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Studies on rheological properties of herbal ice cream prepared by selected medicinal herbs

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Abstract
Herbal ice cream prepared by incorporating medicinal herbs showed textural properties. *Asparagus racemosus* W, *Asparagus adscendens* R, *Punica granatum* L and *Dactylorhiza hatagirea* are popular medicinal plant has containing improvement textural quality of dairy frozen product. The present study was carried out to find the cohesiveness, consistency and index viscosity measured by texture profile analysis devoice of herbal powder inclusion in the ice cream. The result found that best cohesiveness, consistency and index viscosity of herbal ice cream were inclusion 1%, 2%, 3% and 4% herbs used respectively in selected ice cream compared to 0% used of herb in ice cream. Ice cream was prepared by this method was subjected to sensory properties of herbal ice cream.

Keywords: Texture, Herbal Ice Cream, cohesiveness, consistency and index viscosity

1. Introduction
Ice cream is a frozen dairy product made by suitable blending and processing of cream and other milk products, together with sugar and flavour, with or without stabilizer or colour and with the incorporation of air during the freezing process (Sukumar,1980). One of the most used instrumental methods for solid food is the Texture Profile Analysis (TPA). In this method, a sample of food is compressed and decompressed two times, imitating the first two chews on a food. The results obtained with this probe give different texture notes that have good correlation with the obtained by sensory methods (Bourne, 2004). The instrumental TPA was developed 40 years ago and it is a very popular and used method not only in research but also in the industry as quality control of the food texture (Pons and Fiszman, 1996). 'Traditional' use of herbal medicines implies substantial historical use, and this is certainly true for many products that are available as 'traditional herbal medicines'. In many developing countries, a large proportion of the population relies on traditional practitioners and their armamentarium of medicinal plants in order to meet healthcare needs (Shaw, 1998). The present investigation is an alternate to manufacture acceptable quality of Herbal ice cream using different levels of herbs with the following objectives: To analyze the rheological properties of Herbal ice cream.

Material and Methods
Whole milk was collected (Brand- amul milk) from Mahewa, Allahabad. Skimmed milk powder brand name 'Anik Spray' was obtained from the local market of Allahabad. Cream brand name amul was Obtain from local market of Allahabad. Sugar was collected from the local market of Allahabad. Herbs *Asparagus racemosus* W (Asparagus), *Asparagus adscendens* R (Green asparagus), *Punica granatum* L (Pomegranate) and *Dactylorhiza hatagirea* (Salep orchid) were Obtain from Deoband, Saharanpur. Stabilizer and Emulsifier were obtained from scientific corporation, Allahabad.

Preparation of ice cream sample:
For experimental treatment: Calculated amount of Herbs (asparagus, salep orchid, green asparagus and pomegranate) was added into calculated amount of milk, sugar, and cream as per calculation for T_0 (without herbs), T_1P_1 (1% level of pomegranate seed powder), T_1P_2 (2% level of pomegranate seed powder), T_1P_3 (3% level of pomegranate seed powder), T_1P_4 (4% level of pomegranate seed powder), T_2A_1 (1% level of asparagus powder), T_2A_2 (2% level of asparagus powder), T_2A_3 (3% level of asparagus powder), T_2A_4 (4% level of asparagus

powder), T_3S_1 (1% level of salep orchid powder), T_3S_2 (2% level of salep orchid powder), T_3S_3 (3% level of salep orchid powder), T_3S_4 (4% level of salep orchid powder), T_4G_1 (1% level of green asparagus powder), T_4G_2 (2% level of green asparagus powder), T_4G_3 (3% level of green asparagus powder), T_4G_4 (4% level of green asparagus powder), and heated at 50 ^{0}C.

Mixing of solid ingredients: Calculated amounts of dry ingredients like skim milk powder, sugar, stabilizer and emulsifier was mixed and added to liquid ingredient and thoroughly stirred with the help of wooden ladle.

Homogenization: The ice cream mix for control and treatment was homogenized at 150kg/cm^2 in first stage and 50kg/cm^2 in 2nd stage at 60-62 ^{0}C using two stage homogenization.

