

Effect of sugar replacement with date paste and date syrup on texture and sensory quality of kesari (traditional Indian dessert)

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تأثير استبدال السكر بعجينة التمر والدبس على الملمس والجودة الحسية للحلوى الهندية التقليدية (كيساري)

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ABSTRACT. In this study, a popular Indian dessert, kesari, was reformulated by substituting refined sugar at various levels (0%=control, 25%, 50%, 75% and 100%) with date past and syrup, and changes in instrumental texture profile, L*a*b* colour values and sensory properties were determined. The hardness of date syrup kesari was higher than that of date paste kesari. However, there were no differences in hardness among various levels of replacement. There were no differences between syrup vs paste products or among various levels of replacements in cohesiveness, springiness, gumminess, adhesiveness and chewiness of kesari. The developed kesari scored 5.5 to 7.5 on a 9 level hedonic scale (like slightly-like moderately) in all sensory attributes. Replacement of sugar at 75% and 100% levels, significantly lowered the scores for most of the sensory attributes. Around 50% of the panellist in informed sensory, selected 50% replaced products (paste or syrup) as their first choice.

KEYWORDS: Date paste; date syrup; texture; sweetness; colour; kesari.

الملخص: في هذه الدراسة، تم تغيير مكونات حلوى هندية شعبية يطلق عليها كيساري، عن طريق استبدال السكر المكرر بنسب مختلفة (0، 25، 50، 75 و 100٪) بحلوى الكيساري المضاف إليها الدبس كان أعلى من تلك المنتجة بإضافة عجينة التمر. ومع ذلك، لم تكن هناك اختلافات في صلابة المنتج بين مختلف النسب المضافة. كذلك لم تكن هناك اختلافات بين تلك المنتجة بإضافة الدبس أو عجينة التمر أو بين النسب المختلفة منهما في التماسك، والمرونة، والالتصاق والمضغ. وقد سجلت الحلوى المطورة معدل 5,5 إلى 7,5 على مقياس هيدونيك 9 (أفضله قليلا - أفضله معتدل) في جميع السمات الحسية. إن استبدال السكر بنسبة 75 و 100٪، خفضت بشكل كبير القيم لمعظم الصفات الحسية. وجد أن حوالي 50٪ من المشاركين في التقييم الحسي والذين تم اطلاعهم عن المنتج مسبقاً، اختاروا المنتج (عجينة أو دبس) الذي به نسبة استبدال تقدر بـ 50٪ من بقية المنتجات كخيارهم الأول.

الكلمات المفتاحية: عجينة التمر؛ الدبس، الملمس؛ طعم حلو؛ اللون، كيساري

Introduction

Kesari is a popular semolina-based sweet which is commonly included in many varieties of south Indian meals. It is also consumed in north India as 'sheera' and 'sooji' halwa. A different version of this sweet is also common in Nepal, Bangladesh, Pakistan, Afghanistan and other countries like Albania, Azerbaijan, Bulgaria, Cyprus, Greece, Montenegro, Macedonia and Turkey. Kesari is generally made with wheat semolina, sugar and ghee. Also dry fruits, nuts and saffron are often added in different regions (Banu et al., 2013).

Sugar is an important ingredient in the preparation of enumerable sweets. It has many functional properties

in foods such as bulking agent, preservative, texturizer, humectant, dispersing agent, stabilizer, fermentation substrate, flavor carrier, browning agent and decorative agent (Pai, 2006). In the recent years there has been a lot of concern about the excessive consumption of sugar, and its effect on health. Scientific evidence demonstrates that excessive added sugar increases the risk of overweight, obesity, cardiovascular diseases, dyslipidemia, high blood pressure, tooth decay, nutrient deficiencies, and may cause hypoglycaemia and hyperactivity in children and in sensitive people (Lustig et al., 2012). The World Health Organization recommends limiting added sugar intake to <10% of total energy (World Health Organization, 2003). The food guide from the United States Department of Agriculture (USDA) recommends consumption of added sugar in the range of 6 to 10% of total energy. To minimize the intake of added sugar, and enjoy the delicious sweet taste, the natural sugar from the fruits would be the ideal solution. Fruits in its various forms have the potential to blend with the ingre-

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dients of many products both at home-preparation and industry level. There are abundant opportunities to use fruit concentrate, dried fruits and fruit powder in various food preparations to replace added sugar and add sweet taste with several healthy bioactive compounds. Dates are ideal fruits to substitute added sugar in foods. In the present study sugar was replaced by date syrup and paste in the development of Kesari.

