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RESEARCH PAPER

Effect of *Dactylorhiza hatagirea* (Salep orchid) on quality and standard of Ice-Cream

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Abstract : The study examined the various quality parameters test of prepared ice-cream and cost analysis. Five Ice-Cream samples were found rich in nutritive value, antioxidant, antimicrobial, antifungal, sensory quality and economically cost. The determined and collected data of various parameters were analyzed by Random Block Design and data checked out at $p<0.05$ level. This study concentrates on Experimental treatment of Ice-Cream manufactured methods which was subjected to organolaptic properties. As per sampling, *Dactylorhiza hatagirea* powder was added at the rate of 0%, 1%, 2%, 3% and 4% levels, respectively and determined the physical, chemical, antioxidant, rheological properties and cost increases as added levels was increase in herbal Ice-Cream. The result revealed that best score in sensory characteristics of *Dactylorhiza hatagirea* powder included Ice-Cream were @ 3% followed by 1%, 2% and 4% used of herbs, respectively in selected Ice-Cream and also control Ice-Cream sample. The study was carried out to find the functional properties quantitative of *Dactylorhiza hatagirea* powder incorporated Ice-Cream. These herbs were used in making improvement and enhancement of medicinal value in Ice-Cream.

Key Words : *Dactylorhiza hatagirea,* Salep orchid, Functional, Sensory, Texture profile, DPPH, FRAP

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INTRODUCTION

Milk is known as the most necessary food for life in infant. Milk and dairy products have formed an integral element of human diet since the earliest domestication animals. Milk has a high nutrient density and thus contributes significantly to the daily intake of several nutrients. It contains many constituents including proteins, fats, carbohydrates, vitamins and minerals (Cakmak *et al.,* 2012). Ice-Cream is a dairy product, is a complex food colloid that consists of air bubbles, fat globules, ice crystals and an unfrozen serum phase. It is a frozen dessert that is delicious, nutritious and relatively cheap. It is made from dairy products such as cream combined with flavours and sweeteners such as sugar (Mohan *et al.,* 2014). Herbal Ice-Cream is having number of medicinal properties *viz* anti-septic, anti-microbial, anti-viral, antidiabetic, antioxidants and etc (Ali *et al.,* 2014). Bioactive compounds are naturally occurring in the medicinal plants, leaves, vegetables and roots (Ponnusamy *et al*, 2009). The medicinal value of plants lies in some chemical substances that produce a definite physiological action as the human body (Zhang, 2009).

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In traditional medicine *Dactylorhiza hatagirea* has been prescribed for dressing and treating of glottal inflammations, antibiotic; prevent the cancer also and especially used for sexual strength (Faraji *et al.,* 2013). *Dactylorhiza hatagirea* is a food ingre-dient used for different purposes in food formu-lations and obtained by milling of dried tubers of wild orchids. It is in powder form, white colored and generally used for the traditional production of salep drink and Kahramanmaraº type Ice-Cream in Turkey (Syed and Shah, 2016). *Dactylorhiza hatagirea* contains glucomannan and starch as well as some minerals and water (Goff *et al.,* 2008). *Dactylorhiza hatagirea* is mostly used in food formulations as a stabilizing agent in food technology due to its strong thicken-ing ability when incorporated into the solutions. It is also preferred for its characteristic flavor which plays an important role in the sensory properties of the final product. *Dactylorhiza hatagirea* drink (Salep drink) is a traditional bev-erage prepared by boiling milk with salep powder and sugar in world. It is a hot drink and generally consumed in winters. The *Dactylorhiza hatagirea* powder is preferred by consumers from all ages. Therefore, the current experiment was designed to affect of *Dactylorhiza hatagirea* powder on quality aspects of Ice-Cream as *Dactylorhiza hatagirea* powder including in Ice-Cream for natural flavour and antioxidative health benefits. The *Dactylorhiza hatagirea* powder effects on physico-chemical, sensory, rheological, antioxidant, microbiological characteristics and cost of Ice-Cream were also studied.

MATERIAL AND METHODS

Raw materials :

Fully matured and dried *Dactylorhiza hatagirea* powder was procured from local market at Deoband in Saharanpur district of Uttar Pradesh. Whole milk, Skim milk powder, cream and others additives was purchased from local market, Allahabad.

