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Studies on physical, rheological and sensorial properties of ashwagandha (*Withania somnifera*) root powder based Ice-Cream

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Abstract
The present investigation was aimed to evaluate sensorial and physical characteristics of ice-cream. The ice-cream were made by incorporating ashwagandha root powder at varying concentration viz., 1%, 2%, 3% and 4%. Ice cream was evaluated for its physical properties like Overrun, Total solids, Meltdown point, specific gravity and viscosity. Further prepared ice-cream was evaluated for its sensory properties by using 9 point hedonic scale. Results revealed that overrun and meltdown point of ice-cream decreased due to increase in viscosity, specific gravity and total solids of resultant ice-cream. From the sensorial examination it was found that treatment T_1 and T_2 were most acceptable as compared to rest of other. Overall acceptability was not significant for T_3 and T_4.

Keywords: Ice-cream, sensory evaluation, physical properties

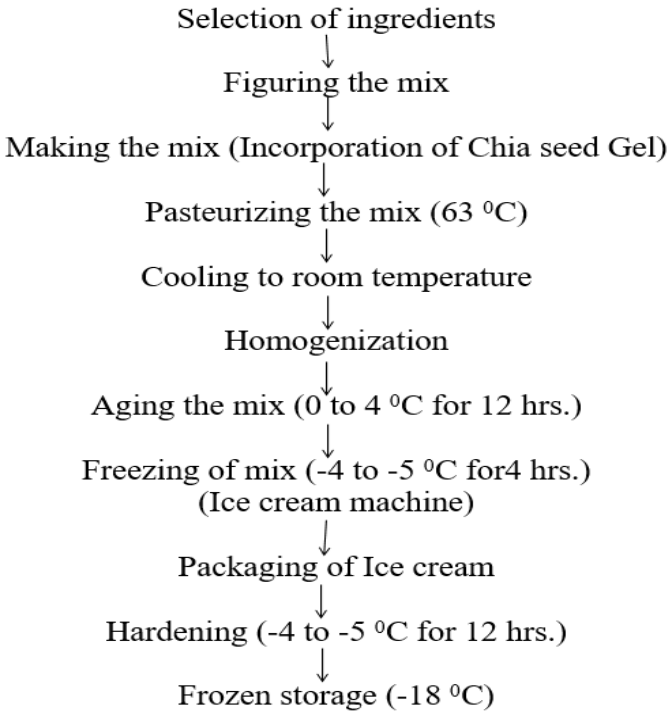
1. Introduction
Ice cream (*glaces a la crème* in French; *Eiskrem* in German; *helado* in Spanish; Morozhenoe in Russian; *Roomijs* in Dutch; *Fledies* in Danish; *Gelato* in Italian; *Sorvetes de crème* in Portugese) is a frozen mixture. The mixture generally referred as ice cream mix is pasteurized and homogenized before freezing. Freezing involves rapid removal of heat while agitating vigorously to incorporate air, thus imparting desirable smoothness and softness to the frozen product (Marshall *et al.*, 2003) [4].
Ashwagandha (*Withania somnifera*) is one of the most valued medicinal plant and widely used in Indian traditional health care systems for curing various diseases. It is also one of the members of GRAS (Generally Regarded as Safe) category of plants that can be used for therapeutic purposes. Ashwagandha, in Sanskrit means "horse`s smell" probably originating from the odour of its which resembles that of sweaty used in Ayurvedic medicine in a way similar to that ginseng is used in traditional Chinese medicine. Roots of Ashwagandha has been extensively used in many indigenous preparations for its medicinal values such as antiaging, aphrodisiac, cardio tonic, antistress, anti-inflammatory, antioxidants, hyroregulatory, antiperooxidative, hemopoietic, rejuvenating, anti tumouretc (Mishra *et al*., 2000) [5]. Ashwagandha exerts these properties because of its biochemical constituents like alkaloids and steroidal lactones.

2. Materials and Methods
The present investigation was carried out in Department of Food Engineering and Food Chemistry and Nutrition, College of Food Technology, V.N.M.K.V., Parbhani.

The various materials required and methods used in the present study are given below with suitable headings.