Date is a delicious fruit with sweet taste and fleshy mouth feel. Dates consist of about 70% sugar (sucrose, glucose, and fructose) and are rich in dietary fibre, phenolic compounds and vitamins. Scientific studies have shown that dates and their aqueous extracts have demonstrated the free radical scavenging activity, inhibition of free radical-mediated macromolecular damages, antimutagenic, and immunomodulatory activities (Vayalil, 2002; Al-Farsi and Lee, 2012; Saafi et al., 2009).

Traditionally, dates have been considered as the staple food in the Arab Gulf regions. They are mainly consumed fresh or dried. In the processed form, they are consumed as paste, syrup, pickles, jams, jellies, and are used in many bakery and confectionary products together with chocolate, coconut, honey, vinegar, and others (Al-Hooti et al., 1997; Besbes et al., 2009; Manickavasagan et al., 2012, Benmeddour, et al., 2013; Abessa et al., 2013).

Manickavasagan et al. (2013) added date paste, syrup and chopped dates in idli preparation by substituting dates with sugar as an accompaniment. Manickavasagan et al. (2014) substituted sugar with date paste and syrup in the fermentation of appam batter. Eullech et al. (2014) improved halva quality using date fiber from date pulp. Aboubacar et al. (2010) used date syrup to replace sugar in Muffin. Sidhu et al. (2003) used dates to substitute sugar in pan bread. However, there are no reports using dates in any of the traditional Indian desserts. The objective of the present work was to substitute sugar with date paste and syrup in kesari preparation and determine their effect on the texture, colour and sensory

quality.

Materials and methods

Materials

Semolina (approximate particle size of 300-700 μm ; Dahabi, Oman Flour Mills Company, Muscat, Sultanate of Oman), ghee (Almarai, Almarai company, Riyadh, Kingdom of Saudi Arabia), date fruit (Khalas variety, procured from local market), date syrup (National dates, National United Manufacturing company LLC, Sultanate of Oman) and sugar were purchased from a super-market in Muscat, Sultanate of Oman.

Methods

Preparation of date paste

To make paste, the date fruits (pitted) were soaked in warm water (40°C) for 1h to soften the flesh. The flesh was ground in a mixer grinder (M/s Panasonic, Model MX-AC2105, Panasonic Corp., India) until a smooth homogenous paste was obtained (Sanchez-Zapata et al., 2011).

Preparation of Kesari bath

Control kesari: Semolina with 5 g of ghee was roasted at 140°C for 3 min. To 15 g of melted ghee, water was added (semolina to water ratio, 1:6 (w/w)). To the boiling water and ghee mixture roasted semolina was added gradually, while stirring continuously. Once semolina was cooked, sugar was added (semolina to sugar ratio, 1:1 (v/v)). An additional 15 g of ghee were added and stirred.

Reformulated kesari: Similar to control, kesari bath was prepared using date syrup and paste as sweetening agent using the same raw materials and procedures except the white sugar was replaced by increasing proportion of date syrup and paste (25, 50, 75 and 100%). The amount

Table 1. Textural attributes of Kesari prepared with date paste and syrup (n=3).

