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Shaeeduddin
PG Student, Warner College of
Dairy Technology, SHUATS,
Naini, Allahabad, Uttar
Pradesh, India

Dr. Avinash Singh
Associate Professor, Warner
College of Dairy Technology,
SHUATS, Naini, Allahabad,
Uttar Pradesh, India

Mohammad Sameem
PG Student, Warner College of
Dairy Technology, SHUATS,
Naini, Allahabad, Uttar
Pradesh, India

Neeraj Kumar Dixit
PG Student, Warner College of
Dairy Technology, SHUATS,
Naini, Allahabad, Uttar
Pradesh, India

Efficacy of white chocolate couverture in mewa malai kulfi Popsicle

Shaeeduddin, Dr. Avinash Singh, Mohammad Sameem and Neeraj Kumar Dixit

Abstract
In the new millennium we are the witnessing the upward trend in nutritional and health awareness which has increased the consumer demand for functional foods. Kulfi is popular Indian frozen dessert; White chocolate contains a wide range of antioxidants that includes soluble phenolic compounds (phenolic acids, Catechin, Epicatechin, and Proanthocyanidins), insoluble polymeric phenolics and methylxanthines. In the investigation has been made to develop white chocolate couverture by combining different proportions of white chocolate and palm kernel oil ie. 30:70 (T_1), 40:60 (T_2), 50:50 (T_3). The sensory score for overall acceptability of white chocolate couvertures of treatments T_1, T_2, and T_3 were 6.98, 8.56 and 8.16, respectively. It was observed that though the white chocolate couverture prepared from 40 parts white chocolate and 60 parts palm kernel oil (T_2) was closer to control in acceptance. The acceptability for treatment T3 and T1 was rated between like moderately to like very much for all sensory attributes. On an average the white chocolate couvertures of treatment T_2 contained 74.43 per cent fat, 2.91 per cent protein, 98.72 per cent total solid, 20.74per cent carbohydrate, 0.31per cent ash, 1.10 per cent moisture and 0.53 acidity. Obtained satisfactory result as for as sensory score is considered at the overall result can be rated as $T_2 \geq T_3 > T_1$.

Keywords: butter, SMP, sugar, stabilizer & emulsifier, honey, palm kernel oil, white chocolate

Introduction
The word kulfi derives its origin from the Hindustani word kulaf meaning a „lock" or a „container" that has to be unlocked. And, indeed the recess of the metal cone that encases the frozen delight has to be pried open to release the confection (Aneja, 1992) [6]. Couverture chocolate is a very high-quality chocolate that contains a higher percentage of cocoa butter (32‐39%) than baking or eating chocolate. This additional cocoa butter, combined with proper tempering, gives the chocolate more sheen, a firmer snap when broken, and a creamy mellow flavor. The total percentage cited on many brands of chocolate is based on some combination of cocoa butter in relation to cocoa solids (cacao). In order to be properly labeled as couverture, the product must contain not less than 35% total dry cocoa solids, including not less than 31% cocoa butter and not less than 2.5% of dry non-fat cocoa solids; Couverture is used by professionals for dipping, coating, molding and garnishing. Palm kernel oil is yellowish oil extracted from the kernel of palm nuts of palm tree (*Elaeis guineensis*), an indigenous wild tree of tropical Africa and part of Asia. It is dark brown in colour when processed or extracted locally. Palm kernel oil is an important source of fat and is used in food processing industries, soap making, cosmetics, pharmaceutical industries. The palatability of kulfi and goodness of white chocolate and palm kernel oil couverture can be combined in the form of mewa malai Popsicle, keeping the above in mind an effort was made to formulate mewa malai kulfi popsicle by formulating a couverture consisting of different ratio of white chocolate and palm kernel oil and asses its organoleptic, microbiological and physic-chemical quality in to find the best combination.

Materials and Methods
Butter, S.M.P., Sugar, Honey, Emulsifier & Stabilizer, Chocolate, Palm kernel oil, Nuts (Almond, pistachio) and Kulfi Stick were collected from the local market of Allahabad whereas the required analytical grade chemicals and compounds were obtained from the research lab of "Warner College of Dairy technology" Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad (U.P.) India. Three treatment samples were studied and each treatment was replicated five times.

