



Physicochemical Analysis and Sensory Evaluation of Kheer Fortified with Carrot Shreds

Manojkumar R. Salunkhe¹, Pushkraj J. Sawant^{2*}, Dhruvaraj N. Sawant³ and Dinesh C. Rai²

¹Department of Animal Husbandry and Dairying, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, INDIA

²Department of Animal Husbandry and Dairying, Banaras Hindu University, Varanasi, Uttar Pradesh, INDIA

³Department of Animal Science and Dairy Science, Dr. D.Y. Patil College of Agriculture, Talsande, Maharashtra, INDIA

*Corresponding author: PJ Sawant; Email: sawantpushkraj@gmail.com

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ABSTRACT

The study was aimed at evaluating the characteristics of kheer fortified with carrot shreds. Four samples of milk and carrot shreds blends viz. T₁ (90:10), T₂ (85:15), T₃ (80:20), T₄ (75:25) was prepared with sugar at the rate of 8% and cardamom at the rate of 0.2%. The physicochemical composition of carrot kheer was affected by levels of carrot shreds in the kheer, moisture, fat and protein content decreased with increase in the amount of carrot shreds while that of total solids and ash content increased. The present investigation shows that the carrot kheer prepared with 15% carrot shreds in treatment T₂ showed maximum sensory score. The cost of production of highly acceptable carrot kheer was ₹ 108.5 per kg.

Keywords: Carrot, kheer, physicochemical analysis, sensory evaluation, cost structure

India is largest milk producing country, whose major portion i.e. about 50-55% is converted into various traditional milk products such as khoa, curd, malia, desi butter, paneer, ghee, sweet dessert, etc. (Patil *et al.* 2015). A variety of sweet desserts are prepared for various festive occasions, mainly in unorganized sector across the country (Gupta *et al.* 2014; Bankar *et al.* 2012). Among them, kheer is one which is popular all over the country. Kheer is known by different names in different parts of country such as 'Kheer' in north-western region, 'Payasam' in southern region, 'Payas' in eastern region, 'Phirni' in northern region and as 'Kheech' in Mewar region of Rajasthan. It is offered on religious occasions, social functions and festivals (Thompson, 1995;

Shivakumar *et al.* 2014). Kheer is semisolid cereal based dairy dessert, conventionally prepared by partial dehydration of whole milk in karahi over direct fire with sugar and usually rice or semolina (Shivakumar *et al.* 2014). It is preferably made from buffalo milk. The major ingredients of kheer are milk, sugar, rice, raisins, coconut powder, flavouring agents like saffron, cardamom and dry fruits such as almond, pistachio, cashewnut, etc. The recipe of kheer can be varied by replacing rice with wheat, makhana, vermicelli, semolina, and even carrot (Gupta *et al.* 2014; Jha *et al.* 2013).

Carrot is widely available in India all round the year with annual production of 4.14 lakh tonnes (Sharma *et al.* 2012). Carrot is used in manufacturing of various

milk products like flavoured milk beverages, ice-cream, whey beverages, sandesh, chamcham, rasmadhuri, rasogolla, etc. Hundred gram of carrot consist of 86 gm moisture, 0.9 gm protein, 0.2 gm fat, 10.6 gm carbohydrate, 1.2 gm fibre, 3 mg vitamin C, 15 μ g folic acid, 80 mg calcium, 30 mg phosphorus, 2.2 mg iron, 21 mg magnesium, 0.5 mg niacin and 48 kcal energy (Joy *et al.* 2001). Carrots is used for fortification due its health benefits like reducing cholesterol, prevention from heart attacks, certain cancers, improving vision, and reducing the signs of premature aging. Furthermore, carrots have the ability to increase the health of your skin, boost the immune system, aid digestion, improve cardiovascular health, detoxify the body and boost oral health in a variety of ways. They also provide a well-rounded influx of vitamins and minerals (Anonymous, 2015). Thus present study was carried out to evaluate the physicochemical and sensory properties of kheer fortified with carrot shreds.

MATERIAL AND METHODS

The experiment was conducted in laboratory of Department of Animal Husbandry and Dairying, College of Agriculture, Nagpur, Maharashtra, India. Fresh cow milk was collected from dairy farm of College of Agriculture, Nagpur. Fresh carrots, sugar, ghee and cardamom were purchased from local market.

Preparation of carrot shreds

Fresh carrots of pusa kesar variety were purchased from local market of a particular vendor to avoid variation. These were washed with clean water. The root hairs of carrot were peeled out. The uniform shreds were obtained by using stainless steel shredder. The shredded carrot was then well fried in ghee.