Product	Hardness	Cohesiveness	Springiness	Gumminess	Adhesiveness	Chewiness
Control (100:0)	4.44 \pm 2.73	0.13 \pm 0.01	0.30 \pm 0.09	0.95 \pm 0.15	0.23 \pm 0.08	0.25 \pm 0.09
75:25	4.57 \pm 2.30	0.11 \pm 0.01	0.404 \pm 0.09	0.73 \pm 0.44	0.24 \pm 0.02	0.27 \pm 0.09
50:50	4.69 \pm 2.84	0.13 \pm 0.01	0.343 \pm 0.11	0.87 \pm 0.44	0.27 \pm 0.06	0.27 \pm 0.08
25:75	4.78 \pm 3.66	0.15 \pm 0.01	0.314 \pm 0.14	1.34 \pm 0.71	0.30 \pm 0.07	0.36 \pm 0.06
0:100	4.82 \pm 2.99	0.47 \pm 0.05	0.274 \pm 0.08	1.44 \pm 0.41	0.33 \pm 0.03	0.19 \pm 0.04
Date paste - Kesari						
75:25	4.57 \pm 0.89	0.11 \pm 0.01	0.35 \pm 0.04	0.50 \pm 0.12	0.25 \pm 0.09	0.17 \pm 0.04
50:50	4.64 \pm 1.03	0.11 \pm 0.03	0.32 \pm 0.05	0.37 \pm 0.06	0.30 \pm 0.07	0.12 \pm 0.02
25:75	4.67 \pm 0.95	0.11 \pm 0.05	0.30 \pm 0.05	0.82 \pm 0.18	0.51 \pm 0.10	0.24 \pm 0.05
0:100	4.15 \pm 0.57	0.10 \pm 0.01	0.29 \pm 0.03	1.62 \pm 0.61	1.50 \pm 0.53	0.73 \pm 0.64

of date syrup and paste added was calculated based on the sugar content of dates (70%.) The entire experiment was done in triplicates (n=3).

Texture Measurement

A texture analyzer (Model TA XT2i, Stable Micro Systems, Surrey, England) was used to measure the force-time curve using the two-cycle compression test (Rahman and Al-Farsi, 2005). A plate (diameter 7.5 cm) compressed the Kesari cube (10 mm × 10 mm × 10 mm) placed on a mounted fixed table. The load cell was calibrated with a 5 kg weight. The equipment was set to zero automatically lowering the plate until the bottom surface of the plate just contacted the table before each experiment. Then the crosshead was allowed to descend at the rate of 2 mm/s to a total deformation 3 mm (70% compression). When the compression stroke was completed, plunger abruptly reversed its direction and started upward stroke at 5 mm/s. Then a second (down and up) cycle was run on the same sample. All operations were automatically controlled by the Texture Analyzer. The compression depth was held constant at 3 mm in all experiments. The instrument automatically recorded the force-displacement or force-time curve. The experiment was conducted in triplicates (n=3).

Colour Measurement

Colour of kesari samples was measured using Hunter Lab Colour Measuring System (LabScan XE, Hunter Associates Laboratory, Reston, USA). Values were mea-

Table 2. Mean values (standard deviation) of Hunter colour determinant (L*, a*, b*) of kesari prepared with date paste and syrup (n=3).

	L*	a*	b*
Control			
(100:0)	75.02 ^a (2.56)	-2.47 ^a (0.20)	11.74 ^a (0.69)
Date syrup - Kesari			
75:25	55.71 ^{be} (0.69)	0.97 ^b (0.08)	11.92 ^a (0.52)
50:50	53.07 ^{be} (3.46)	1.32 ^c (0.11)	11.88 ^{ab} (1.81)
25:75	44.08 ^c (4.58)	2.43 ^{dg} (0.32)	12.99 ^{ab} (0.02)
0:100	42.77 ^c (0.56)	3.30 ^e (0.22)	13.77 ^b (0.04)
Date paste - Kesari			
75:25	66.60 ^d (2.56)	0.68 ^f (0.07)	11.13 ^a (0.52)
50:50	63.99 ^d (0.94)	2.28 ^d (0.04)	11.88 ^a (0.58)
25:75	61.65 ^d (2.14)	2.63 ^g (0.14)	11.82 ^a (0.83)
0:100	57.24 ^{de} (2.69)	3.09 ^{he} (0.19)	13.06 ^b (0.82)

sured in terms of L* (lightness), a* (+a* : red, -a* : green), and b* (+b* : yellow, -b* : blue) values.

