QUALITY CHARACTERIZATION OF CASEIN ENRICHED ICE CREAM WAFER CONE

***Ayyavoo Preamnath Manoharan*[1], G. Saarunikesh[2] and C. Ashokkumar[3]**

Department of Food Process Engineering
College of Food and Dairy Technology
Tamil Nadu Veterinary and Animal Sciences University
Koduvalli, Chennai - 600 052.

ABSTRACT

An investigation was carried out to assess the nutritional, texture profile, microbial and sensory quality of wafer cones. Refined wheat flour and water, sugar, lecithin oil, vegetable fat, baking powder, SMBS (Sodium Meta Bisulphite) were used for the preparation of the wafer cone. Treatments were prepared with casein powder at the rate of 3, 5 and 7 per cent for enriching the wafer cones and control sample were prepared by using refined wheat flour. The quality assessment for moisture, protein and fat was carried out using infrared analyser from NDC technologies. Sensory acceptability was assessed by 9- Point Hedonic Scale and results were analysed statistically.

Key Words: Wafer cones, Casein powder, Quality characterization, Ice Cream

INTRODUCTION

Ice cream is a delicious, wholesome, frozen dairy product and is liked equally by the people of all age groups. 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. Ice cream is an excellent source of food energy, and 50% of its total solids content is sugar, including lactose, sucrose, and corn syrup solids (Deosarkar *et al.,* 2016). These constituents are almost completely assimilated and makes ice cream a desirable food for growing children. There are two types of ice cream. One is Hardened ice cream which facilitates stacking of ice cream packages during storage and transportation. The other is soft ice cream sold as drawn from the freezer without hardening. Soft ice cream it is generally lower in milk fat (3.6%) than hardening ice cream (10- 18%) and produced at a temperature of about -4°C compared to hardening ice cream, which is stored at-15°C.

A warmer temperature of soft serve ice cream allows the taste buds to detect more flavour. The air introduced into soft serve ice cream may vary from 0-60% of the volume of the finished product. The ideal acceptable air content is between 33 and 45% of volume (Adhikari *et al*., 2020).

*Corresponding author;
Email: ayyavoo.manoharan@gmail.com
[1]Professor and Head
[2] B. Tech student
[3] Project Director

The first ice cream cone was produced in 1896 by Italo Marchiony. Marchiony, who emigrated from Italy in the late 1800s, invented ice cream cone in New York City. He was granted a patent in December 1903. A similar creation was independently introduced in 1904 St. Louis World's Fair by Ernest A. Hamwi, a Syrian concessionaire. Hamwi was selling a crisp, waffle-like pastry - zalabis - in a booth right next to an ice cream vendor. The vendor ran out of dishes and to solve the situation he quickly rolled one of his wafer-like waffles in the shape of a cone, or cornucopia, and gave it to the ice cream vendor. The cone cooled in a few seconds, the vendor put some ice cream in it, the customers were happy.

As the modern ice cream cone developed, two distinct types of cones emerged. The rolled cone was a waffle, baked in a round shape and rolled as soon as it came off the griddle. In a few seconds, it hardened in the form of a crisp cone. The second type of cone was molded either by pouring batter into a shell, inserting a core on which the cone was baked, and then removing the core; or pouring the batter into a mold, baking it and then splitting the mold so the cone could be removed. Now, millions of rolled cones are turned out on machines that are capable of producing about 150,000 cones every 24 hours. Modern era – Ice cream cakes, pies, stick items, novelties and many other items have been introduced from time to time. The ice cream cone made its mark at the Louisiana Purchase Exposition in St. Louis, Missouri (St. Louis Fair) in 1904. There are conflicting legends about various waffle makers who started selling waffles folded into cones to ice cream vendors who ran out of plates. Howard Johnson's restaurants advertised "a world of 28 flavours." Baskin-Robbins made its 31 flavours (one for each day of the month). The company now boasts that it has developed over 1000 varieties.

Ice cream is a favourite food in any store or restaurant. This tasty treat is known to cool down in the summer and makes an edible container for a cold snack. The frosty smoothness of the ice cream complements the crispy crunch of the cone for an interesting taste combination. There are almost as many stories of how the ice cream cone was invented as there are flavours that it holds. Pre-determined quantity of ice cream is automatically filled in each cone. Cones are not only convenient but there is no residual waste as well. They are of different colours and flavours. This is a very common product and can be produced all over the country. Nearness to urban market should be the main guiding factor. Casein is the principle protein in bovine milk, which is mainly responsible for the functionality of milk proteins. Initially, casein was used primarily for industrial application, e.g. glue, plastics, paper coating, etc. In the 1960s, casein was upgraded for use as food ingredient to enhance the physical properties and to improve the nutrition of foods.

