

UTILIZATION OF KHAMANG RICE (*Oryza sativa*) FOR THE PREPARATION OF KHEER

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ABSTRACT

The research work entitled “Utilization of khamang rice (*Oryza sativa*) for the preparation of kheer” was carried out during the year 2017-18. Milk was standardized to 4 per cent fat and the kheer prepared with addition of khamang rice at 1.5% (T₁), 2% (T₂), 2.5% (T₃) and 3% (T₄) per cent by weight of milk. The results of four treatments with five replications were statistically analyzed by using completely randomized design (CRD). The data regarding fat, total solids, protein, ash, moisture and evaluation of sensory characteristics like flavour, body and texture, colour and appearance and overall acceptability were subjected to statistical analysis. Total solids, protein and ash percentage of kheer were increased with increase in the level of khamang rice and fat and moisture percentage were decreased with increase in the level of khamang rice. The sensory evaluation was (overall acceptability) carried out by the judges and showed that kheer prepared by adding with 3 parts khamang rice (T₄) had secured the highest score (97.40) and ranked as acceptable treatment. This kheer contained 5.31 per cent fat, 39.56 per cent total solids, 3.78 per cent protein, 1.61 per cent ash and 60.44 per cent moisture. The cost of production of kheer was increase with the increase in the level of khamang rice. The cost of production was higher in treatment T₄ with the addition of 3 parts khamang rice (Rs.86.00 kg⁻¹) which was superiorly accepted by the panel of judges. Hence, it is inferred that superior quality kheer can be prepared by addition of 3 per cent of khamang rice.

(Key words: Kheer, khamang rice, physicochemical parameters, sensory attributes, cost, structure)

INTRODUCTION

The term kheer (used in North India) may derive Sanskrit word from ksheeram (which means milk). Kheer is known by different names, in different parts of the country, such as ‘kheer’ in North Western region, ‘payasam’ in Southern region, ‘payas’ in Eastern region, ‘phirni’ in Northern region, ‘kheech’ in Mewar region and ‘payesh’ in Bengal, (Aneja *et al.*, 2002).

Kheer is one of the most common traditional dairy desserts which is mainly offered on religious occasions, social functions and festivals. Kheer has evolved itself to suit regional and personal preferences (Kadam *et al.*, 2011). It is a semi solid cereal-based dairy dessert prepared by cooking rice with sugar or jaggery in milk till the point when rice starch gets gelatinized. The major ingredients of kheer are milk, sugar, rice, dry fruits and flavoring ingredients (Jha *et al.*, 2015).

Traditional Indian products include several innovative blends used in the preparation of variety of milk based delicacies. Kheer, a sweet milk-rice confection, finds mention as payasa in Buddhist- Jain literature in 400 BC. Kheer is a very delicious cereal based indigenous milk product. It is popular throughout the country, and enjoyed by all sections of the society, because of its good taste, higher nutritional value and relatively lowers cost. Conventionally, it is prepared by partial dehydration of whole milk in a karahi over a fire together with sugar and usually rice or semolina (De *et al.*, 1976). Rice (*Oryza* spp.) is one of the most important food crops in the world, being planted on almost 11 per cent of the Earth’s cultivated land area over a wide number of ecosystems (Khush, 2005 and Maclean *et al.*, 2002).

Fragrant rice is an aromatic rice in which the flavour is slightly less pronounced than Basmati. The length and slenderness of the grains suggest that they should remain separate on cooking but it differs from other long grain rice in that it has a soft and slightly sticky texture when cooked.

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This rice is good with Chinese and South East Asian food. (Schenker, 2012). 'Khamang' is the variety of fragrant rice developed at Zonal Agricultural Research Station, Sindewahi Dr. PanjabraoDeshmukhKrishiVidyapeeth, Akola. This variety having more yield potential as compared to local variety and also pleasant smell.

Keeping these in mind, the present study entitled "Utilization of khamang rice (*Oryza sativa*) for the preparation of kheer" was undertaken with the objectives to find out the suitable level of khamang rice along with sensory evaluation, physico-chemical quality and its cost structure.