Sensory Analysis

Evaluation sheet

The samples were evaluated on a 9 level hedonic sensory scale (1- like extremely, 2 – like very much, 3 – like moderately, 4 – like slightly, 5 – neither like nor dislike, 6 – dislike slightly, 7 – dislike moderately, 8 – dislike very much, 9 – dislike extremely). The panellists were asked to test 9 attributes of the products and give a score on the hedonic scale. The attributes were: appearance (colour, surface smoothness), mouth feel (softness, chewiness, solubility, sweetness, taste), aroma and overall acceptability. The panellists were also asked to select their first choice among the given products.

Panel and sensory

The untrained panellists were randomly selected from a pool of undergraduate students and employees at Sultan Qaboos University (n=40). Two types of sensory tests (informed and blind) were conducted in four batches (10 people in each batch; total 20 blind and 20 informed). The panellists were within the age range of 19 to 50. For blind sensory evaluation, no product information was provided to the panellists, and coded samples were given, whereas in the informed sensory evaluation, the panellists were explained about the ingredients of these products. The actual names were given to the samples in informed sensory evaluation. This study was conducted at the “Sensory and Food Preparation Laboratory” of the College of Agricultural and Marine Sciences at Sultan Qaboos University.

Statistical Analysis

The effect of date type and replacement level on individual attribute of instrumental texture and sensory quality was studied by analysis of variance (ANOVA) using factorial design models with the general linear model (GLM) procedure using Statistical Analysis System software (SAS, version 8.02, SAS Institute, Inc., Cary, NC). Two factorial model (2 date products (date paste * date syrup) × 5 replacement levels (0% * 25% * 50% * 75% * 100%)) for texture analysis and three factorial model (2 date products (date paste * date syrup) × 5 replacement levels (0% * 25% * 50% * 75% * 100%) × 2 sensory type (blind * informed)) for sensory analysis were used. In each textural and sensory attribute, the differences within levels was tested at 95% confidence interval ($\alpha=0.05$) by the least significant difference (LSD) method of comparison of mean. The colour values of the reformulated products were compared with control and each other using t – test at 5% significance level.



Figure 1. Visual aspect of kesari prepared with different concentrations of date paste and syrup as replacement for white sugar.

Results and discussion

Instrumental Texture Profile

Texture attributes of kesari as affected by replacement of sugar with date syrup and paste at various levels (0, 25, 50, 75 and 100%) are given in Table 1. The values

were 4.15-4.82 N, 0.10-0.47, 0.27-0.40, 0.37-1.62, 0.23-1.50, 0.12-0.73 for hardness, cohesiveness, springiness, gumminess, adhesiveness and chewiness, respectively. The hardness of the reformulated kesari with date syrup was significantly higher than that of date paste. Otherwise, there were no differences in any other texture

Table 3. Mean value (standard deviation) of sensory scores given by 20 panellists during a blind test. Values correspond to a 9-level hedonic scale from 1: Like extremely to 9: dislike extremely.

