



Preparation and Sensory Evaluation of Date Yoghurt Ice Cream – A Potential Healthy Dairy Product

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Abstract | Due to consumers' concerns about the use of cane sugar in dairy products, scientists are looking for alternative sweetening options without the risk of diabetes and other diseases. The present study was conducted to prepare the Yoghurt Ice Cream (YIC) from buffalo milk using date fruit as natural sweetener replacing the cane sugar. In first experiment, YIC was produced by addition of date with various levels (each of paste and chopped forms) and compared with control to select the most acceptable product. The YIC was perceived significantly lower score ($P < 0.05$) when produced with 10 and 15% of either date paste (4.22 and 4.67, respectively) or date chopped (4.11 and 4.72, respectively) in contrast to control (7.72). While it was produced with 20% of date either paste or chopped became acceptable and received statistically similar ($P > 0.05$) score for acceptability (7.72 and 7.78, respectively) compared to the control (7.72). In the second experiment, the most acceptable product (20% date of both forms paste and chopped) was selected for further sensory evaluation descriptive based. The appearance/color of YIC was noted more attractive by the addition of date chopped than the control and with date paste (score; 3.84, 3.79 and 3.67, respectively) but differences existed non-significant. In case of taste/flavor, the YIC with date chopped perceived significantly ($P < 0.05$) higher score (43.34) compared to that of control (38.28) followed by date paste YIC (34.89). However, the date paste YIC and control was found statistically similar ($P > 0.05$) for the score of body/texture (24.92, 24.70, respectively) and melting quality (3.45 and 3.51, respectively) but significantly differ ($P < 0.05$) from date chopped (27.89 and 4.36, respectively). It was concluded that the cane sugar could be replaced by the addition of 20% of date paste and/or chopped to produce acceptable YIC. Study further concludes that the YIC with addition of date chopped was found to be more attractive in appearance/color and palatable in taste/flavor than the addition of date paste.

Keywords | Dates, Evaluation, Ice-cream, Sensory, Yoghurt.

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INTRODUCTION

In dairy products, the use of cane sugar as sweetener might increase the risks for heart diseases, arteriosclerosis, glucose intolerance, dental caries, diabetes mellitus and hypertension (Anderson, 1997; Johnson and Yon 2010; Ardali and Akbarian, 2014). However, the intake of added cane sugar has been limited to less than 10 percent of total energy by the recommendation of World Health Organ-

ization (WHO, 2003; Kranz et al., 2005). Gheisari et al. (2019) also reported that the peoples have been reduced the consumption of sucrose enriched foods considering to their health and now moving towards alternative options like dates, honey etc.

Dates (fruit) are rich in natural sugars like fructose and glucose; physiologically fructose does not require insulin for absorption thus it is appropriate for diabetic patients

providing a high amount of energy, and also suitable for children and nursing mothers by supplementing them the potassium, calcium, phosphorous and iron (Amiri et al., 2014). Because of recent advances, the production of ice cream is rapidly developing technology and has become a profitable industry; over 240 different types of ice cream are produced based on various ingredients and methods of freezing (Güven and Karaca, 2002). Thus the use of natural sweetener like date can be valuable source in formulation of yoghurt ice cream mix. Therefore, considering the importance of subject current study was designed to produce the yoghurt ice cream with addition of date instead of cane sugar with acceptable level.

MATERIALS AND METHODS

The study was carried out to produce the yoghurt ice cream from whole buffalo milk with the addition of date fruit (natural sweetener) to replace the cane sugar at the laboratory of Department Dairy Technology, Faculty of Animal Production and Technology, Shaheed Benazir Bhutto University of Veterinary and Animal Sciences Sakrand. In first experiment, the yoghurt ice cream was prepared with both forms of date as paste and chopped substituting the cane sugar in contrast to control (Yoghurt ice cream with cane sugar) where ice mix was formulated as shown in Table-1. In the second experiment, on the basis of sensorial acceptance the most acceptable product of each date paste and date chopped was selected for further studies. A total of three trials each in triplicate batches were conducted to observe the statistical difference among them, and product was analyzed for sensory characteristics.

DATES PREPARATION

Date paste: The date paste was prepared as reported by Manickavasagan et al. (2013) where dried date fruit was purchased from local market and soaked in warm water for 10min to soften the flesh. The dates were recognized as 'Aseel' variety, which contained 67.11% total sugars (Momin, 2011). Then seeds removed manually and the flesh was ground in the mixer (WB National Supper blender) until a smooth homogenous paste was obtained.