MATERIALS AND METHODS

The raw materials were procured from the local market. The technological aspects of Casein Enriched ice cream cone, proximate analysis, microbiological, sensory analysis and texture profile analysis were carried out. The equipment used include NDC technologies, Muffle

furnace, autoclave, incubator, mixer grinder (Make: Philips Model HR1456), weighing balance, vessels, ice cream cone making Machine (1320 pc/ hr production) by M B TECH Industries. The glassware used for microbiological studies were thoroughly washed, dried and sterilized using hot air oven.

Processing techniques

Ice cream cone was prepared to contain a final composition of 100 g Maida as per IS 7463 (1988), 2.5 g sugar as per IS498 (1985), 2.5 g vegetable fat as per IS7187 (1989), 5 g lecithin oil as permitted PFA rules , 0.5 g sodium bicarbonate as per IS1159 (1981), 0.5 g SMBS as per IS2124 (1974) and water 200 g IS4251 (1967) after inclusion of different levels (T_1 T_2 and T_3) of casein powder as per IS1167 (1965) using fractional factorial design (Table 1). The flow chart of processing of wafers is presented in Fig.1. Dry ingredients were all first measured into a bowl and oil, lecithin, water added and mixing done using a mixer grinder at low speed until all ingredients were well mixed to form a batter. The resulting batters were baked using ice cream cone making machine.

Table 1: Quantity of ingredients and different level of casein enrich in wafer cones

Raw materials	T_0 (g)	T_1 (g)	T_2 (g)	T_3 (g)
Maida	100	97	95	93
Sugar	2.5	2.5	2.5	2.5
Vegetable fat	2.5	2.5	2.5	2.5
Lecithin oil	5	5	5	5
Baking powder	0.5	0.5	0.5	0.5
SMBS	0.5	0.5	0.5	0.5
Water	200	200	200	200
Casein powder	---	3	5	7
Total	**311 g**	**311 g**	**311 g**	**311 g**

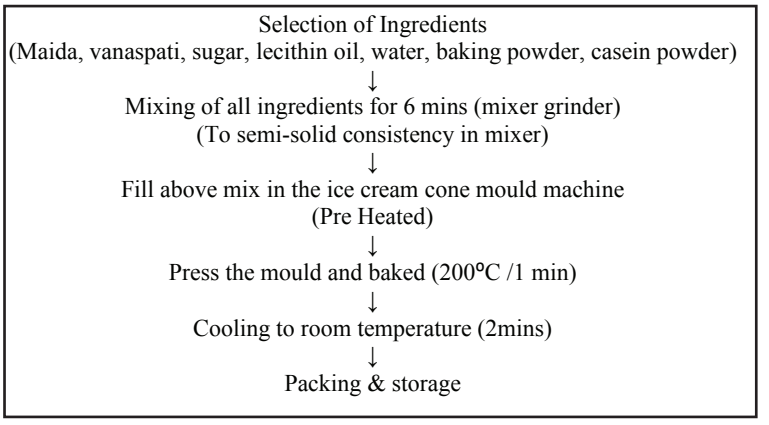

Fig: 1 Flow chart for processing of wafers

RESULT AND DISCUSSION

Proximate analysis of casein enriched wafer cones

The mean values for the proximate analysis Control (T_0), T_1, T_2 and T3 are presented in Table 2. The mean value of fat, protein, carbohydrates, ash, moisture and total solids of the control sample was 9.37±0.073, 10.14±.022, 73.69±.124, 0.64±.00, 6.15±.081 and 93.81±.091 respectively. The fat values were 11.44±.112, 11.67±0.061 and 15.02±.003 T_1, T_2 and T3 respectively. The corresponding values of protein, carbohydrates, ash, moisture and total solids are shown in table 2. Nandini *et al*., (2019), studies showed that fat, protein values were 4.2% and 12%, whereas in this studies fat, protein content of wafer cone ranged from 11.44 to 15.02 and 10.74 to 25.21 respectively. The increase in fat and protein content of the developed wafer cone due to addition of lecithin oil and casein. Increasing fat and protein have reduces the carbohydrates. The decreasing effect on carbohydrate may also be due to incorporation of casein powder possessing 80% protein in the wafer cones.