Preparation of different *Dactylorhiza Hatagirea* (Salep Orchid) used Ice-Cream samples

Ice-Cream samples were prepared as incorporated different levels of *Dactylorhiza hatagirea* powder *viz*., 0%, 1%, 2%, 3% and 4% respectively and 0% control treatment was prepared without *Dactylorhiza hatagirea* powder. Preparation process of the Ice-Cream was specified 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 nutritional, functional and antioxidant qualities.

Physico-chemical analysis :

Fresh Ice-Cream samples prepared by different levels of *Dactylorhiza hatagirea* powder were analyzed for physic-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 FSSAI (2012).

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 (Wood, 2011).

Texture profile analysis :

TPA of Ice-Cream samples analyzed to TPA device according by food product texture profile analysis. Analyzed parameter by texture profile analysis as: consistency, cohesiveness, index of viscosity as per the procedure prescribed by Pon *et al.* (2015).

Antioxidant activity :

Antioxidant activities in Ice-Cream samples were analyzed to standard methods *viz., Diphenylpicryl hydrazyl* (DPPH) and Ferric reducing antioxidant power (FRAP) test. The Ferric reducing antioxidant power (FRAP) test was conducted according to the method described by Kuhnen *et al.* (2014). Antioxidant activity of herbal Ice-Cream was determined using stable radical, 1, 1-diphenyl-2-picrylhydrazyl (DPPH), as described by Ashwani and Dinesh (2016).

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 Mc Conkey agar and yeast and mould count using media potato dextrose agar, described by Naim *et al.* (2014).

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 calculated according by formula from book of Jana (2016).

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 (Smith, 2015).

RESULTS AND DISCUSSION

The results indicate that the *Dactylorhiza hatagirea* powder based Ice-Cream showed physic-chemical properties, sensory attributes, rheological quality, antioxidant activity and microbial load. The Ice-Cream manufactured by different concentrations of *Dactylorhiza hatagirea* powder in 1%, 2%, 3% and 4%, respectively and control treatment was prepare without *Dactylorhiza hatagirea* powder.

Effect of different levels of *Dactylorhiza hatagirea* powder on the physico-chemical properties of Ice-Cream :

The averages value of total solid, fat, carbohydrate, protein, ash, acidity, overrun and melting time of freshly manufactured Ice-Cream are presented in Table 1. The effect of included *Dactylorhiza hatagirea* powder in Ice-Cream was found to exercise significant ($p < 0.05$) influence in the total solid, carbohydrate, protein, acidity both being slightly but significantly for all experimental samples. The experimental analysis of fat, ash, melting time and overrun both average values was analyzed non-significant ($p < 0.05$). 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 *Dactylorhiza hatagirea* powder. The maximum chemical composition and physical properties of Ice-Cream samples were founded 4% level inclusion of *Dactylorhiza hatagirea* powder followed by 3%, 2%, 1%, 0% level inclusion of *Dactylorhiza hatagirea* powder, respectively. Further, addition of *Dactylorhiza hatagirea* 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).

Effect of different levels of *Dactylorhiza hatagirea* powder on the sensory attributes, texture profile analysis and antioxidant activity of Ice-Cream :

The Ice-Cream of best sample *i.e.* 3% *Dactylorhiza hatagirea* powder included Ice-Cream was evaluated for various sensory qualities, rheological properties and antioxidant activity and were also other levels of powder included Ice-Cream and the data sowed in Table 2. Parameters of sensory quality assessment were flavour and taste, body and texture, colour and appearance, overall acceptability. The maximum score of overall acceptability was found in 3% powder included Ice-Cream while minimum score was recorded of 0% powder included Ice-Cream. Statistical analysis of colour and appearance, overall acceptability both data was found significantly ($p < 0.05$) and flavour and taste, body and texture data were found no significant ($p < 0.05$). Rheological properties 3% *Dactylorhiza hatagirea* powder included Ice-Cream were found averages and minimum consistency value of 1% and maximum value of 3% powder added Ice-Cream ($p < 0.05$).