MATERIALS AND METHODS

The present investigation on "Utilization of khamang rice (*Oryza sativa*) for the preparation of kheer" was carried out at the Section of Animal Husbandry and Dairy Science, College of Agriculture, Nagpur during the year 2017-2018. During the entire study fresh, clean, whole cow milk was obtained from Animal Husbandry and Dairy Science section, College of Agriculture, Nagpur. The milk was strained through clean muslin cloth and transferred into well cleaned and sterilized flat bottom stainless steel vessel. Dry and clean khamang rice soaked in water for 3 hrs used for preparation of kheer.

Fresh cow milk was standardized at 4 per cent fat and 8.5 per cent SNF and then it was taken in an iron karahi and heated on gentle fire. At the time of boiling, milk was stirred with the help of stainless steel ladle in a circular manner. For adequately cooking and concentrating the initial kheer mixture, it was boiled and reduced to 40 per cent volume. Thus, table servable kheer contained 1.5, 2, 2.5 and 3 per cent khamang rice paste in khamang rice based kheer.

Treatment details

T₁ = 98.5 Parts of cow milk + 1.5 parts of khamang rice

T₂ = 98.0 Parts of cow milk + 2.0 parts of khamang rice

T₃ = 97.5 Parts of cow milk + 2.5 parts of khamang rice

T₄ = 97.0 Parts of cow milk + 3.0 parts of khamang rice

Note: 8 per cent sugar was common in all treatments.

Chemical analysis of kheer

Determination of fat

Fat content in kheer was determined by Mojonnier fat extraction apparatus method as prescribed by Anonymous (1981).

Determination of total solids

The percentage of total solids in kheer was determined by using gravimetric method as prescribed by Anonymous (1961).

Determination of protein

The protein content in kheer was determined as per the procedure recommended by Anonymous (1961).

Determination of ash

The ash content in kheer was determined as per the method recommended by Anonymous (1980).

Sensory evaluation

The quality of kheer was judged by offering the sample to the panel of 5 judges in each trial separately by Score card method for sensory evaluation of kheer as suggested by Pal and Gupta, (1985).

Characters	Perfect score
Flavour	45
Body and texture	35
Colour and appearance	25
Total	100

Overall acceptability was determined by a trained sensory panel (minimum of 6 members) on a 9-point hedonic scale as prescribed by Nelson and Trout (1964).

Hedonic rating

Sr. No.	Remarks	Score
1	Like extremely	9
2	Like very much	8
3	Like moderately	7
4	Like slightly	6
5	Neither like nor dislike	5
6	Dislike slightly	4
7	Dislike moderately	3
8	Dislike very much	2
9	Dislike extremely	1

Note:- Score of 5.5 and above indicates acceptability within the score of 1 to 9.

Statistical analysis

The experiment was laid out in CRD with four treatments in five replications. The data obtained were analyzed statistically according to method described by Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The finished product of khamang rice kheer was subjected for the proximate analysis viz., fat, total solids, protein, ash and moisture. The results obtained on account of these parameters are presented in table 1.

Fat content

The fat content in the finished product formulated under the different treatment combinations was estimated. The mean fat content in kheer samples was significantly affected due to the addition of khamang rice at different levels. The fat content in the kheer prepared with addition of khamang rice at 1.5 per cent (T₁), 2 per cent (T₂), 2.5 per cent (T₃) and 3 per cent (T₄) were recorded as 5.81, 5.67, 5.50 and 5.31 per cent, respectively. The results indicated that, with the increased levels of khamang rice significantly reduced fat percentage of kheer. This might be due to the fact that fat content of khamang rice was considerably less

as compared to the fat content of milk. On contrary, Desale *et al.* (2017) reported that the fat content in rice kheer was ranged from 1.75 to 2.53 per cent.

Total solids content

The average total solids content in kheer samples was significantly affected due to the addition of khamang rice at different levels. The total solids content in the kheer prepared with the addition of khamang rice at 1.5 per cent (T_1), 2 per cent (T_2), 2.5 per cent (T_3) and 3 per cent (T_4) were recorded as 36.42, 37.23, 38.40 and 39.56 per cent, respectively. The total solids percentage was significantly highest (39.56 per cent) in kheer prepared with the addition of 3 per cent of khamang rice (T_4) while, total solids content was lowest (36.42 per cent) in kheer prepared with the addition of 1.5 per cent of khamang rice (T_1). The results indicated that, with the increase in the levels of khamang rice significantly increased total solids percentage of kheer. This might be due to the fact that total solids content of khamang rice was considerably more as compared to the total solids content of milk. The present findings are in agreement with the results obtained by Unnikrishnan *et al.* (2000), who reported 38.4 per cent total solids content in rice payasam. Likewise, Deshmukh *et al.* (2017), analyzed total solids content of poppy seeds kheer in different proportions of cow milk with poppy seeds i.e. 98:02, 96:04 and 94:06 with one control i.e. 97.5:2.5 cow milk with rice and found 37.00, 38.89, 41.42 and 35.02 per cent total solids respectively.