2.1 Materials
Milk, sugar, cream, skim milk powder and chia seed gel were obtained from local market.

2.2 Preparation of Ice cream



(Sukumar De, 2008) [9].

Fig 1: Flow sheet for preparation of ice cream

Table 1: Different Treatments with incorporation of ashwagandha root powder at varying concentration

Sr. No.	Treatments	Ashwagandha root powder (%)	Ice-cream Mix Qty. 1 Ltr.
1	T_0	Nil	1
2	T_1	1	1
3	T_2	2	1
4	T_3	3	1
5	T_4	4	1

2.3 Meltdown point

To determine the meltdown of ice cream, 80.0 g of sample was put on a wire mesh attached to a graduated cylinder and maintained under a controlled temperature chamber at 25 ºC and environment of constant relative humidity (50 ± 1%). The dripped volume was measured at a 10 minute intervals for a total of 45 minutes (Lee and White, 1991). The first drop time was measured as the volume drip per minute. The data recorded was used to determine the melting rate (ml/minute).

2.4 Apparent Viscosity (After Aging)

Viscosity of the unfrozen mixes was measured using a Brookfield LVDV-E Viscometer (Brookfield Engineering Laboratories, Middleboro, MA) with LV Spindle #1 (61) after aging. All measurements were recorded after 15 s at 12 rpm and reported as the apparent viscosity.

2.5 Organoleptic Evaluation

Ashwagandha root powder based ice cream were evaluated for sensory characteristics by using 9-point hedonic rating scale ranging from like extremely to dislike extremely (as per method given by Srilakshmi, 2002) [8]. The 10 panelists were selected from the staff of College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. Ice cream samples were subjected for sensory parameters like color and appearance, flavor, taste, texture and overall acceptability.

2.6 Specific Gravity

Specific gravity of the ice cream mixes was determined as described by Winton (1958) [10] at 20 ºC. Specific gravity of resultant ice cream samples was determined by means of filling a cool cup (with known weight and volume), with the resultant ice cream and then weighted.

Specific gravity= Weight of ice cream/ Cup volume

2.7 Overrun

Overrun was determined in duplicate and calculated according to the following equation as per method describe by Sukumar De, 1977.

$$\% \text{ Overrun} = \frac{\text{(Volume ice cream) - (volume of ice cream mix)}}{\text{Volume of ice cream mix}} \times 100$$

2.8 Statistical analysis

The obtained data in the present investigation was statistically analysed. The analysis of variance of the data obtained was done by using completely randomized design (CRD) for different treatments as per the method given by Panse and Sukhatme (1967) [7].

3. Results and Discussion

Table 2: Physical Properties of Ice-cream

Treatments		Physical properties			
	Over Run (%)	Total solid (%)	Meltdown point (ml/min)	Specific Gravity g/cm3	Viscosity of mix (cp)
T0	55.32	34.60	1.90	0.70	129.87
T1	55.10	34.90	1.89	0.78	130.54
T2	54.90	35.10	1.88	0.84	132.56
T3	54.50	35.30	1.85	0.89	134.26
T4	54.06	35.80	1.81	0.94	135.10
SE±	0.051	0.015	0.061	0.037	0.109
CD@5%	0.156	0.045	0.185	0.113	0.329

The tabulated results showed the effects of varying concentration of ashwagandha root powder on the physical characteristics of ice-cream.

The amount of overrun desired in ice cream depends on the composition of the mix and the processing conditions employed. Too much overrun is likely to result in a product with a snowy, fluffy defect. On the other hand, too little overrun would result in a soggy, heavy product. It was clearly seen from the results that ashwagandha root powder affects the air whipping qualities of ice cream which reduces overrun of ice-cream. Results were statistically significant for controlled sample

It was revealed from the table that total solids content of the ice-creams were in the range of 34.60 to 35.80 per cent. The treatment T_4 Contains highest amount of total solids and least by T_0. The increase in total solids was attributed due to the ashwagandha root powder. Similar results were obtained by Murtaza *et al.* (2014) [6] and Aykan *et al.* (2008) [2].

Meltdown point was found to be in the range of 1.90 to 1.81 ml/min. The highest meltdown point was recorded for the control T_0. The meltdown point of icecream with successive levels of ashwandha root powder decreased this was attributed due to the formation of H bond by powder molecules with water.