Antioxidant analyses were analyzed by DPPH and FRAP both methods. The maximum antioxidant activity were founded 4% level inclusion of *Dactylorhiza*

Table 1: The average value of chemical and physical attribute of *Dactylorhiza hatagirea* based ice-cream

Treatments	*Dactylorhiza hatagirea* powder percentage (%)	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_3S_1	1%	38.54	10.05	3.71	24.09	0.69	0.19	69.00	0.65
T_3S_2	2%	39.40	10.05	3.79	24.84	0.72	0.20	70.44	0.63
T_3S_3	3%	40.42	10.09	3.86	25.73	0.74	0.21	70.79	0.62
T_3S_4	4%	41.30	10.13	3.93	26.47	0.77	0.22	71.31	0.60

Note: T_0 Control sample, T_3S_1 1% Dactylorhiza hatagirea powder, T_3S_2 2% Dactylorhiza hatagirea powder, T_3S_3 3% Dactylorhiza hatagirea powder, T_3S_4 4% Dactylorhiza hatagirea powder incorporated ice-cream

hatagirea powder followed by 3%, 2%, 1% level inclusion of *Dactylorhiza hatagirea* powder respectively data showed in Table 2 and Fig. 1 DPPH and 2 FRAP average value. Statistical analysis of antioxidant activity data was found significantly (p <0.05).

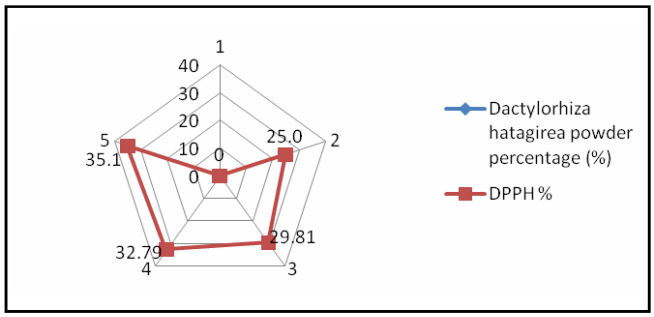

Fig. 1: Diphenylpicrylhydrazyl (DPPH) average in *Dactylorhiza hatagirea* based ice-cream

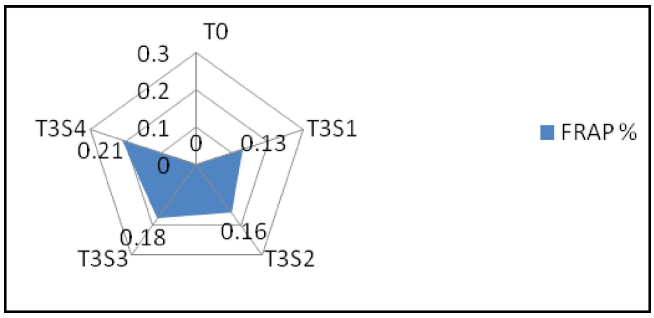

Fig. 2: Ferric reducing antioxidant power (FRAP) average in *Dactylorhiza hatagirea* based ice-cream

Effect of different levels of *Dactylorhiza hatagirea* powder on the Microbial quality of Ice-Cream :

The above result indicates that initially there was

Table 2 : The average value of sensory attributes, texture profile analysis and antioxidant activity of ice-cream

Treatments	*Dactylorhiza hatagirea* powder percentage (%)	Sensory attributes (Score)				Rheological properties (+/- S.D.)			Antioxidant activity	
		Flavour and taste	Body and texture	Colour and appearance	Overall acceptability	consistency	cohesiveness	Index of viscosity	DPPH activity (%)	FRAP Activity (µM)
T_0	0%	7.24	7.56	7.36	7.32	2596.167	-125.71	-349.34	Blank sample	Blank sample
T_3S_1	1%	7.56	7.72	7.56	7.59	2282.973	-190.67	-284.81	25.00±0.03	0.13±0.01
T_3S_2	2%	7.68	7.92	7.76	7.77	3118.900	-214.52	-264.29	29.81±0.01	0.16±0.01
T_3S_3	3%	7.72	8.00	7.96	7.88	2931.199	-185.82	-286.10	32.79±0.02	0.18±0.02
T_3S_4	4%	7.64	7.84	7.96	7.85	2741.013	-175.32	-432.92	35.10±0.03	0.21±0.02

Note: T_0 Control sample, T_3S_1 1% Dactylorhiza hatagirea powder, T_3S_2 2% Dactylorhiza hatagirea powder, T_3S_3 3% Dactylorhiza hatagirea powder, T_3S_4 4% Dactylorhiza hatagirea powder incorporated Ice-Cream.

