SENSORY AND NUTRITIONAL QUALITY OF SWEET RECIPES PREPARED USING DATES PALM JAGGERY

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ABSTRACT

Present study deals with preparation of experimental recipes like diamond cuts, sweet rice, sesame seeds laddoo & pumpkin kheer using dates palm jaggery. Control recipes were prepared using sugarcane jaggery. Sensory evaluation was carried out in three trials by six judges. Diamond cuts made using dates palm jaggery were highly accepted for all sensory attributes (perfect scores of 10). Appearance, colour, doneness & texture of experimental sweet rice & sesame seeds laddoo prepared using dates palm jaggery received identical mean scores (10 for very good) to that of control sweet rice & sesame seeds laddoo prepared using sugarcane jaggery. Experimental pumpkin kheer prepared with dates palm jaggery was significantly rated above control pumpkin kheer prepared with sugarcane jaggery for appearance & colour ($t=5.88$, $p<0.01$). All experimental recipes were found energy dense, good in carbohydrate, protein & fat.

Keywords: dates palm jaggery, sugarcane jaggery, sensory evaluation, energy, protein.

1. INTRODUCTION:

Jaggery is the sugarcane based traditional Indian sweetener. It is a traditional unrefined non-centrifugal sugar consumed in many countries. Jaggery is known by many different names in the world, the most important being gur, un-refined

muscovado, whole cane sugar, panela (Latin America), jaggery (South Asia) and kokuto (Japan) (Nevkar et al., 2005 & Shrivastav et al., 2016). Almost 3/4th of the cane produced in India is being utilized for producing jaggery. Jaggery is nutritious as compared to white sugar, it contains up to 50% sucrose, up to 20% invert sugars with some other insoluble matter such as ash, proteins and bagasse fibers (Ghosh & Agrawal, 1983, Rao et al., 2007).

Sugarcane is the most preferred source of jaggery. Date palms, coconut palms and the sago plant are other sources of jaggery or gur. No chemical processes are involved in the preparation of jaggery and the preparation relies heavily on a hygienic process. Mostly traditional methods are relied on to produce jaggery. Sugar is prepared from the sap of the sago, dates palm and coconut plants are the newer sources for it. Jaggery is a relatively pure and wholesome sugar, possessing high amounts of nutrients. Traditional Indian medicine or Ayurveda considers jaggery to be the most useful food in the treatment of various lung and throat infections. It is considered a better choice than refined sugars as it is a rich source of iron and other required minerals and is, therefore, highly recommended as part of a healthy lifestyle. Jaggery is ascribed with various medicinal properties and other health benefits (Said & Pradhan, 2013). Jaggery has great nutritive and medicinal value. Jaggery purifies the blood prevents the rheumatic afflictions and disorders of bile and process properties of higher order (Sahu & Saxena, 1994; Sahu & Paul, 1998). A pure and wholesome food, it shares the variety of essential amino acids, minerals and vitamins of the sugarcane juice and this is why it is considered a healthier option. It is also high on calcium which is required for maintenance of bone strength and is a healthy and delicious snack. Being rich in iron, it prevents diseases like anemia and also contains essential nutrients like magnesium and potassium (Singh et al., 2013).

Besides sugarcane jaggery, the sap collected from some palm trees such as palmyra-palm (*Borassus flabellifer* L.), coconut-palm (*Cocos nucifera* L.), wild datepalm (*Phoenix sylvestris* Roxb.) and sago-palm (*Caryota urens* L.) is used for preparation of jaggery (Pattnayak & Misra, 2004 & Nath et al., 2015). Palm jaggery is almost like a jaggery that is made out of sugarcane juice. Palm jaggery is made from the extract of palm trees in Southern India. The Jaggery is processed from the unfermented palmyra tree sap called neera. It is highly priced due to its medicinal properties (Vengaiah et al., 2013). It has an intense, earthy taste or reminiscent of chocolates in its taste. The palm jaggery obtained after processing is darker and richer

in colour. It is slight salty to taste but much healthier of the two. Due to its cooling effects over human body, it is of high value. It does not have the bone meal content which is used for whitening processed sugar. The price of the palm jaggery is more than that of sugar. The first extract of the palm juice which is boiled at high temperatures, is being added with a little salt. The added salt then acts as a preservative. This also prevents the jaggery from becoming too sweet. When it gets cooled, it is poured into a container & shaped (Singh et al., 2011).