Sugar (%)	Appearance		Mouth feel				Taste	Aroma	Overall acceptability
	Colour	Surface smoothness	Softness	Chewiness	Sweetness	Solubility			
Control									
(100:0)	7.55 (1.28)	7.20 (1.20)	7.00 (1.26)	7.05 (1.47)	7.00 (1.30)	6.8 (1.64)	7.15 (1.31)	6.60 (1.57)	7.10 (1.12)
Date syrup - Kesari									
75:25	7.15 (0.93)	7.25 (1.12)	6.70 (1.56)	6.85 (1.46)	6.10 (1.12)	6.45 (1.57)	6.50 (1.36)	5.95 (1.43)	6.50 (1.19)
50:50	7.05 (1.10)	7.15 (1.09)	6.90 (1.17)	7.00±1.45	6.90 (1.33)	6.65 (1.50)	6.70 (1.53)	5.95 (1.19)	7.00 (1.30)
25:75	7.15 (1.27)	6.90 (1.12)	7.00 (1.41)	6.85 (1.46)	6.70 (1.81)	6.50 (1.54)	7.00 (1.59)	6.60 (1.35)	7.00 (1.56)
0:100	7.25 (1.02)	7.00 (1.41)	7.05 (1.19)	7.00 (1.17)	6.80 (1.20)	6.40 (1.60)	6.80 (1.28)	6.40 (1.23)	6.80 (1.28)
Date paste - Kesari									
75:25	6.80 (1.28)	6.6 (1.35)	6.60 (1.10)	6.05 (1.47)	6.50 (1.47)	6.75 (1.21)	6.70 (1.30)	6.15 (1.14)	6.90 (1.12)
50:50	7.15 (1.04)	6.55 (0.94)	6.60 (0.99)	6.35 (1.42)	6.55 (1.28)	6.50 (0.83)	6.80 (1.28)	5.85 (0.88)	6.85 (1.04)
25:75	6.55 (0.60)	6.50 (0.95)	6.90 (1.07)	6.30 (1.66)	6.65 (1.81)	6.60 (1.23)	6.50 (1.15)	6.15 (1.27)	6.70 (1.13)
0:100	6.45 (0.94)	6.20 (1.54)	6.75 (1.25)	6.20 (1.70)	6.20 (1.74)	6.20 (1.36)	6.05 (1.43)	6.40 (1.43)	6.30 (1.59)

Table 4. Mean value (standard deviation) of sensory scores given by 20 panellists during an informed test. Values correspond to a 9 level hedonic scale from 1-Like extremely to 9-dislike extremely.

Sugar (%)	Appearance		Mouth feel				Taste	Aroma	Overall acceptability
	Colour	Surface smoothness	Softness	Chewiness	Sweetness	Solubility			
Control									
(100:0)	7.55 (1.28)	7.20 (1.20)	7.00 (1.26)	7.05 (1.47)	7.00 (1.30)	6.80 (1.64)	7.15 (1.31)	6.60 (1.57)	7.10 (1.12)
Date syrup - Kesari									
75:25	7.15 (1.14)	6.85 (1.27)	6.55 (1.54)	6.90 (1.07)	6.95 (1.00)	6.35 (1.42)	6.75 (1.16)	6.60 (1.27)	6.95 (1.32)
50:50	7.75 (1.02)	7.15 (0.81)	7.00 (1.08)	6.80 (1.06)	7.35 (1.18)	6.85 (1.18)	7.60 (1.14)	6.90 (1.25)	7.40 (0.94)
25:75	7.20 (0.89)	6.65 (0.75)	6.60 (0.94)	6.50 (1.05)	6.50 (1.61)	6.30 (1.03)	6.55 (1.47)	6.35 (1.18)	6.60 (1.39)
0:100	6.15 (1.95)	5.80 (1.36)	6.20 (1.24)	5.60 (1.35)	5.75 (1.83)	5.55 (1.32)	5.55 (1.73)	6.05 (1.50)	5.65 (1.84)
Date paste - Kesari									
75:25	6.95 (1.27)	6.70 (1.54)	6.85 (1.07)	7.05 (1.00)	6.55 (1.42)	6.85 (1.16)	6.45 (1.27)	6.90 (1.32)	6.90 (1.12)
50:50	7.10 (0.81)	7.30 (1.08)	7.20 (1.06)	7.85 (1.18)	7.00 (1.18)	7.95 (1.14)	7.20 (1.25)	7.60 (0.94)	6.85 (1.04)
25:75	6.85 (0.75)	6.95 (0.94)	6.70 (1.05)	7.20 (1.61)	6.80 (1.03)	7.15 (1.47)	6.75 (1.18)	6.85 (1.39)	6.70 (1.13)
0:100	5.90 (1.36)	6.00 (1.24)	6.10 (1.35)	5.90 (1.83)	5.45 (1.32)	5.55 (1.73)	6.40 (1.50)	5.50 (1.84)	6.30 (1.59)