Table 3: The average value of standard plate count and yeast & mould count in ice-cream at different days

Treatments	*Dactylorhiza hatagirea* powder percentage (%)	MEAN of SPC X 10^3 C.F.U/g												
		0th DAY	*7th DAY*	*14th DAY*	*21th DAY*	*28th DAY*	*35th DAY*	*42th DAY*	*49th DAY*	*56th DAY*	*63th DAY*	*70th DAY*	*77th DAY*	*84th DAY*	*91th DAY*
T_0	0%	6.4	8.60	13.8	18.40	23.4	28.40	30.4	34.8	44.0	51.60	58.4	65.40	71.80	76.20
T_3S_1	1%	5.6	7.20	12.2	14.20	22.8	25.60	30.2	34.2	43.2	50.20	56.0	64.80	70.60	74.80
T_3S_2	2%	5.2	6.80	12.0	14.20	21.6	25.00	29.6	33.0	42.4	49.80	53.6	62.80	69.40	74.20
T_3S_3	3%	4.8	6.40	11.6	13.40	21.0	25.20	29.0	31.4	41.6	48.40	52.8	61.60	67.80	71.80
T_3S_4	4%	5.0	6.00	11.6	12.80	20.4	25.20	28.6	30.8	41.6	47.60	52.0	60.80	66.80	71.20
Yeast and Mould count X 10^1 C.F.U/g															
T_0	0%	0.00	0.00	0.40	0.80	1.20	2.00	2.60	3.80	4.00	4.60	6.40	7.20	7.80	8.60
T_3S_1	1%	0.00	0.00	0.20	0.20	1.00	1.40	2.40	3.40	3.60	4.40	5.40	4.80	5.40	8.40
T_3S_2	2%	0.00	0.00	0.00	0.60	1.00	1.20	2.00	3.00	3.20	4.00	4.40	4.60	5.20	7.60
T_3S_3	3%	0.00	0.00	0.00	0.40	0.80	1.20	2.20	2.60	2.80	3.80	4.20	4.40	5.00	6.80
T_3S_4	4%	0.00	0.00	0.00	0.20	0.60	1.00	1.60	2.60	2.80	3.40	3.60	3.60	4.80	6.60

Note: T_0 Control sample, T_3S_1 1% Dactylorhiza hatagirea powder, T_3S_2 2% Dactylorhiza hatagirea powder, T_3S_3 3% Dactylorhiza hatagirea powder, T_3S_4 4% Dactylorhiza hatagirea powder incorporated ice-cream

an increase of 4 ×10^3 to 6.4 ×10^3 C.F.U/g. SPC in all the samples during the first day of storage. Thereafter gradual increase was observed in samples ranging from (4.8 to 76.20) × 10^3 C.F.U/gm. within 91 days of storage data value sowed in Table 3. The minimum SPC in Ice-Cream prepared by 4%, 3%, 2%, 1% and 0% level of *Dactylorhiza hatagirea* powder at 0 to 91 days were found @ 4 % followed by 3%, 2%, 1% and 0% inclusion *Dactylorhiza hatagirea* powder in Ice-Cream. Statistical analysis of SPC of 4% inclusion of *Dactylorhiza hatagirea* powder in Ice-Cream 0 to 91 day was found high significantly difference ($p < 0.05$). The standard of the SPC 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 (Kenneth, 2013; FSSAI, 2015; Jana, 2016).

Yeast and Mould Count analyzed at different level of *Dactylorhiza hatagirea* 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 *Dactylorhiza hatagirea* powder followed by 3%, 2% and 1% used of *Dactylorhiza hatagirea* powder in Ice-Cream. Statistical analysis factorial design of Yeast and mould Count of 4 % inclusion of *Dactylorhiza hatagirea* 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 mould1× 10^2 cfu/ml (Hosen and Kober 2009) 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 (Caglayanlar *et al.,* 2009).

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 and stored). This indicates that proper hygienic precautions had been taken during the production, packaging and storage of Ice-Cream.

Cost of *Dactylorhiza hatagirea* used Ice-Cream :

Cost of Ice-Cream was calculated by cost of ingredients using in Ice-Cream. Maximum cost was found 335.31 rupees per kg of 4% *Dactylorhiza hatagirea* powder included Ice-Cream, 274.95 rupees per kg cost of 3%, 214.72 rupees per kg 2% and minimum cost 153.99 rupees per kg was 1% *Dactylorhiza hatagirea* added Ice-Cream and plain Ice-Cream 94.14 rupees per kg. The cost wise *Dactylorhiza hatagirea* Ice-Cream treatment combinations were also more economical as compared to the Ice-Cream available in present day market.

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