Jaggery is a popular part of the cuisines of the Indian subcontinent and is used in the various sweet dishes preparations like candy, toffees, jaggery cakes and other similar sweet preparations. Its regular usage is advocated in the daily diet as it is a healthy and unrefined form of sugar. According to the Indian culture, it is to be eaten in the raw form before any important occasion or any new project or venture is undertaken. The sap of the date palm is regarded as the ideal source for producing the best type of sugar and it is, therefore, highly valued (Unde et al., 2011).

To meet the future sweetener requirement, the scope of jaggery seems to be promising. Present research is an attempt to prepare & evaluate the food products prepared using dates palm jaggery in comparison with sugarcane jaggery.

2. MATERIALS AND METHODS:

High grade quality dates palm jaggery & sugarcane jaggery (Kolhapuri gur) were purchased. Stages of jaggery cookery were determined **(Srilakshmi, 2015)**. Photographic representation of sugarcane & dates palm jaggery is given in Plate - I.

Plate I: Photograph of sugarcane & dates palm jaggery

Experimental recipes namely ***diamond cuts, sweet rice, sesame seeds laddoo & pumpkin kheer*** were prepared using dates palm jaggery. Recipes prepared from sugarcane jaggery were served as control. Recipes were standardized using standard procedures. Table 1 shows composition of recipes.

Table 1: Proportion of ingredients for control and experimental recipes

Sr. No.	Ingredients	Quantity of Ingredients (g)	
		Control Recipes (sugarcane jaggery)	**Experimental Recipes** (dates palm jaggery)
I	**Diamond Cuts**		
1	Refined Wheat Flour	66.5	66.5
2	Whole Wheat Flour	33.5	33.5
3	Whole Milk Powder	20	20
4	Sugarcane Jaggery	40	-
5	Dates Palm Jaggery	-	40
6	Cardamom Powder	2	2
7	Baking Powder	2	2
8	Hot Ghee	7	7
9	Salt	2	2
10	Groundnut Oil	90	90
II	**Sweet Rice**		
1	Basmati Rice	180	180
2	Sugarcane Jaggery	100	-
3	Dates Palm Jaggery	-	100
4	Wholesome Milk	90	90
5	Ghee	20	20
6	Cardamom Powder	2	2
7	Cashew Nuts	10	10
8	Raisins	5	5
9	Bay Leaf	2	2
10	Cloves	5	5
III	**Sesame Seeds Laddoo**		
1	Til/Sesame Seeds	100	100
2	Sugarcane Jaggery	150	-
3	Dates Palm Jaggery	-	150
IV	**Pumpkin Kheer**		
1	Pumpkin	100	100
2	Wholesome Milk	500	500
3	Milk Powder	30	30
4	Sugarcane Jaggery	40	-
5	Dates Palm Jaggery	-	40
6	Ghee	7	7
7	Cardamom Powder	2	2
8	Saffron	5 strands	5 strands

Sensory evaluation of control and experimental recipes was done in three palatability trials by six trained judges for various palatability attributes such as appearance, colour, doneness, consistency, texture, flavour, taste and acceptability. Scoring was done for maximum score of 10 to a minimum score of 4 for all sensory attributes (10-very good, 8-good, 6-fair and 4-poor). Key used for sensory evaluation of recipes is presented in Table 2.