Correspondence
Dr. Avinash Singh
Associate Professor, Warner
College of Dairy Technology,
SHUATS, Naini, Allahabad,
Uttar Pradesh, India

In all 15 samples were studied. Average values for physico-chemical, microbial and sensory analysis were recorded for the final product. The final products were analyzed for percent ash, acidity, carbohydrate, fat, moisture, protein and total solid. Microbiological analysis involved estimation of Coliform count, Standard plate count, Yeast & Mould count. Sensory analysis was carried out on 9 point Hedonic scale to judge for body & texture, colour & appearance, flavour and over all acceptability.

Preparation of Kulfi
The kulfi was prepared by selecting ingredient like skim milk powder, butter, stabilizer & emulsifier was used to formulate a mix with 9.5% fat, 11% SNF, 0.28% stabilizer & emulsifier and 17.34% sugar Liquid ingredient and solid ingredient was moved separately water was heated to corporate moisture to one fold consistency water 61.5%. Ingredient in a steem pan a stirrer and heating 40-50ºc, after heating mix addition of sugar 17.34%, the mix was filtered by using muslin cloth and after filtration mix was homogenization. Water was added ate 23%. Then evaporated by heating (23% moisture removed). The mix was than aged (at 40°F (5°C) for at least 4 hours), after ageing honey e 1.44% was added to the mix and prepared mix divided in to two part, and one part transferred in to Continuous Freezer (-4 to -5^{0}C/23 to 25^{0}F & 5% overrun) and second part mix was combined with first part mix. Mix was transferred to moulds (80 ml) and frozen in a ice plant candy and transferred to hardening tunnel (-28 °c) and then stored in cold room at -23°C and transfer in to ice candy tank. Kulfi was stored in cold room.

Preparation of white chocolate couvertures.
White chocolate couverture was prepared by mixing white chocolate and Palm kernel oil in different proportion as per the requirement of treatment in a double jacketed container maintained at 45-50ºc. For each treatment, white chocolate and Palm kernel oil was mixed in the following ratio i.e. 30:70, 40:60, 50:50 respectively to this mixture almond and pistachio 1-5 mm size was added @ 5%.

Physico-chemical analysis
Fat content was estimated by using HCL Methods given in SP (part 11)-1981. Protein by using kjeldhal method given in SP (part 11)-1981. Carbohydrate percentage was estimated by using lane-eynon method given in (IS: 1050, 1983). Ash percentage was estimated by using muffle furnace as per the procedure given in SP: 18 (part11)-1981. Total solid percentage was estimated as per the procedure given in IS: SP: 18 (part 11)1981. Moisture percentage was estimated as per the procedure given in SP: 18 (part 11)1981. Acidity percentage was estimated as par the procedure laid down in IS: 1479, part: 1 (1960).

Microbiological Analysis
All the white chocolate couvertures samples were analyzed for Standard Plate Count (SPC), Coliform count and Yeast and Mold count (YMC) by the methods as described in IS: 5550 (2005).

Sensory Analysis
Consisting Sensory evaluation of white chocolate couverture samples were carried out by a trained panelist of six judges by using 9- point hedonic scale described by Lim (2011). sensory parameter like Colour & appearance, body & texture, flavor & taste, overall acceptability and melting resistance sensory parameter were include for study.

Statistical Analysis
The data obtained during different phases of this study was analyzed using Randomized Block Design. The experiment was designed and responses analyzed using software Design Expert Version 8.0.10.

Results and Discussion
Different level of white chocolate and palm kernel oil was studied for feasibility and suitability for use in white chocolate couverture in kulfi Popsicle

(a) Physico- chemical analysis
Fat content
Highest mean fat percentage in samples of different treatments and control, was recorded in the sample of T1 (80.45) followed by T2 (74.43), T3 (68.32).

Protein content
Highest mean protein percentage in samples of different treatments and control, was recorded in the sample of T3 (3.68) followed by T2 (2.91), T1 (2.19).

Ash content
Highest mean ash percentage in samples of different treatments and control, was recorded in the sample of T3 (0.40) followed by T2 (0.31), T1 (0.22).

Carbohydrate content
Highest mean carbohydrate percentage in samples of different treatments and control, was recorded in the sample of T0 (35.33) followed by T1 (34.62), T2 (33.96), T3 (33.29).

Moisture content
Highest mean moisture percentage in samples of different treatments and control, was recorded in the sample of T3 (25.93) followed by T2 (20.74), T1 (15.07).