Specific gravity of ice cream was measured in g/ cm^3 and results were obtained in the range of 0.70 to 0.94. The increase in specific gravity of icecream was attributed due to increasing of substitution levels of ashwandha root powder may be attributed to increment of mix's viscosity which affects on whipping rate of mixes (Arbuckle, 1977) [1].

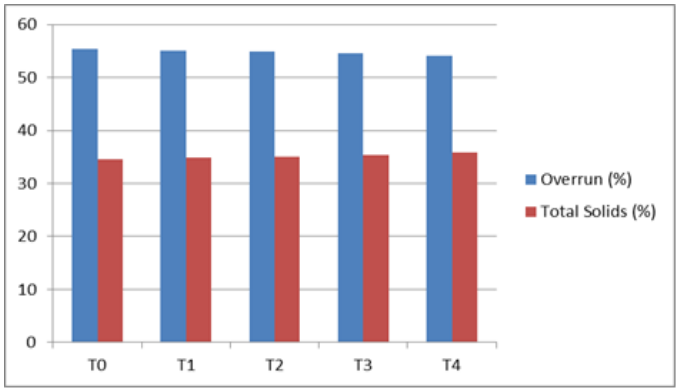


Fig 1: Effects of varying concentration of ashwagandha root powder on the Overrun and Total soilds of Ice cream

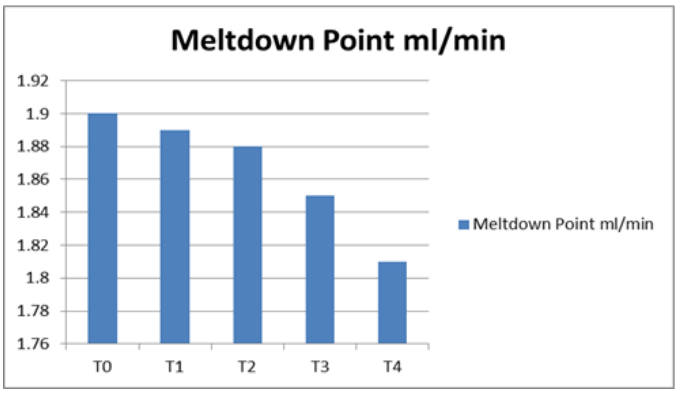


Fig 2: Effects of varying concentration of ashwagandha root powder on meltdown point of ice cream

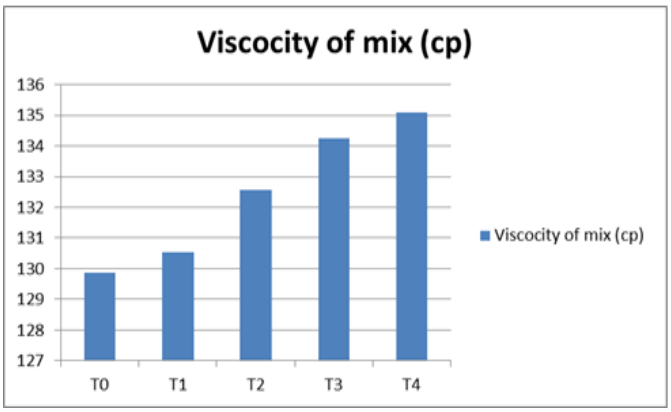


Fig 3: Effects of varying concentration of ashwagandha root powder on viscosity of ice cream

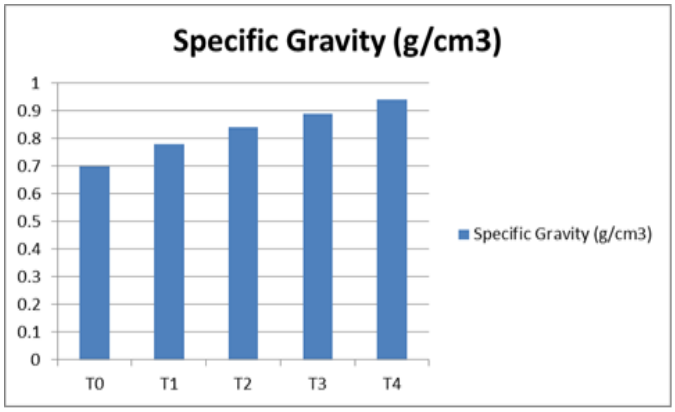


Fig 4: Effects of varying concentration of ashwagandha root powder on specific gravity of ice cream