Protein content

The mean protein content in kheer samples was significantly affected due to the addition of khamang rice at different levels. The protein content in the kheer prepared with addition khamang rice at 1.5 per cent (T_1), 2 per cent (T_2), 2.5 per cent (T_3) and 3 per cent (T_4) were 3.69, 3.73, 3.76 and 3.78 per cent, respectively. The protein percentage was significantly highest (3.78 per cent) in kheer prepared with addition of 3 per cent of khamang rice (T_4) while, protein content was lowest (3.69 per cent) in kheer prepared with addition of 1.5 per cent of khamang rice (T_1). The results indicated that with the increase in the levels of khamang rice there was significantly increase in protein percentage of kheer. This might be due to the fact that protein content of khamang rice was considerably more (8.20 per cent) as compared to the protein content of milk. On contrary, Desale *et al.* (2017) recorded higher amount of protein content in different combination of Basmati and Govindbhog rice. They recorded protein content in the range of 5.28 to 5.65 per cent, when kheer prepared with Basmati as control and Govindbhog rice (3.5 to 4.5 %) under different combination with cow milk. Likewise, more or less similar trends pertaining to protein content (5.28 to 5.65 %) was found in kheer prepared with buffalo milk and sweet potato / rice combination (Dadge *et al.*, 2014).

Ash content

The ash content in kheer samples was significantly affected due to the addition of khamang rice at different levels. The ash content in the kheer prepared with the

addition khamang rice at 1.5 per cent (T_1), 2 per cent (T_2), 2.5 per cent (T_3) and 3 per cent (T_4) were recorded as 1.38, 1.45, 1.57 and 1.61 per cent, respectively. The ash percentage was significantly highest (1.61 per cent) in kheer prepared with addition of 3 per cent khamang rice (T_4) while, ash content was lowest (1.38 per cent) in kheer prepared with addition of 1.5 per cent khamang rice (T_1). The results indicated that with the increased levels of khamang rice there was significantly increase in ash percentage of kheer. This might be due to the fact that ash content of khamang rice was considerably more as compared to the ash content of milk. More or less similar results were reported by Deshmukh *et al.* (2017), they prepared kheer with different combinations of cow milk and rice / poppy seeds as 97.5:2.5 (T_1), 98:02 (T_2), 96:04 (T_3) and 94:06 (T_4) and found ash content as 1.37, 1.46, 1.52 and 1.65 per cent, respectively. While, kheer prepared with different combinations of cow milk and carrot shreds as 90:10 (T_1), 85:15 (T_2), 80:20 (T_3) and 75:25 (T_4) per cent and ash content recorded as 1.54, 1.68, 1.84 and 2.00 per cent, respectively, (Salunkhe *et al.*, 2015). These results are comparable with the result of present study.

Moisture content

The moisture content in kheer samples was significantly affected due to the addition of khamang rice at different levels. Moisture contents in the kheer prepared with addition of khamang rice at 1.5 per cent (T_1), 2 per cent (T_2), 2.5 per cent (T_3) and 3 per cent (T_4) were 63.61, 62.77, 61.60 and 60.44 per cent, respectively. The moisture per cent was significantly highest (63.61 per cent) in kheer prepared with addition of 1.5 per cent khamang rice (T_1) while, moisture content was lowest (60.44 per cent) in kheer prepared with addition of 3 per cent khamang rice (T_4). The results indicated that, with the increase in the levels of khamang rice there was significant reduction in moisture percentage of kheer.