Total solids content
Highest mean total solid percentage in samples of different treatments and control, was recorded in the sample of T1 (98.93) followed by T2 (98.72), T3 (98.55).

Acidity content
Highest mean acidity percentage in samples of different treatments and control, was recorded in the sample of T3 (0.52) followed by T2 (0.53), T1 (0.54).

Table 1: Average data of physico-chemical analysis for different parameters of samples of white chocolate couvertures.

Parameters	Scores/ values based on mean value of different parameters of treatments			S/NS	CD Value
Treatment	T$_1$	T$_2$	T$_3$		
Fat%	80.46	74.43	68.32	S	0.21
Protein%	2.19	2.91	3.68	S	0.04
Moisture%	0.91	1.10	1.29	S	0.03

Carbohydrate%	15.07	20.74	25.93	S	0.24
Ash%	0.22	0.31	0.40	S	0.04
Total solids%	98.93	98.72	98.55	S	0.03
Acidity%(lactic acid)	0.52	0.53	0.54	S	0.06

S=Significant at 5% level
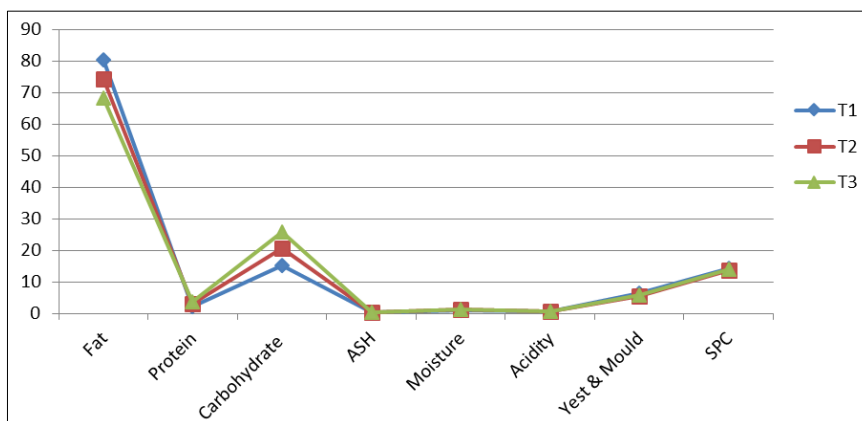NS=Non- Significant at 5% level

Fig 1: Physico- chemical Analysis of white chocolate couvertures

(b) Microbiological analysis
Standard plate count
Highest mean standard plate count in samples of different treatments and control, was recorded in the sample of T1 (14.20) followed by T3 (14.00), T2 (13.60).

Yeast and mould
Highest mean yeast and mould percentage in samples of different treatments and control, was recorded in the sample of T1 (6.40) followed by T3 (5.8), T2 (5.4).

Coli form count
It is evident from the table that the coli from test for experimental sample was negative. It shows the absence of gram negative bacteria which means the strict hygienic practice was maintained during the product preparation.

Table 2: Average data of microbiological analysis for different parameters of samples of white chocolate couvertures.

Parameters	Scores/ values based on mean value of different parameters of treatments			S/NS	CD Value
Treatment	T_1	T_2	T_3		
SPC($\times 10^7$ cfu/ml)	14.20	13.60	14.00	S	1.41
Yeast & mould ($\times 10^1$ cfu/gm)	6.40	5.40	5.80	S	1.21
Coliform ($\times 10^1$ cfu/gm)	Nil	Nil	Nil		Nil

S=Significant at 5% level
NS=Non- Significant at 5% level

(c) Organoleptic Taste
Flavour and taste
Highest mean flavour and taste score in samples of different treatments and control, was recorded in the sample of T2 (8.80) followed by T3 (8.60), T1 (7.00).

Colour and appearance
Highest mean colour and appearance score in samples of different treatments and control, was recorded in the sample of T2 (8.60) followed by T3 (8.20), T1 (7.20).

Body and texture
Highest mean body and texture score in samples of different treatments and control, was recorded in the sample of T2 (8.40) followed by T3 (7.80), T1 (7.00).

Overall acceptability
Highest mean overall acceptability score in samples of different treatments and control, was recorded in the sample of T2 (8.56) followed by T3 (8.16), T1 (6.98).

Melting resistance
Highest mean melting resistance score in samples of different treatments and control, was recorded in the sample of T2 (8.80) followed by T3 (8.10), T1 (7.35).