Texture profile analysis of casein enriched wafer cones

The mean values for the texture profile analysis of T_0 and T_1, T_2 and T_3 are presented in Table 3. The mean value of hardness, fracturability, cohesiveness, gumminess and chewiness of the control sample was 8.64±0.24, 1.29±.049, 0.007± 04, 45±.075 and 3.33±.045 respectively. The hardness values were 12.34±0.773, 13.27±1.096 and 14.71±.783 for T_1, T_2 and T_3 respectively. The results of present study revealed that the percentage of casein powder increases and hardness increases. The hardness of cone gives longer hand holding time for better consumption for ice cream. The increase in hardness reduces cohesiveness of ice cream cones shown in (fig.2). Similarly there was a slight increase or decrease in gumminess and chewiness of casein enriched wafer cones.

Table 2. Proximate analysis of casein enriched wafer cones (Mean ±SE)*

S.No	Compositions	T0 (%)	T1 (%)	T2 (%)	T3 (%)	F value
1.	Fat	9.37±0.073^a	11.44±.112^b	11.67±0.061^c	15.02±.003^d	1013.130
2.	Protein	10.14±.022^a	10.74±.045^b	25.21±.003^d	24.13±.003^c	106317.400
3.	Carbohydrates	73.69±.124^d	70.77±.124^c	54.67±.050^b	52.55±.028^a	13714.651
4.	Ash	0.64±.00^a	0.63±.003^a	1.09±.005^c	1.00±.002^b	4704.301
5.	Moisture	6.15±.081^a	6.40±.026^b	7.36±.007^c	7.28±.027^c	189.918
6.	Total solids	93.81±.091^c	93.59±.026^b	92.63±.007^a	92.71±.027^a	147.127

Mean bearing different superscript in a columns differ significantly (P< 0.01)* Average of 10 trials

Table 3.Texture profile analysis of casein enriched wafer cones (Mean ±SE)*

S. No	Parameters	T0(N)	T1(N)	T2(N)	T3(N)	F value
1.	Hardness	8.64±.246 [a]	12.34±.773 [b]	13.27±1.096 [bc]	14.71±.783 [c]	10.871
2.	Fracturability	1.29±.049 [a]	10.85±.817 [b]	11.89±1.223 [b]	12.45±.866 [b]	37.948
3.	Cohesiveness	0.007± 0 [c]	0.005±0 [b]	0.004±0 [b]	0.002±0 [a]	18.621
4.	Gumminess	4.45±.075 [a]	4.49±.236 [a]	4.75±.420 [a]	4.72±.445 [a]	0.220
5.	Chewiness	3.33±.045 [a]	2.96±.158 [a]	3.24±.379 [a]	3.33±.484 [a]	0.296

Mean bearing different superscript in a columns differ significantly (P< 0.01)
* Average of 10 trials

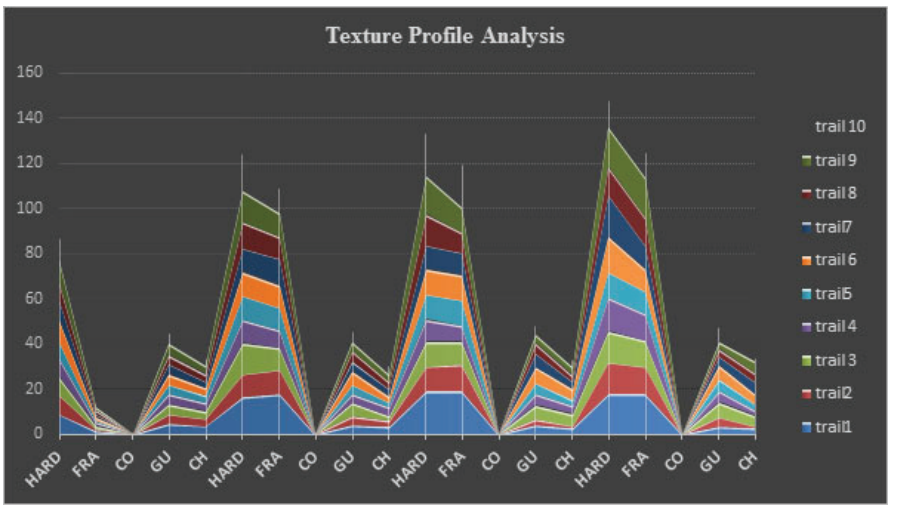

Fig: 2 Texture profile analysis of casein enriched wafer cones

Y - axis shows 1/10 N

X - axis shows Hardness (HARD), Fracturability (FRA), Cohesiveness (CO), gumminess (GU), chewiness (CH)