Pasteurization: The control and experimental ice cream mixes was pasteurized at 68.3 ^{0}C for 30 minutes by batch method. Pasteurization done after homogenization to avoid any contamination that was caused by the homogenizer and to avoid lipolysis of fat during ageing period.

Cooling and Ageing – the mix was immediately Cooled to 5 ^{0}C and held at that temperature for 4-6 hrs.

Freezing of ice-cream mixes- The mixes were frozen in a mechanically operated batch freezer without air injection system. Whipping and incorporation of air were done naturally till the desired over run is achieved (70%).The ice cream will be packaged in a suitable container and hardened in a deep freezer at -18 ^{0}C. Preparation of ice cream method by **Sukumar (1980)**

Texture Profile Analysis:

TPA of herbal ice cream analyzed to texture analyzer according by food product texture profile analysis. Analyzed parameter by texture profile analysis as: consistency, cohesiveness, index of viscosity.

Statistical Analysis:

The data was analyzed statistically by analysis of variance at (RBD) 5% level of significance. The data obtained were statistically analyzed for its validity by using factorial design and critical difference (C.D.) technique (Imran and Coover, 1983).

Number of treatments	-	17
Number of replications	-	5
Total number of samples	-	85

Results and Discussions

The results shown above indicate that the herbal powder based ice cream has good texture profile, which was confirmed by method used for the TPA device. The herbal ice cream prepared by different concentration of pomegranate powder, Asparagus powder, Salep orchid powder and green Asparagus powder in 1%, 2%, 3% and 4% respectively. Control ice cream was prepared by without herbs.

Table A: Table for texture profile analysis of herbal ice cream (+/- S.D.)

S.N.	Treatment Combination	HERBS	RHEOLOGICAL PRIPERTIES (+/- S.D.)		
			Consistency	Cohesiveness	Index of viscosity
1	T_0	Control	2596.167	-125.71	-349.34
2	T_1P_1	Pomegranate	3097.791	-190.23	-422.14
3	T_1P_2		3347.944	-203.27	-438.19
4	T_1P_3		4084.330	-238.42	-522.45
5	T_1P_4		3994.713	-233.36	-514.64
6	T_2A_1	Asparagus	2844.875	-180.96	-398.93
7	T_2A_2		1756.774	-92.41	-195.14
8	T_2A_3		1945.236	-110.04	-244.43
9	T_2A_4		1934.593	-108.66	-238.96
10	T_3S_1	Salep Orchid	2282.973	-190.67	-284.81
11	T_3S_2		3118.900	-214.52	-264.29
12	T_3S_3		2931.199	-185.82	-286.10
13	T_3S_4		2741.013	-175.32	-432.92
14	T_4G_1	Green Asparagus	2665.915	-164.18	-405.82
15	T_4G_2		2519.470	-138.66	-453.31
16	T_4G_3		2458.685	-146.47	-425.02
17	T_4G_4		3118.183	-196.78	-405.76

Consistency: consistency of herbal ice cream prepared by selected medicinal herbs sowed result (table A) was found higher than T_1P_3, T_2A_1, T_3S_2 and T_4G_4 followed by T_0, T_1P_4, T_1P_2, T_1P_1, T_2A_2, T_2A_3, T_2A_4, T_3S_1, T_3S_3, T_3S_4, T_4G_1, T_4G_2 and T_4G_3. Statistically analysis was found significant.

Table B: Anova for Consistency of Ice Cream

Source Of Variance	D.F.	F (Cal)	F. Tab (5%)	Result
Due To Type Of Herbs	3	297.67*	2.76	S
Due To Percentage Of Herbs	4	18.61*	2.53	S
Due To Interaction (Herbs X Percentage)	12	56.55*	1.92	S

***Significant at 5% level (p<0.05); N.S. Non-significant**

Cohesiveness: Cohesiveness of herbal ice cream prepared by selected medicinal herbs sowed result in table (A) was smaller than T_1P_3, T_2A_1, T_3S_2 and T_4G_4 followed by T_0, T_1P_4, T_1P_2, T_1P_1, T_2A_2, T_2A_3, T_2A_4, T_3S_1, T_3S_3, T_3S_4, T_4G_1, T_4G_2 and T_4G_3. Statistically analysis was found significant.