Date chopped: The date chopped was made according to procedure described by Manickavasagan et al. (2013), using same date variety (Aseel) as used in date paste. A sharp stainless steel knife was used to remove the seeds and the dates were copped into small pieces of approximately 3mm cubes.

PREPARATION OF YOGHURT CULTURE

The starter culture was prepared by the fermentation of whole buffalo milk with natural yoghurt culture and purified by re-culturing it several times. This purified culture

was maintained during the experimental period.

Preparation and freezing of yoghurt ice mix: The yoghurt ice cream mix was produced according to method as reported by Guner et al. (2007) with slight modifications. The date (paste or chopped), cane sugar (in case of control) and gelatin (stabilizer) was added in the whole buffalo milk at temperature 40°C and this formulated mixture (Table-1) was heated at 90°C (5min) and cooled to 45°C. The yoghurt when reached at desired level of pH (30% of total amount of mix) was added with ice cream blend. Then this yoghurt ice mix was shifted to conventional ice cream machine and frozen for approximately 20min. Finally it was transferred to a freezer at $-18\pm 2^{\circ}\text{C}$ to harden and stored till further observations.

Acceptability of date yoghurt ice cream: The yoghurt ice cream prepared with various concentrations of date paste and date chopped was served to a panel of six judges to rate score for overall acceptability according to the method as reported by Hui (1993). A nine-point Hedonic scale of likeness or dislikeness was used where, nine was liked extremely, eight liked very much, seven like moderately, six liked slightly, five neither liked nor disliked, four disliked slightly, three disliked moderately two disliked very much and one disliked extremely.

Sensory characteristics of date yoghurt ice cream: The sensory characteristics/attributes of most acceptable product (i.e. date yoghurt ice cream either with paste or chopped at concentration 20%) were observed as method described by Nelson and Trout (1981). The panel of six judges was first experienced with different sensory attributes like appearance/color, taste/ flavor, body/texture and melting quality of the yoghurt ice cream, then samples were served at room temperature to rate the score over 10, 45, 30 and 10, respectively. Where higher score perceived for each attribute had indicated the good quality of the product.

STATISTICAL ANALYSIS

The data were analyzed according to the statistical procedure of analysis of variance (ANOVA) as reported by Gomez and Gomez (1984). In case of significant differences, the means were further computed using least significant difference (LSD) at 5% level of probability through computerized statistical package i.e. Student Edition of Statistix (SXW), version 8.1 (Copyright 2005, Analytical software, USA).

Table 1: Concentration (%) of various ingredients used in preparation of yoghurt ice mix

Type of yoghurt ice cream	Batch	Composition of yoghurt ice mix (%)				
		Whole buffalo milk	Yoghurt	Cane sugar	Date	Stabilizer (gelatin)
Control		70	30	15	0	0.2
YDP	Batch-1	70	30	0	10	0.2
	Batch-2	70	30	0	15	0.2
	Batch-3	70	30	0	20	0.2
YDC	Batch-1	70	30	0	10	0.2
	Batch-2	70	30	0	15	0.2
	Batch-3	70	30	0	20	0.2

YDP = Yoghurt ice cream with date paste, YDC = Yoghurt ice cream with date chopped