Microbiological analysis casein enriched wafer cones

The mean values for the standard plate count (SPC) of casein enriched wafer cones T_0,T_1,T_2 and T_3 (Fig. 3), Yeast and Mould count and Coliform are presented in table 4. The Yeast and Mould count and Coliform were absent in both control and enriched samples. The mean value of SPC was 9.8 × 10^3 for T_0 and for, T_1, T_2 and T_3 were 8.7× 10^3, 6.5× 10^3 and 9.5× 10^3 respectively. Nabi *et al*., (2016) studies showed that ice cream cone SPC ranged from 8.2 × 10^4 to 2.57 × 10^6 CFU ml^{-1}, whereas in the present study the SPC was 9.5× 10^3 CFU ml^{-1}. The low bacterial load in the present study may be due to strict hygienic measures adopted during production of cones. Yeast and Mould and coliform were absent in T_0, T_1, T_2 and T_3 (Nabi *et al.,* 2016).

Table 4. Microbiology analysis of casein enriched wafer cones (Mean ±SE)*

S.No	Type of Organisms	T_0 (CFU/ml)	T_1 (CFU/ml)	T_2 (CFU/ml)	T_3 (CFU/ml)
1.	Standard plate count	$9.8 \times 10^3 \pm 0.975$	$8.7\times 10^3 \pm 0.731$`	$6.5\times 10^3 \pm 0.600$	$9.5\times 10^3 \pm 0.600$
2.	Yeast and mould count	Absent	Absent	Absent	Absent
3.	Coliform	Nil	Nil	Nil	Nil

Mean bearing different superscript in a columns differ significantly (P< 0.01)
* Average of 10 trials

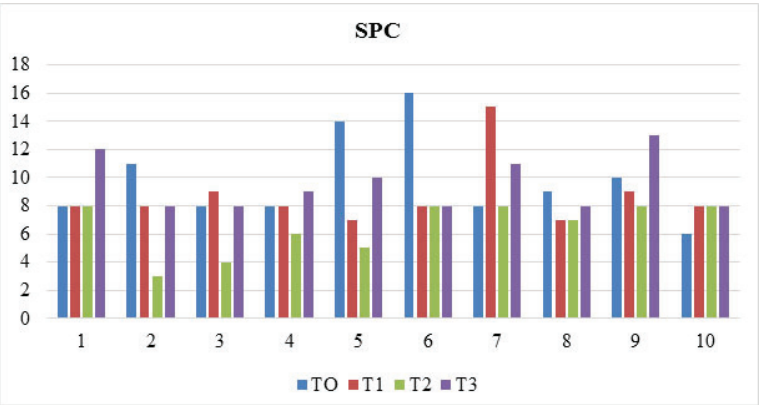

Fig 3. Standard plate count of casein enriched wafer cones

x- axis shows no. of. Trials
y- axis shows 1×10^3 no. of. colonies

Sensory Analysis

The mean values for the sensory analysis of T_0, T_1, T_2 and T_3 are presented in Table 5. The mean value of hardness, crispness and overall acceptability were 7.6, 7.4 and 6.8 respectively for the control sample. For T_1, T_2 and T_3 Hardness, crispness and overall acceptability 6.5, 6.9, 7.0; 7.7, 7.7, 7.9 and 5.9, 5.6, 5.5 respectively. Kigozi *et al*., (2014) studies revealed that the present research work in all aspects. The consumer acceptance of hardness, crispness and overall acceptability are high in values. The sensory scores suggested for formulations revealed T1, T2, T3 were had maximum acceptability as shown in fig.4

Table 5. Sensory Analysis of Casein Enriched Wafer Cones (Mean ±SE)*

S.No	Parameter	T0	T1	T2	T3	F value
1.	Hardness	$7.6\pm.339^{b}$	$6.5\pm.223^{a}$	$7.7\pm.152^{b}$	$5.9\pm.525^{a}$	6.551
2.	Crispiness	$7.4 \pm .339^{bc}$	$6.9\pm.233^{b}$	$7.7\pm.152^{c}$	$5.6\pm.221^{a}$	14.202
3.	Overall acceptability	$6.8\pm.249^{b}$	$7.0\pm.149^{b}$	$7.9\pm.276^{c}$	$5.5\pm.268^{a}$	16.800