Preparation of kheer

The procedure given by De (1980) was followed for preparation of kheer with slight modification to it. Cow milk was filtered by passing through muslin cloth and was standardized at 4% fat and 8.5% SNF. The milk was boiled vigorously in open pan for 3-5 minutes and the calculated amount of carrot shreds earlier fried in ghee was added as per treatment. The mixture was then heated gently with stirring to which sugar at 8 percent and cardamom at 0.2% was added as per treatment. The mixture was then further heated up to 30-35 minutes till the concentration reached up to 2:1. The finished product was cooled at room temperature, then transferred to sterilized polyethylene (PE) pouches and stored at 4°C temperature in refrigerator.

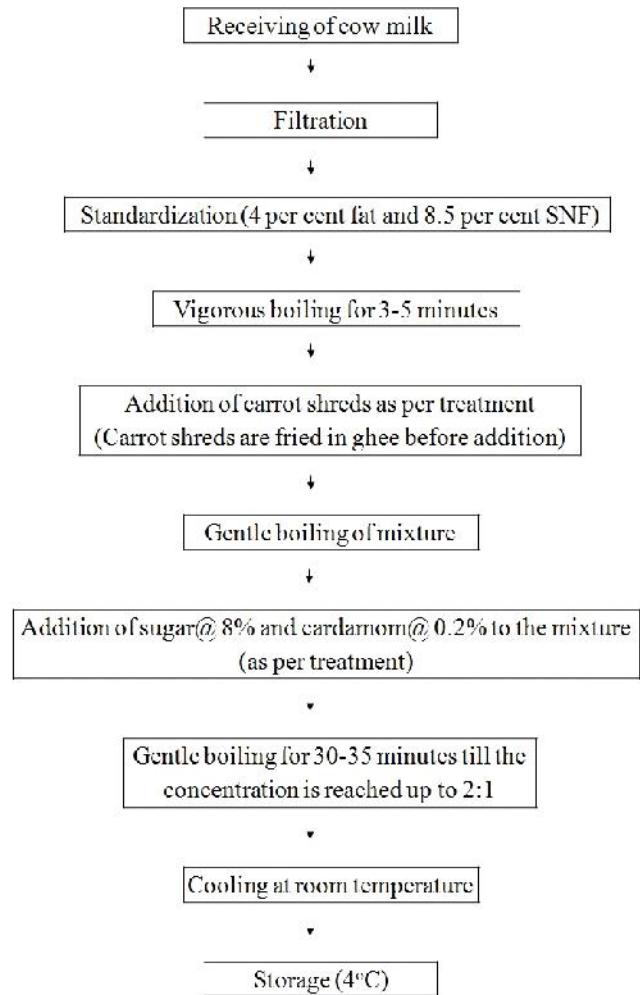


Fig. 1. Preparation of carrot kheer

Treatment details

Kheer was prepared by using four levels of carrot shreds. The level of sugar at 8% and cardamom at 0.2% is common in all treatment. The details of treatment are as follows:

$$T_1 = 10\% \text{ carrot shreds} + 90\% \text{ of milk by weight.}$$

$$T_2 = 15\% \text{ carrot shreds} + 85\% \text{ of milk by weight.}$$

$$T_3 = 20\% \text{ carrot shreds} + 80\% \text{ of milk by weight.}$$

$$T_4 = 25\% \text{ carrot shreds} + 75\% \text{ of milk by weight.}$$

Chemical analyses

The sample of finished product obtained from various treatment combinations were chemically analyzed for fat, protein, total solids, ash and moisture. The fat content was determined by method as described in IS: 1224 part II (1977), protein content, total solids content as per IS: 1479 part II (1961) and ash content as per AOAC (1990).

Table 1: Chemical composition of kheer fortified with carrot shreds

Treatment	Constituents (percent)				
	Moisture	Fat	Protein	Total solids	Ash
T ₁	69.90	7.23	5.81	30.10	1.54
T ₂	68.87	6.85	5.54	31.13	1.68
T ₃	67.85	6.45	5.25	32.15	1.84
T ₄	66.89	5.99	4.97	33.11	2.00
SE±	0.027	0.028	0.032	0.027	0.038
CD at 5%	0.083	0.085	0.097	0.083	0.012

Values with different superscripts T₁, T₂, T₃, T₄ differ significantly (p<0.05).

Table 2: Sensory evaluation of kheer fortified with carrot shreds

Treatment	Sensory score			
	Flavour (out of 45)	Body and Texture (out of 35)	Colour and Appearance (out of 20)	Overall acceptability (out of 9)
T ₁	38.54	32.22	16.61	7.83
T ₂	43.77	34.67	19.65	8.41
T ₃	42.00	33.91	18.37	8.13
T ₄	36.08	30.86	15.76	7.12
SE±	0.352	0.269	0.091	0.054
CD at 5%	1.057	0.808	0.275	0.164

Values with different superscripts T₁, T₂, T₃, T₄ differ significantly (p<0.05).