More or less similar results were reported by Deshmukh *et al.* (2017), they prepared kheer with different combinations of cow milk and rice / poppy seeds as 97.5:2.5 (T_1), 98:02 (T_2), 96:04 (T_3) and 94:06 (T_4) were 64.98, 62.96, 60.92 and 58.40 per cent, respectively. On contrary, moisture content of carrot shreds in different proportions of 90:10 (T_1), 85:15 (T_2), 80:20 (T_3) and 75:25 (T_4) milk to carrot shreds were 69.90, 68.87, 67.85 and 66.89 per cent, respectively. This might be due to the fact that moisture content of carrot shreds was considerably less as compared to the moisture content of milk (Salunkhe *et al.*, 2015). These results are comparable with the result of present study.

Sensory evaluation of kheer

The quality of khamang rice kheer was judged by sensory evaluation in respect of flavour, body and texture and colour and appearance by a trained panel of judges on a 100-point scale as prescribed by Pal and Gupta (1985).

The data with respect to sensory evaluation of kheer are presented in table 2.

Flavour

The flavour score of kheer prepared with addition

of khamang rice at 1.5 per cent (T_1), 2 per cent (T_2), 2.5 per cent (T_3) and 3 per cent (T_4) were recorded as 40.20, 40.60, 41.20 and 43.80 per cent, respectively. Significantly highest score (43.80 out of 45) was obtained by kheer prepared with 3 per cent khamang rice (T_4) as compared to other treatments. The khamang rice (T_4) was appreciated, followed by T_1 , T_2 and T_3 treatments. The khamang rice kheer prepared with 3 parts (43.80) of khamang rice was superior over 1.5, 2 and 2.5 parts / levels. Barela and Shelke (2017) prepared kheer in different proportions of 100:00 (T_1), 90:10 (T_2), 80:20 (T_3), 70:30 (T_4) and 60:40 (T_5) cow milk to coconut milk. The kheer prepared with 20 parts (score 43.20) of coconut milk was superior over 10, 30 and 40 parts / levels. It was noticed that increased in the levels of coconut milk resulted in better flavour of kheer up to certain limit. Salunkhe *et al.* (2015) prepared kheer by using different levels of carrot shreds. The carrot shreds kheer prepared with 15 parts (score 43.77) of carrot shreds was superior over 10, 20 and 25 parts / levels.

Body and texture

The body and texture score of kheer prepared with addition of khamang rice at 1.5 per cent (T_1), 2 per cent (T_2), 2.5 per cent (T_3) and 3 per cent (T_4) were recorded as 31.20, 31.40, 32.00 and 34.60 per cent, respectively. Significantly highest score (34.60 out of 35) was obtained by kheer prepared with 3 per cent khamang rice (T_4) as compared to other treatments. The khamang rice (T_4) was appreciated, followed by T_1 , T_2 and T_3 . The kheer prepared with 3 parts (34.60 out of 35) of khamang rice was superior over 1.5, 2 and 2.5 parts levels. Salunkhe *et al.* (2015) prepared kheer by using different levels of carrot shreds. The carrot shreds kheer prepared with 15 parts (score 34.67 out of 35) of carrot shreds was superior over 10, 20 and 25 parts levels. Barela and Shelke (2017) prepared kheer in different proportions of 100:00 (T_1), 90:10 (T_2), 80:20 (T_3), 70:30 (T_4) and 60:40 (T_5) cow milk to coconut milk. The kheer prepared with 20 parts (score 34.67 out of 35) of coconut milk was superior over 10, 30 and 40 parts levels.

Colour and appearance

The colour and appearance score kheer prepared with addition khamang rice at 1.5 per cent (T_1), 2 per cent (T_2), 2.5 per cent (T_3) and 3 per cent (T_4) were recorded as 15.80, 16.60, 17.40 and 19.00 per cent, respectively. Significantly highest score (19 out of 20) was obtained by kheer prepared with 3 per cent khamang rice (T_4) as compared to other treatments. The khamang rice kheer (T_4) was appreciated, followed by T_1 , T_2 and T_3 . The kheer prepared

with 3 parts of khamang rice was superior over 1.5, 2 and 2.5 parts levels. More or less similar results were reported by Deshmukh *et al.* (2017). They prepared kheer from cow milk with addition of poppy seeds. The kheer prepared with 2 parts (19 out of 20) of poppy seeds was superior over 2.5 parts rice (T_1), 4 (T_3) and 6 (T_4) parts poppy seeds. These findings are in line with the findings of present study.

Overall acceptability

Organoleptic evaluation for overall acceptability of product was determined by 9 point Hedonic scale as suggested by Nelson and Trout (1964).