Scale for Hardness, Crispiness, Overall Acceptability Range, 9 = “like extremely” to 1 = “dislike extremely”
Mean bearing different superscript in a columns differ significantly (P< 0.01)
* Average of 10 trials

Fig.4 sensory analysis of casein enriched wafer cones

CONCLUSIONS

The increasing use of wafer cones in food processing industry is expected. Wafers can be made more nutritious by replacing refined wheat flour with casein protein at different concentration produce nutritionally enriched wafer cones. In this study though the combination of 93g maida, 2.5 g sugar, 2.5 g vegetable fat, 5 g lecithin oil, 0.5 g baking powder, 0.5 g SMBS, 200 g water and 7 g casein powder (T3) was found to be nutritionally better because of the increased level of constituents. Based on the sensory evaluation of wafer cone made with the ingredient combination of 95 g maida, 2.5 g sugar, 2.5 g vegetable fat, 5 g lecithin oil, 0.5 g baking powder, 0.5 g SMBS, 200 g water and 5 g casein powder (T2) shows higher overall acceptability by the sensory scores as compared to other proportion of treatments. Hence, the combination of ingredient formulated in treatment (T2) and (T3) is more recommended for upscaling the food products in the food industry for wafer cone production.

REFERENCES

Adhikari, B.M., Truong, T., Prakash, S., Bansal, N. and Bhandari, B. (2020). Impact of incorporation of CO2 on the melting, texture and sensory attributes of soft-serve ice cream. *International Dairy Journal*, **109**: 104789.

Deosarkar, S.S., Kalyankar, S.D., Pawshe, R.D. and Khedkar, C.D. (2016). Ice cream: Composition and health effects. In: (Eds) Caballero, B., Finglas, P.M. and Toldrá, F., Encyclipedia of Food Heath, Academic Press.

IS498 (1985), Sugar, Indian Standard cones - specification (First Revision), Bureau of Indian Standards, Manak Bhavan, Bahadur Shah, Zafar Marg, New Delhi 110002.

IS1159 (1984)Specification for baking powder (First Revision), Bureau of Indian Standards, Manak Bhavan, Bahadur Shah, Zafar Marg, New Delhi 110002.

IS1167 (1965), Casein edible, Indian Standard cones - specification (First Revision), Bureau of Indian Standards, Manak Bhavan, Bahadur Shah, Zafar Marg, New Delhi 110002.

IS2124 (1974), Sodium Bicarbonate - specification (First Revision), Bureau of Indian Standards, Manak Bhavan, Bahadur Shah, Zafar Marg, New Delhi 110002.

IS4251 (1967), Water, Indian Standard cones - specification (First Revision), Bureau of Indian Standards, Manak Bhavan, Bahadur Shah, Zafar Marg, New Delhi 110002.

IS7187 (1989), Indian Standard cones - specification (First Revision) Ice cream cone, Bureau of Indian Standards, Manak Bhavan, Bahadur Shah, Zafar Marg, New Delhi 110002.

IS7463 (1988), Maida (Wheat Flour), Indian Standard cones - specification (First Revision) , Bureau of Indian Standards, Manak Bhavan, Bahadur Shah, Zafar Marg, New Delhi 110002.

Kigozi, J., Banadda, N., Byaruhanga, Y., Kaaya, A. and Musoke, L. (2014). Optimization of Texture in Sorghum Ice Cream Cone Production Using Sensory Analysis, *The Open Food Science Journal,* **8**: 18-21.

Nabi, A. H. M., Islam, M. N., Al Reza, M. S., Haque, M. A., Uddin, M., Talukder, S. A. and Zubair, M. A. (2016). Evaluation of microbiological quality and safety of locally processed ice cream in DHAKA city, Bangladesh. *Annals. Food Science and Technology.*

Nandini. N., Bhasker.V. and Srinivas Maloo. (2019). Development and quality evaluation of wafers incorporated with pearl millet flour and sorghum millet flour. *International Journal of Food Science and Nutrition* ISSN: 2455-4898, Volume 4; Issue 1; January; Page No. 09-15.