RESULTS

ACCEPTABILITY OF DATE YOGHURT ICE CREAM

The acceptability of yoghurt ice cream prepared with various concentrations of date either as paste or chopped was observed against the control yoghurt ice cream (with cane sugar), and the score rated by panel of judges is presented in Table-2. Under trial-1 the score for acceptability of yoghurt ice cream prepared either with date paste of 10 and 15% (4.17 and 5.00, respectively) or with date chopped of 10 and 15% (4.17 and 4.50, respectively) was noted statistically similar ($P>0.05$) to each other but significantly lowest ($P<0.05$) against the control sample (7.83). When date paste and date chopped at level of 20% added to yoghurt ice cream instead of cane sugar the score for acceptability (i.e. 7.67) was found statistically similar to that of control but markedly higher than date paste and date chopped (at both levels of 10 and 15%) yoghurt ice cream. In case of trial-2, addition of date paste and chopped each with concentration of 10 and 15percent in yoghurt ice cream did not receive the acceptable and/or relative ($P<0.05$) score i.e. 4.17, 4.67, 4.00 and 5.33 respectively in contrast to that of yoghurt ice cream with cane sugar (control; 7.67). While with 20% addition of either date paste or chopped the yoghurt ice cream got more acceptable score (7.50 and 7.83, respectively) than that of control but differences existed non significant ($P>0.05$), however significantly differ from yoghurt ice cream with 10 and 15% of each date paste and chopped. In trial-3 the yoghurt ice cream with 10 and 15% date paste and 15% date chopped perceived similar score (i.e. 4.33) but slightly higher ($P>0.05$) score than yoghurt ice cream with 10% date chopped (4.17) while markedly lowered ($P<0.05$) from control (7.67). However, the score for acceptability of yoghurt ice cream with 20% addition of date either in paste or chopped form (8.00 and 7.83, respectively) was recorded relatively similar to that of control but remarkably vary from yoghurt ice cream with 10 and 15% of each date paste and chopped. Further Table-2 shows that there was no any significant difference ($P>0.05$) among the trials for acceptability score of control, yoghurt ice cream with date paste and/or with date chopped at

level 10, 15 and 20% except yoghurt ice cream with date chopped at 15% of trial-2 that varied significantly from trial-1 and 2.

Further the overall average score perceived for acceptability of yoghurt ice cream prepared with date paste and date chopped against the control (with cane sugar) was computed and results are depicted in Figure-1. The average score received for acceptability of yoghurt ice cream prepared with either date paste (4.22) or date chopped (4.22) at the rate of 10% was noted significantly lowest ($P<0.05$) than the control (7.72). Similarly the yoghurt ice cream added with date paste and date chopped at the rate of 15% perceived the score (4.67 and 4.72, respectively) remarkably lower ($P<0.05$) in contrast to that of control. When the date was added at the rate of 20% in yoghurt ice cream instead of cane sugar either as paste or chopped the average score (7.72 and 7.78, respectively) rated to be statistically similar ($P>0.05$) to that of control yoghurt ice cream (7.72).

ANALYSIS OF SENSORY ATTRIBUTES OF DATE

In current study further the yoghurt ice cream prepared with 20% date paste and date chopped by replacing the cane sugar was served among the panel of six Judges to rate the score for sensory attributes against the control and results are shown in Table-3. The appearance/color of yoghurt ice cream appeared to be more attractive with addition of date chopped (score; 3.84) than the control (score; 3.79) and yoghurt ice cream added with date paste (score; 3.67) but the differences existed non significant. The yoghurt ice cream with date chopped was received remarkably ($P<0.05$) higher score for the taste/flavor (43.34) compared to control (38.28) and date paste yoghurt ice cream (34.89). The body/texture of yoghurt ice cream either with cane sugar (control) or with addition of date paste perceived statistically similar score (24.92 and 24.70, respectively), while it was significantly lower ($P<0.05$) than that of yoghurt ice cream added with date chopped (27.89). Similarly, the score for melting quality of control (3.51) and yoghurt ice cream with date paste (3.45) was rated

Table 2: Acceptability of yoghurt ice cream prepared with addition of different concentrations of dates instead of cane sugar

Addition of date as:	Concentration of date (%)	Acceptability score (maximum 9)						LSD (0.05) SE ±
		Trial-1		Trial-2		Trial-3		
		Mean	SD	Mean	SD	Mean	SD	
Control*	0.0	7.83 ^a	0.75	7.67 ^a	0.82	7.67 ^a	0.52	0.7687
Paste	10.0	4.17 ^d	0.75	4.17 ^d	0.75	4.33 ^{cd}	0.82	0.3803
	15.0	5.00 ^{bc}	0.89	4.67 ^{bcd}	1.21	4.33 ^{cd}	1.37	
	20.0	7.67 ^a	0.51	7.50 ^a	0.55	8.00 ^a	0.89	
Chopped	10.0	4.17 ^d	0.75	4.00 ^d	0.89	4.17 ^d	0.75	
	15.0	4.50 ^{cd}	1.05	5.33 ^b	0.82	4.33 ^{cd}	0.82	
	20.0	7.67 ^a	0.52	7.83 ^a	0.41	7.83 ^a	0.41	