The mean scores for overall acceptability of kheer prepared in the proportion of 98.5:1.5 (T_1), 98:2 (T_2), 97.5:2.5 (T_3) and 97:3 (T_4) cow milk to khamang rice were recorded as 6.60, 7.60, 7.80 and 8.60, respectively. Hence, it is inferred that increase in the levels of khamang rice resulted in better overall acceptability score of kheer. Similarly Aneja *et al.* (2002) opined that the rheological properties of kheer serve as important acceptability parameters. Studies on body and texture of kheer have found improvement in the sensory score from 6.9 to 8.5 (On 9 point Hedonic scale). Deshmukh *et al.* (2017) reported scores for overall acceptability of kheer prepared in the proportion of 97.5:2.5 cow milk to rice (T_1), 98:2 (T_2), 96:4 (T_3) and 94:6 (T_4) cow milk to poppy seeds were 7.58, 8.32, 6.27 and 5.11, respectively. Durgrao *et al.* (2017) prepared instant rice. The overall acceptability of Basmati rice was highest as compared to the Indrayani rice. The overall acceptability of Basmati rice was highest i.e. (9). The overall acceptability of Indrayani rice was lowest i.e. (7). The instant Basmati rice had scored maximum (8) flavour values, whereas instant rice of Indrayani and HMT rice scored minimum (7) flavour values respectively. Flavour was main criteria that make the product to be liked or disliked.

Cost of production

The cost of production of 1 kg khamang rice kheer ranged from Rs. 81.40 to 86.00. The cost of production of different treatment combinations was Rs. 81.40, Rs. 82.93, Rs. 84.47 and Rs.86.00 for treatments 98.5:1.5 (T_1), 98.0:2.0 (T_2), 97.5:2.5 (T_3) and 97.0:3.0 (T_4) respectively parts of cow milk to khamang rice. The cost of production increased with the increase in the levels of khamang rice. Lowest cost of production (Rs. 81.40) was recorded in case of kheer prepared with addition of 1.5 per cent khamang rice (T_1). However, the cost of production (Rs. 86.00) of kheer with 3 per cent khamang rice (T_4) was found to be best treatment as selected by panel of judges for sensory evaluation.

Table 1. Physico-chemical attributes of kheer as affected by different levels of khamang rice (per cent)

Treatments	Fat	Total solids	Protein	Ash	Moisture
T ₁ = 98.5 Parts of cow milk + 1.5 parts of khamang rice	5.81 ^a	36.42 ^d	3.69 ^d	1.38 ^d	63.61 ^a
T ₂ = 98.0 Parts of cow milk + 2.0 parts of khamang rice	5.67 ^b	37.23 ^c	3.73 ^c	1.45 ^c	62.77 ^b
T ₃ = 97.5 Parts of cow milk + 2.5 parts of khamang rice	5.50 ^c	38.40 ^b	3.76 ^b	1.57 ^b	61.60 ^c
T ₄ = 97.0 Parts of cow milk + 3.0 parts of khamang rice	5.31 ^d	39.56 ^a	3.78 ^a	1.61 ^a	60.44 ^d
SE ±	0.0057	0.056	0.004	0.007	0.045
CD @ 5 %	0.0167	0.167	0.012	0.021	0.134

Table 2. Combined table for sensory attributes of kheer as affected by different levels of khamang rice

Treatments	Flavour(45)	Body and texture(35)	Colour and appearance(20)	Overall acceptability hedonic scale (out of 9)
T ₁ = 98.5 Parts of cow milk + 1.5 parts of khamang rice	40.20 ^b	31.20 ^b	15.80 ^d	6.60 ^c
T ₂ = 98.0 Parts of cow milk + 2.0 parts of khamang rice	40.60 ^b	31.40 ^b	16.60 ^c	7.60 ^b
T ₃ = 97.5 Parts of cow milk + 2.5 parts of khamang rice	41.20 ^b	32.00 ^b	17.40 ^b	7.80 ^b
T ₄ = 97.0 Parts of cow milk + 3.0 parts of khamang rice	43.80 ^a	34.60 ^a	19.00 ^a	8.60 ^a
SE ±	0.41	0.34	0.25	0.23
CD @ 5 %	1.22	1.00	0.75	0.69

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