Table 3: Sensory Evaluation of Ice-cream

Treatment	Sensory Attributes				
	Color & Appearance	Flavor	Taste	Texture & Mouth feel	Overall Acceptability
T_0	8.5	8.6	8.5	8.4	8.4
T_1	8.4	8.3	8.20	8.02	8.10
T_2	8.5	8.3	8.1	8.0	8.2
T_3	7.7	7.6	6.6	7.0	7.2
T_4	7.7	6.5	6.1	6.3	6.6
SE±	0.040	0.060	0.045	0.090	0.103
CD@5%	0.122	0.180	0.136	0.271	0.309

*Each value is a mean of three determinations.
T_0= Control
T_1= Ice cream with1% Ashwagandha root powder (ARP)
T_2= Ice cream with 2% Ashwagandha root powder
T_3= Ice cream with 3% Ashwagandha root powder
T_4= Ice cream with 4% Ashwagandha root powder

From the table it was observed that maximum organoleptic scores were recorded for controlled sample (8.42). The minimum score for organoleptic evaluation were obtained for the T_4 (6.66).

The sensorial score of treatment for colour and appearance, flavour, taste, texture and mouthfeel, overall acceptability (8.42, 8.32, 8.02, 8.10 respectively) which is very near to the results of T_0 and this is also same for theT_2. From the obtained result, it is revealed that as the levels of ashwagandha root powder increases the score for sensory parameters (Color & Appearance, Flavor, Body & Texture and Overall Acceptability) was decreased gradually.

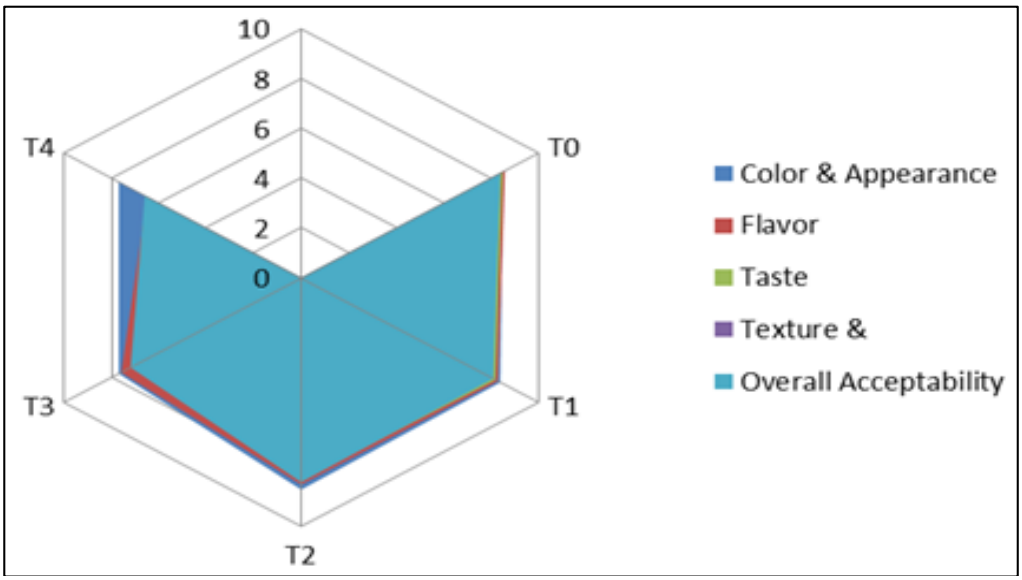


Fig 5: Sensory evaluation of ice cream prepared by using ashwagandha root powder

4. Conclusion

Incorporation of ashwagandha root powder at varying concentration significantly affected on the physical properties of ice cream. The results revealed that ARP based ice cream had somewhat low melting point. The overrun of ice cream decreased and specific gravity increase by successive levels of ARP and this may attributed increase in the viscosity of ice cream.

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