Table 3. Cost structure of carrot kheer

Treatments	Sl. No.	Particular	Cost	T1		T2		T3		T4	
				Qty (ml)	Amt (₹)	Qty (g)	Amt (Rs)	Qty (g)	Amt (₹)	Qty (g)	Amt (₹)
1	Cow milk (ml)	₹ 35 per litre	1800	63	1700	59.5	1600	56	1500	52.5	
2	Carrot (g)	₹ 30 per kg	200	6	300	9	400	12	500	15	
3	Sugar (g)	₹ 40 per kg	160	6.4	160	6.4	160	6.4	160	6.4	
4	Cardamom (g)	₹ 240 per 100 gm	4	9.6	4	9.6	4	9.6	4	9.6	
5	Cow's Ghee (g)	₹ 450 per kg	15	6.75	20	9.0	25	11.25	30	13.5	
6	Fuel charges	₹ 670/cylinder	—	10	—	10	—	10	—	10	
7	Miscellanies charges	₹ 5.0	—	5.0	—	5.0	—	5.0	—	5.0	
	Cost per Kg		—	106.75	—	108.5	—	110.25	—	112	



Moisture content was determined by subtracting percent total solids content from 100.

Sensory evaluation

The quality of four kheer samples in quintuplicate ($n=20$) was judged by sensory evaluation by offering the sample to the panel of 5 semi-trained judges at morning in between 10.00 am to 11.00 am in each trial separated by score card method suggested by Pal and Gupta (1985) and organoleptic evaluation for overall acceptability of the product was judged by nine point hedonic scale as prescribed by Nelson and Trout (1964).

Statistical analyses

The experiment was laid out in completely randomized design (CRD) with 4 treatments and 5 replications. The data obtained was statistically analyzed according to the method described by Snedecor and Cochran (1994). The significance was evaluated on basis of critical difference at 5%.

RESULTS AND DISCUSSION

Chemical analysis

The result of chemical analysis of samples is present in Table 1. The average moisture content of finished product ranges from 66.89 (T_4) to 69.90 (T_1). The values for the moisture content varied significantly ($p<0.05$). The decrease in moisture content was due to less moisture content of carrot shreds (60- 65%) as compared to milk. The results for moisture content are similar to those reported by De (1980). The values for fat content varied significantly ($p<0.05$). The fat content decreased from 7.23 (T_1) to 5.99 (T_4). The decrease in fat content was there as the carrot shreds contain less fat than milk. The results for fat content are similar to those reported by Qureshi *et al.* (2005). The minimum protein content (4.97) was found in T_4 while maximum (5.81) in T_1 . The decrease in protein was there as carrot shreds contain less protein than milk. The values for protein content varied significantly ($p<0.05$). The results for protein content were similar to those reported by Chaudhary (1989). The values for total solids content increased from 30.10 (T_1) to 33.11(T_4). The increase in total solids content was there as carrot shreds contain more total solids than milk. The results of total solids content noted for all samples were found significantly ($p<0.05$) different. The results for total solids content were more or less similar to those reported by Mani *et al.* (1955) and De *et al.* (1976). The values for ash content increased from 1.54 (T_1) to 2.00 (T_4). The increase in ash content might be due to

high mineral content in carrot shreds as compared to milk. The results for ash content were similar to those reported by De *et al.* (1976).

Sensory evaluation

The sensory scores given for various samples are present in Table 2. Kheer samples incorporated with 15% carrot shreds scored the highest score of 43.77(T_2) for flavour whereas lowest score was 36.08 (T_4). The score recorded for body and texture ranged from 32.22 to 34.67 for T_1 and T_3 treatment combination samples. The T_4 treatment combination sample had lowest score of 30.86. In case of colour and appearance, the lowest score was recorded for treatment combination T_4 i.e. 15.76 while the score was highest for treatment combination T_2 i.e. 19.65. The scores of organoleptic evaluation for overall acceptability recorded highest score for the treatment combination T_2 i.e. 8.41 over all the other treatment combinations. It is observed that the score for all the parameters increased with increase of carrot shreds in kheer to certain limit, thereafter it decreased proportionately as the higher proportion of carrot shreds decreased the overall acceptability of product. The values for all parameters varied significantly ($p<0.05$).

Cost structure

The cost of finished product for different treatment combinations is represented in Table 3. The cost per litre of finished product ranged between ₹ 106.75 to ₹ 112.00 from T_1 to T_4 treatment. The cost increased with increased level of carrot shreds due to increasingly more consumption of ghee during frying. The cost of carrot kheer with 25% carrot shreds was highest i.e. ₹ 112.00 per kg.

CONCLUSION

It may be concluded that superior quality of kheer fortified with carrot can be prepared by addition of 15 parts of carrot shreds and 85 parts of milk based on sensory evaluation.

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