Values with different superscripts within a row or column varied significantly from one another at P<0.05

*Yoghurt ice cream prepared with cane sugar

SD = Standard deviation

Table 3: Average score for sensory attributes of yoghurt ice cream prepared with dates instead of cane sugar

Yoghurt ice cream	Sensory attributes (Score)							
	Appearance /color (10)		Taste/Flavor (45)		Body/texture (30)		Melting quality (05)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Control	3.79	0.47	38.28 ^b	1.29	24.92 ^b	1.17	3.51 ^b	0.23
YDP	3.67	0.28	34.89 ^c	3.18	24.70 ^b	1.05	3.45 ^b	0.39
YDC	3.84	0.50	43.34 ^a	0.84	27.89 ^a	0.79	4.36 ^a	0.45
LSD (0.05)	NS		2.5101		1.2456		0.4565	
± SE			1.1776		0.5844		0.2142	

Mean values (are the average of three trials) with different superscripts within a column are significantly different from one another at P<0.05.

SD = Standard deviation; NS = Non Significant; YDP = Yoghurt ice cream with date paste; YDC = Yoghurt ice cream with date chopped

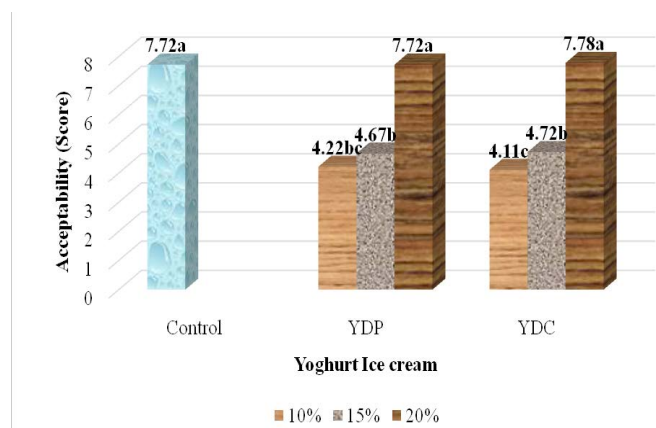


Figure 1: Overall score for acceptability of yoghurt ice cream prepared with addition of dates instead of cane sugar. LSD (0.05) = 0.5234; SE± = 0.2643

a-c: Different alphabetical letters on the bars showing significant difference at P<0.05

Yoghurt ice cream prepared with: Cane sugar= control; Date paste = YDP; and Date chopped = YDC

relatively similar to each other (P>0.05) but comparatively lesser (P<0.05) score than yoghurt ice cream with date

chopped (4.36).

DISCUSSION

The cane sugar has higher functional properties but may cause various health problems like cardiovascular diseases, hypertension, obesity and high glucose level become harmful to particularly diabetic patients (Amiri et al., 2014). However, there is a need to conduct the research on the cane sugar substitution by the addition of other sweeteners highly consumable food products. Dates are natural sweetener and excellent raw materials for the production of value-added products such as bakery yeast, single-cell protein as fodder yeast, citric acid, and date flavored probiotic fermented dairy products (Aleid, 2011). In current study it was hypothesized to produce the yoghurt ice cream with addition of date in paste and chopped form each at various levels (10, 15 and 20%) for the substitute of cane sugar and the results are discussed below.

Our results regarding acceptability of date yoghurt ice cream indicate that the addition of date either in paste or chopped form to yoghurt ice cream with the concentrations