attribute between date types (paste vs syrup) or within replacement levels. This indicates that date paste or syrup can be used to replace sugar without affecting the texture profiles of kesari. Hashim et al. (2009) fortified yogurt with date fiber, and reported that it was harder than control yogurt.

Instrumental Colour

The $L^*a^*b^*$ colour values of the reformulated kesari with date paste and syrup are shown in Table 2.

Addition of date paste and syrup affected the colour of kesari. Significant reduction in the L^* value in reformulated products from the control was observed. In date paste kesari, there were no differences in L^* values between replacement levels, however, it decreased with increasing replacement levels in syrup kesari. Melanins in dates are responsible for the dark colour (Roufegari-Nejad, 2002). An increase in dark colour may also be associated with increase in the antioxidant potential (Anese et al., 1999).

The 'a' value increased with replacement levels in both paste and syrup products. The red index (+a) could be related to the tannins that develop dark colour due to non-enzymatic Millard reaction that takes place during postharvest storage and handling (Roufegari-Nejad 2002). Hashim et al. (2009) reported that addition of date fiber in yogurt decreased L^* and increased a^* values. The 'b' value in 100% replaced syrup and paste kesari

products were significantly higher than the remaining products (without any difference among them).

Sensory Characteristics

The effects of replacement of sugar with date syrup and paste on the sensory characteristics of kesari are presented in Tables 3 and 4. The sensory type (blind vs informed) did not have significant effect on the sensory scores of individual attribute except aroma. Similarly, the date product (paste vs syrup) did not affect the sensory attributes except surface smoothness.

Appearance

The sensory scores for the colour attribute varied between 6.5 and 7.6 representing like moderately to like very much for all the samples. There were no differences in colour among all levels of replacement and control except 100% products. The 100% replaced products scored significantly lower colour value than other products. Similar trend was observed by Aboubacar et al. (2010) in muffins prepared with date syrup did not affect the colour up to 50%, but scored lower than control muffin while adding more syrup. The traditional colour of the kesari normally varied based on regions. In some areas, it is prepared without any colourant, and the product looks white; whereas in other places some food colourants (yellow to orange) are added.

The surface smoothness score for kesari was in the

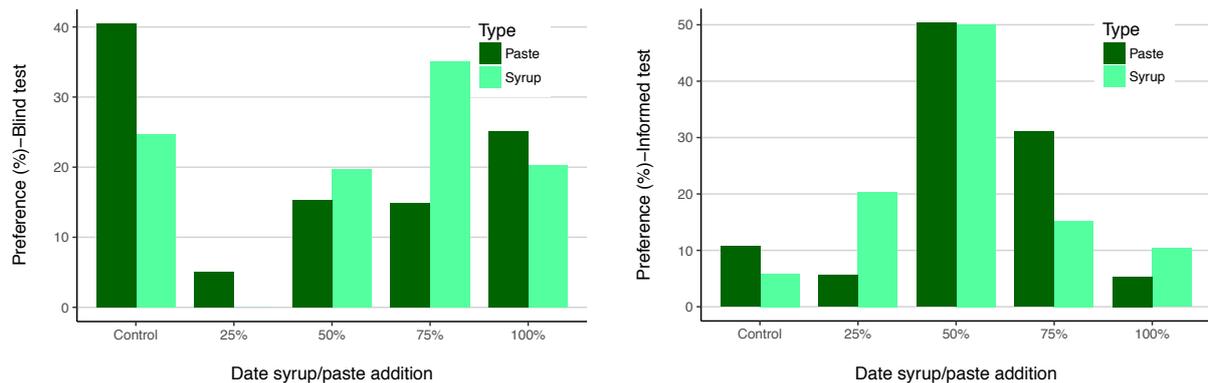


Figure 2. First choice chosen by panellists in blind (left) and informed (right) sensory tests with n=20 panellists for each test.

range of 5.8 to 7.3. The score was lower for the products blended with paste than that of syrup. This may be due to the presence of dark specs of dates skin and fibre in the product (Fig. 1).