Table 2: Key for sensory evaluation of recipes

Appearance	Colour	Doneness	Consistency	Texture	Flavour	Taste	Acceptability	Scores
Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Highly Acceptable	10
Good	Good	Good	Good	Good	Good	Good	Acceptable	8
Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fairly Acceptable	6
Poor	Poor	Poor	Poor	Poor	Poor	Poor	Not Acceptable	4

Nutritive value of each control and experimental recipe was calculated using food values given by **Gopalan et al. (2012), Polamarasetty et al. (2010) and USDA Nutrient Database (http://www.nal.usda.gov/fnic/).**

After gathering trial scores given by panelists, means were derived. Student's 't' test was used to compare control & experimental recipes for various sensory attributes. A level of significance at both 5 % and 1 % levels was assumed to draw conclusions.

3. RESULTS & DISCUSSION:

Good quality jaggery has a good colour & flavour, hardness, crystalline structure & good keeping quality (Srilakshmi, 2015). Experiment was carried out to assess stages of jaggery cooker & results are shown in Table 3.

Table 3: Stages of sugarcane & dates palm jaggery

Sr. No.	Doneness (Stages of Cookery)#	Temperature (^{0}C)	
		Sugarcane Jaggery	Dates Palm Jaggery
2	Thread	112	110
3	Soft Ball	113	111
4	Firm Ball	116	112
5	Hard Ball	122	120
6	Soft Crack	130	132
7	Hard Crack	135	134
8	Caramel	142	136

#Srilakshmi, 2015).

Higher temperatures were obtained for sugarcane jaggery to reach the stages of thread, soft ball & hard ball. Dates palm jaggery showed 132^{0}C for the stage 'soft crack' which was achieved by dropping the jaggery syrup into very cold water; threads were formed which were hard but not brittle. 'Hard crack' stage of dates palm jaggery was obtained at 134^{0}C which was a degree Celsius prior to that of sugarcane jaggery (135^{0}C); threads were hard & brittle. Quicker caramelization was achieved in case of dates palm jaggery as compared to sugarcane jaggery (Table 3). The stages of

boiling of jaggery were comparable with the values given for sugar in the literature (Srilakshmi, 2015).

Singh et al. (2011) stated that sugar and jaggery are the main sweetening agents which are added to beverage and foods for increasing palatability. For the present study, diamond cuts, sweet rice, sesame seeds laddoo & pumpkin kheer were developed using dates pal jaggery & the results of palatability scores & t values are shown in Table 4.

Table 4: Mean palatability scores for control & experimental recipes

Sr. No.	Sensory Characteristics	RECIPES		
		Control	Experimental	t values
I	**Diamond Cuts**			
1	Appearance	10	10	0
2	Colour	10	10	0
3	Doneness	10	10	0
4	Texture	10	10	0
5	Taste	10	10	0
6	Acceptability	10	10	0
II	**Sweet Rice**			
1	Appearance	10	10	0
2	Colour	10	10	0
3	Doneness	10	10	0
4	Texture	10	10	0
5	Taste	9.7	9.8	0.32
6	Acceptability	9.8	9.8	0
III	**Sesame Seeds Laddoo**			
1	Appearance	10	10	0
2	Colour	10	10	0
3	Doneness	10	10	0
4	Texture	10	10	0
5	Taste	9.7	9.8	0.32
6	Acceptability	9.8	9.8	0
IV	**Pumpkin Kheer**			
1	Appearance	9.5	9.8	5.88*
2	Colour	9.5	9.8	5.88*
3	Doneness	10	10	0
4	Consistency	10	10	0
5	Taste	10	10	0
6	Acceptability	10	10	0

* - Significant at both 5 % and at 1% levels ($p<0.01$)
t values without any mark indicate insignificant difference at both 5% & 1% levels ($p>0.05$)

It was noted that diamond cuts made using dates palm jaggery were highly accepted for all sensory attributes (perfect scores of 10) indicating suitability of this type of jaggery in deep fried products.