of 10 and 15% did not preferred by the panel of judges and perceived lowest score for acceptability ($P < 0.05$) compared to the control. While the yoghurt ice cream with 20% either date paste or date chopped was rated with acceptable score, preferred by the panel of judges and received relatively similar score ($P > 0.05$) to that of control. Other researchers used the date with various concentrations as sweetening agent to replace the cane sugar in ice cream. For instance, [Alizadeh et al. \(2013\)](#) conducted the study to compare sensory properties of soft and date ice cream using date and sucrose at the ratio of 0:18.6, 3.65:13.95, 9.3:9.3, 13.95:3.65 and 18.6:0%, respectively. They reported that the suitable taste and likeness was noted higher in ice cream produced with ratio 9.3:9.3 of date and sucrose, respectively as compared to other ice creams. [Hashim and Shamsi \(2016\)](#) investigated the influence of substituting sucrose with various level of date syrup (i.e. 0, 25, 50 and 100%) on the sensory properties of ice cream. Authors stated that the sensory properties of date syrup-ice cream were similar to regular ice cream except for color, aroma and flavour and product was found to be sweetened while sucrose replaced with 100% date syrup. It is of interest to note that the product made under present study found to be acceptable and sweetened at higher concentration of date (i.e. 20%) might be due to the addition of 30% yoghurt in ice mix. However, other study conducted by [Guven and Karaca \(2002\)](#) revealed that the concentrations of cane sugar as 18, 20 and 22% were used to prepare the ice cream type frozen yoghurt. While [Lima et al. \(2016\)](#) used 13.53% of cane sugar in the formulation ice cream mix to produce the ice cream incorporated with beta-carotene encapsulated in solid lipid microparticles. Further the results of present study illustrated in [Figure-1](#) indicate that the score for acceptability of date chopped (20%) yoghurt ice cream (7.78) was slightly high compared to date paste (20%) yoghurt ice cream (7.72) and control (7.72) but differences were observed non-significant. The preference of panellists more probably due to the maintaining of freshness after freezing of mix by the date copped ([Manickavasagan et al., 2013](#)). Some other workers have also attempted the use of various types of substitutions in ice cream instead of sucrose, like stevia ([Cieslinski, 2019](#)), sucralose ([de Lima Bragion et al., 2019](#)), honey, trehalose and erythritol ([Morian et al., 2017](#)) and reported remarkable effects in terms of sensorial and technological performance.

The yoghurt ice cream with most acceptable level of date (20%) substituting the cane sugar was further analyzed for various sensory attributes in comparison of the control. The appearance/color of yoghurt ice cream with date chopped was preferred more by the panelists than control and yoghurt ice cream with date paste but the difference did not vary significantly (score; 3.84, 3.79 and 3.67, respectively). The results are in line with the findings reported by [Man-](#)

[ickavasagan et al. \(2013\)](#) where they carried out the research on an indigenous food (Idli) of India and Sri Lanka using the dates as substitute of sugar, and researchers concluded that the color of Idli with date paste obtained lowest score than the control. However, [Gheisari et al. \(2019\)](#) prepared ice cream with date pulp or liquid in replacement of sugar. They reported that the color of ice cream influenced by the concentrations of date, the partial substitution of cane sugar with date either pulp or liquid had no considerable ($P > 0.05$) effect while complete replacement with date liquid remarkably ($P < 0.05$) reduced the score for color. In present study the taste/flavor of yoghurt ice cream with date chopped was noted remarkably palatable ($P < 0.05$) followed by control and date paste yoghurt ice cream (score; 43.34, 34.89 and 38.28, respectively). Similarly, the study conducted by [Manickavasagan et al. \(2013\)](#) encourages the findings of current research, authors reported that the flavor and taste of Idli with date chopped received highest score but no differences appeared among other products i.e. control, Idli with date paste and Idli with date syrup. In present study, the date paste yoghurt ice cream and control noted as relatively similar ($P > 0.05$) for the score of body/texture and melting quality (24.92, 24.70, and 3.45 and 3.51, respectively) but significantly differ ($P < 0.05$) from date chopped (score; 27.89 and 4.36). The results for control and date paste yoghurt ice cream are in agreement with findings noted by [Mangsi et al. \(2011\)](#) where authors reported the score of body/texture as ranged from 21.5-28.50 averaged as 25.50 ± 0.42 while for the melting of quality it was 2.50 to 4.50 and averaged as 3.56 ± 0.13 . The score of date chopped found to be markedly higher the difference might be due to forms of dates as chopped probably maintained its freshness and panellists preferred more ([Manickavasagan et al., 2013](#)).

CONCLUSION

It was concluded that the cane sugar could be replaced by the addition of either date paste or chopped with concentration of 20% for the acceptable production of yoghurt ice cream. Further study concludes that the yoghurt ice cream with addition of date chopped was found to be more attractive in appearance/color and palatable in taste/flavor than the addition of date in paste form.

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Authors declare no conflict of interest.

AUTHORS CONTRIBUTION

ASM and ASJ conceived the design of experiment. ASM and AAM conducted the experiments, analyzed the data and wrote this draft. AKL assisted in the experiments, helped in writing and proof reading of this manuscript.

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