Products blended with dates (syrup and paste) up to 50% did not differ from the control products. But 75% and 100% products scored significantly lower than control products. Manickavasagan et al. (2013) also noticed dark specs in idlis prepared with chopped dates, which scored lower than control. In general, kesari is expected to be smooth, free from any charred or burnt particles and lumps.

Mouth feel

Softness. The kesari products with 100% sugar replacement had significantly lower score for softness than control and other products (no difference among them). In another study while replacing white sugar with date syrup, Aboubacar et al. (2010) determined that up to 50% replacement of white sugar with date syrup produced similar texture and acceptance rating to that of control muffins.

Chewiness. The chewiness score for kesari were in the range of 5.6 to 7.2. The products blended with 75% and 100% dates scored significantly lower than control and other products. Replacement of sugar with dates up to 50% did not affect the chewiness of kesari.

Sweetness. The sweetness scores of kesari ranged between 5.8 to 7.4. Kesari prepared with 100% dates perceived as less sweeter than other products (no differences between control and other levels of replacements). Gouhari et al. (2005) investigated the possibilities of using date syrup to replace sucrose in ice cream at various levels of substitution (0 to 100%) and determined that up to 50% replacement did not affect the sensory properties.

Solubility. The scores given by the panellists for solubility of kesari was in the range of 5.5 to 7.0. The kesari blended with 100% dates scored significantly lower than

remaining products.

Taste. The score for the taste was from 5.6 to 7.2 during sensory evaluation. Similar to other attributes, 100% replacement kesari scored lesser value than other products.

Aroma. The aroma of the kesari products were from 5.9 to 7.2. The score was significantly higher in the informed test than blind sensory evaluation. This indicates that panellists with prior information on the the ingredients prefer the aroma of dates. Also there was no difference in aroma of reformulated products at all levels and control.

The overall acceptability of kesari products were between 5.5 and 7.6. The acceptability score was significantly lower for 100% replaced products than other products. Therefore, it may not be possible in kesari products to make complete replacement of sugar with dates. However, in some products, 100% replacement of sugar with dates are achievable. For example, Sidhu et al. (2003) used date syrup to replace sucrose in pan bread formulations (0 to 100% replacement), and determined that in spite of lower score in crumb colour of date syrup pan bread, there were no significant differences in texture and overall acceptability of control and date syrup pan breads.

In blind sensory evaluation, the first choice (most preferred product) was spread to almost all products except 25% replaced products. Less than 5% of the panellists preferred 25% replacement products (paste and syrup) category (Fig 2). However, during informed evaluation, around 50% of the panellists opted 50% replacement products (syrup or paste) as their first choice. It is evident that the product information and their health benefits must be clearly informed to the people to promote healthy products. Bowar and Saadat (1998) stated that blind sensory evaluation alone cannot reflect the real food selection, evaluation and acceptance, thus product label information must be provided in this type of studies

Conclusion

Although substitution of sugar with dates in kesari did not affect most of the instrumental textural attributes, the colour values were greatly affected even at 25% replacement level. The sensory attributes were not affected up to 50% replacement level in both date syrup and paste. In informed sensory, the explanation about ingredient information and their health benefits before sensory test significantly affected the panellist's selection of the first choice product. Further research must be carried out on the reformulation of various traditional desserts with dates and other fruits. Similarly industries should investigate the potential of new products with fruits as sweetener. It may not be possible to replace 100% added sugar in certain products; however it is still better to launch new products with partial replacements. It is also important to create awareness among people to include the fruit based products in their diet.

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