Anwar et al. (2011) developed a vitamin C enriched jaggery powder by adding through a natural source *viz.*, cut pieces of amla fruits. Said & Pradhan (2013) opined that value addition to solid jaggery by incorporating various ingredients like sesame seeds, puffed rice, gram, wheat flour, nuts like cashews & almonds, chocolate powder etc can increase demand for jaggery. They also stated that the nutritive value and palatability of different kinds of food products can be enhanced by using different proportions of jaggery. Other uses include jaggery toffees and jaggery cake made with pumpkin preserve, cashew nuts, pea nuts and spices as stated by Nath et al. (2015). Value added jaggery could serve a cheap source of nutrition to the poor and malnourished.

For the present study, appearance, colour, doneness & texture of experimental sweet rice & sesame seeds laddoo prepared using dates palm jaggery received identical scores to that of control sweet rice & sesame seeds laddoo (mean scores of 10). Experimental sweet rice & laddoo were highly liked for their taste, the mean score for which was found to be higher than control sweet rice & laddoo ($t=0.32$, $p>0.05$). These experimental products were ranked similar to that of control for overall acceptability.

For the present study, experimental pumpkin kheer prepared with dates palm jaggery was significantly rated above control pumpkin kheer prepared with sugarcane jaggery for appearance & colour ($t=5.88$, $p<0.01$). Scores for doneness, consistency, taste & acceptability of experimental pumpkin kheer were found to be identical to that of control pumpkin kheer (Table 4). Replacement of sugar in the product formulation of Nepali dish-Bomboyson (a traditional dairy product prepared by cooking khoa with ghee and sugar) by jaggery was studied by Gartaula & Bhattarai (2014) and they reported that replacing the sugar content by jaggery did not alter the overall acceptability of the product and there is increase in the mineral content of the product.

Nutrient composition of control & experimental recipes are demonstrated in Table 5.

Table 5: Nutritive Value of Control & Experimental Recipes (per 100 g)

Sr. No	Nutrients	Control Recipes				Experimental Recipes			
		Diamond Cuts	Sweet Rice	Sesame Seeds Laddoo	Pumpkin Kheer	Diamond Cuts	Sweet Rice	Sesame Seeds Laddoo	Pumpkin Kheer
1	Energy (kcal)	561.06	309.42	455	100.57	556.46	302.17	437	98.81
2	Carbohydrates (g)	45.17	59.73	67	11.8	43.8	57.58	61.64	11.28
3	Protein (g)	6.42	4.19	7.61	4.26	6.59	4.45	8.22	4.33
4	Fat (g)	35.32	6.27	17.26	4.05	40.58	6.32	17.5	4.06
8	Calcium (mg)	109.54	60.1	640	154.33	152.59	128.45	797.8	170.88
9	Phosphorus (mg)	138.25	104.25	252	116.84	141.6	109.57	265.2	118.13
10	Iron (mg)	1.75	1.42	5.3	0.51	2.54	2.67	3.72	0.59
11	Sodium (mg)	12.93	17.2	22.2	57.66	7.95	9.29	2.59	55.83
12	Potassium (mg)	367.34	280.68	63.76	184.82	359.43	268.12	60.72	181.78
13	Magnesium (mg)	56.11	88.6	96	15.42	36.49	57.44	18.6	7.87

Energy, carbohydrate & protein content of experimental recipes made out of dates palm jaggery was found to be less than control recipes made out of sugarcane jaggery. In contrast to this, fat content of experimental recipes was found to be higher than control recipes. In case of diamond cuts, this could be attributed to greater fat absorption.

Experimental recipes were found to be good in calcium & phosphorus. Iron content of recipes was also found to be fairley good. Sodium content of experimental recipes was found be less than control recipes which is because of lower sodium content of dates palm jaggery. However, potassium & magnesium content of experimental recipes were found to be slightly less than control recipes.

4. CONCLUSION:

From the results of present study, it can be said that dates palm jaggery can be incorporated in variety of recipes prepared using different cooking medium like deep fried (diamond cuts), boiled (jaggery rice), cooked (pumpkin kheer) or raw (jaggery til laddoo) without affecting palatability of recipes. Jaggery is highly priced due to its medicinal properties. Nutritive quality of all recipes made using dates palm jaggery was found to be good. These recipes can serve a vehicle for provision of essential nutrients.

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