Table C: Anova for Cohesiveness of Ice Cream

Source Of Variance	D.F.	F (Cal)	F. Tab (5%)	Result
Due To Type Of Herbal	3	970.86*	2.76	S
Due To Percentage Of Herbs	4	379.85*	2.53	S
Due To Interaction (Herbs X Percentage)	12	189.08*	1.92	S

***Significant at 5% level (p<0.05); N.S. Non-significant**

Index of viscosity: Index of viscosity of herbal ice cream prepared by selected medicinal herbs sowed result in table (A) was smaller than T_1P_3, T_2A_1, T_3S_3 and T_4G_2 followed by T_0, T_1P_4, T_1P_2, T_1P_1, T_2A_2, T_2A_3, T_2A_4, T_3S_1, T_3S_2, T_3S_4, T_4G_1, T_4G_4 and T_4G_3. Statistically analysis was found significant.

Table D: Anova for Index of Viscosity of Ice Cream

Source Of Variance	D.F.	F (Cal)	F. Tab (5%)	Result
Due To Type Of Herbs	3	211.54*	2.76	S
Due To Percentage Of Herbs	4	16.85*	2.53	S
Due To Interaction (Herbs X Percentage)	12	40.57*	1.92	S

***Significant at 5% level (p<0.05); N.S. Non-significant**

The factorial analysis of consistency (table B), cohesiveness (table C) and index of viscosity (table D) indicates that the calculated values of F due to type of herbs, due to percentage of herbs and due to interaction between type of herbs and percentage are higher than their respective F value at 5% probability levels. Therefore it can be concluded from the experimental data that there is significant difference between the type of herbs and percentage of herbs also due to interaction between type of herbs and percentage of herbs.

The texture of the cheese is produced by a complex interaction of different factors like milk product composition, manufacturing and processing conditions (Lucey, *et al*., 2003). Nevertheless, to know if miniature milk product were similar to their corresponding commercial

versions, it was performed a multivariate analysis, considering all the responses of the TPA and the compositional analysis. The main differences observed in the product of brand four were the high adhesiveness, and the low values of consistency and cohesiveness. These results suggest that Chihuahua cheese of brand four perhaps were added with an additional ingredient like gum. In vectors represent a graphical display of the loading for the variables used in the PCA. The variables of cohesiveness, hardness and chewiness had similar loads than the variables of protein and fat content, indicating that changes in fat and protein content will affect these texture variables (Nestor and Nalleli 2013). The addition of 2.5% inulin to a low-fat ice cream mixture increased the ice cream's viscosity, adhesiveness, cohesiveness, elasticity, gumminess, chewiness, and fat instability. The hardness of the resulting low-fat ice cream increased when the amount of inulin was increased (Ismail and Metwalli 2013). The difference in the consistency noted in different treatment combinations ranged 543.352 to 715.626 and in the cohesiveness noted in different treatment combinations ranged -38.358 to -56.618 was probably attributed to the addition of date syrup (Siddhu and singh 2011). The difference in the consistency cohesiveness and index of viscosity noted in different treatment combinations was probably attributed due to the addition of different percentage of herbs in the product. Statistically, the effect due to higher percentage ratio between percentage of herbs and the effect due to the variation of type of herbs on treatments affect the consistency of herbal ice cream and effect due to interaction between herbal and percentage is negligible.

Conclusion

The texture profile analysis of herbal ice cream prepared by different level of selected medicinal herbs can be determined accurately, conveniently, and rapidly using consistency, cohesiveness and index of viscosity analyzed. The results of the present study revealed that the inclusion of herbs powder 4%, 3%, 2% and 1% respectively in selected ice cream. The result was found best inclusion of herbs in ice cream compared to without herb ice cream. Ice cream was prepared by this method was subjected to sensory properties of herbal ice cream.

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