Extract, Chinese Patent 1181187 (1998).
7. B. Zhan, Multi-Function Vagina Suppository, Chinese Patent 1103789 (1995).
8. W. Hu, Skin Health Inflammatory Inucta and Producing Process Thereof, Chinese Patent 1156617A (1997).
9. H. Fengchun, X. Liu and H. Chen, Medicine for Treatment of Infectious Oral Diseases, Chinese Patent 1145793A (1997).
10. O.I. Kvasenkov, V.A. Lomachinski, K. Goren and S. Eh, Method of Producing Beverages on Juice Base, Russian Patent 2129396C1 (1999).
11. M.I. Gil, F.A. Tomás-Barberán, B. Hess-Pierce, D.M. Holcroft and A.A. Kader, *J. Agric. Food Chem.*, **48**, 4581 (2000).
12. FSSAI, Food Safety and Standard Authority of India, vol. 3, p. 297 (2012).
13. J.A. Nelson and J.M. Trout, Judging of Dairy Product, p. 255 (1964).
14. AOAC, Methods of Analysis, Washington D.C., edn 14 (1985).
15. I.F. Benzie and J.J. Strain, *Anal. Biochem.*, **239**, 70 (1996).
16. W. Brand-Williams, M.E. Cuvelier and C. Berset, *Lebens. Wissensch. Technol.*, **28**, 25 (1995).
17. APHA, Compendium of Methods for the Microbiological Examination of Foods, American Public Health Association, Washington, DC, edn 3 (1992).
18. D. Sukumar, Indian Dairy Products, Outlines of Dairy Technology, Oxford University Publication, end 20, pp. 389-393 (1980).
19. R.L. Imran and W.B. Coover, A Modern Approach to Statistics, John Wiley & Sons Inc, New York, p. 497 (1983).
20. Y.H. Kenneth, Revised Guidelines for the Assessment of Microbiological Quality of Processed Foods, Department of Health Food and Drugs Administration, Rep of the Philippines, pp. 2-11 (2013).
21. Indian Standards, Methods for the Examination of Ice-cream, Bureau of Indina Standard Institute, New Delhi, p. 2802 (1964).
22. H. Yaman, M. Elmali, Z. Ulukanli, M. Tuzcu and K. Genctav, *J. Rev. Med. Vet.*, **157**, 457 (2006).
23. G.E. Caglayanlar, B. Kunduhoglu and N. Coksoyler, *J. Arts Sci.*, **12**, 93 (2009).