Table 3: Average data of Sensory analysis for different parameters of samples of white chocolate couvertures.

Parameters	Scores/ values based on mean value of different parameters of treatments			S/NS	CD Value
Treatment	T_1	T_2	T_3		
Color & appearance	7.20	8.60	8.20	S	0.40
Flavor and taste	7.00	8.80	8.60	S	0.44
Body and texture	7.00	8.40	7.80	S	0.33
Overall acceptability	6.98	8.56	8.16	S	0.32
Melting resistance	7.37	8.80	8.10	S	0.51

S=Significant at 5% level
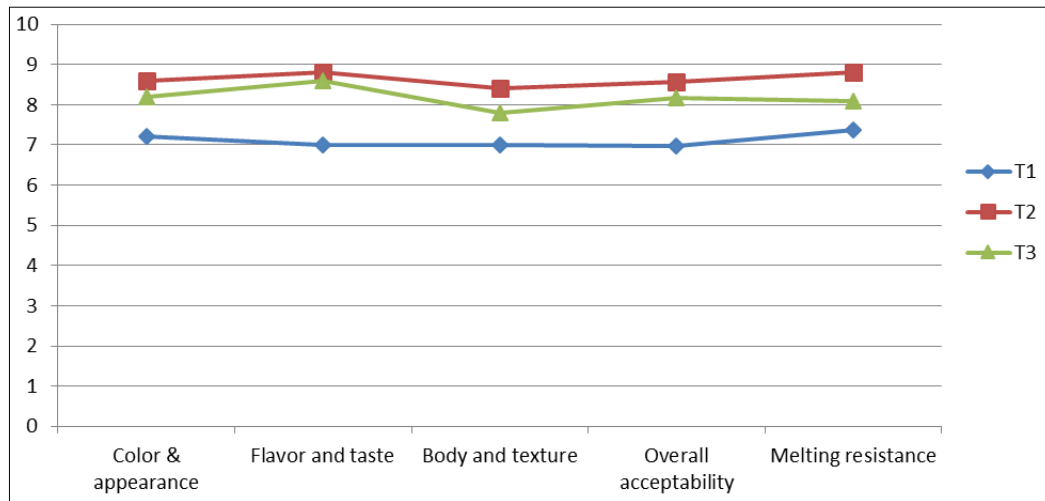NS=Non- Significant at 5% level

Fig 2: Sensory Analysis of white chocolate couvertures

(d) White chocolate couvertures
Coating
Highest mean coating percentage in samples of different

treatments and control, was recorded in the sample of T3 (5.31) followed by T2 (5.04), T1 (4.73).

Table 4: Average data of coating for parameter of samples of white chocolate couvertures.

Parameter	Scores/ values based on mean value of parameters of treatments			S/NS	CD Value
Treatment	T_1	T_2	T_3		
Coating/gm.	4.73	5.04	5.31	S	0.36

S=Significant at 5% level
NS=Non- Significant at 5% level

Cost analysis
The cost of experimental white chocolate couvertures of

different treatments are presented in Table 5. and following observations were made:

Table 5: Cost analysis of experimental white chocolate couvertures (Rs. / Litre)

Ingredient	Amount required for 100 ml			Rate in Rs/ Litre	Cost in Rs.		
	T_1	T_2	T_3		T_1	T_2	T_3
Palm kernel oil	70 ml	60 ml	50 ml	127	8.89	7.62	6.35
White chocolate	30ml	40 ml	50 ml	300/kg	9	12	15
Pistachio	2.5g.	2.5g.	2.5g.	1600/kg	4	4	4
Almond	2.5g.	2.5g.	2.5g.	750/kg	1.87	1.87	1.87
Total Weight	105	105	105		23.76	25.49	27.22
Weight of couvertures per kulfi/gm	4.73	5.04	5.31		1.31	1.34	1.51

Conclusion
In view of the experimental result obtained during the present investigation, it may be concluded that white chocolate couverture can be used for coating kulfi stick, among the various combination it was found that the treatment with 40% white chocolate and 60% palm kernel oil was best as for as sensory and other physico-chemical characteristic is considered. However other treatment ie 30% white chocolate and 70% palm kernel oil as well as 50% white chocolate and 50% palm kernel oil obtained satisfactory result as for as sensory score is considered at the overall result can be rated as $T_2 \geq T_3 > T_1$.

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