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Development of a Process and Standardization of Parameters for the Manufacture of Kheer

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Abstract
Kheer is a cereal based Traditional Indian Dairy Product. It is very popular all over the India. The processing or manufacturing of the kheer in different region is done by different method and the ingredients used in the kheer having different proportions. The present investigation deal with the standardization of the methodology for processing of the kheer and selection of different types of ingredients used in kheer at different level. The parameters were standardized based on sensory evaluation of kheer based on 9 point hedonic scale by panel of judges. Basmati with long grain gave proper cooking, consistency as well as aesthetic as compared to Gujarat-17. The standardized pasteurized milk, 2 times concentration of milk, level of rice at 7% of concentrated milk, pre-cooking of rice at 90°C for 10 min and 12% level of sugar were finalized for manufacture of kheer.

1. Introduction

Kheer is popular in the northwest, central and eastern parts of the country, and is popular as *Payasam* in the southern states. It has been the premier milk delicacy associated with festivities and celebration from time immemorial. Hindu mythology refers, to it as the celestial nectar, 'Amrit' or elixir and gives it a place of prominence among foods as the secret of immortality- the life giving food. The two great epics of the Hindu mythology provide evidence of its popularity. Since those times of kings and nobles, kheer has maintained its place of prominence in the Indian diet. No festival is considered complete without kheer as dessert. Looking towards the nutritional value of kheer, it contains solids of milk in approximately two fold concentration plus additional, rice and sugar, the food nutritive value of kheer is fairly high. The average shelf life of kheer reported by De (1991) is 2-3 days at 37±1˚C and 10-15 days at 4±1˚C [1]. Sukumar De *et al.* (1976) studied the effect of Fat content in milk, level of rice and sugar content in kheer on final quality of kheer [2]. In present investigation we have taken the parameters like type of milk, level of concentration of milk, type as well as level of rice, pre-cooking of rice and level of sugar on sensory quality of final product.

2. Material and Methodology

This experiment anticipated the process standardization for kheer. It involved optimization of selected important process parameter such as varying level of milk concentration, rice and sugar addition which has influenced the quality of the final product. It involved pre-cooking of rice to improve rice cooking and viscosity of the final product. All the trials and experimental samples manufactured were analyzed for their sensory properties.

2.1 Selection of raw materials

2.1.1 Milk

The four types of milk were used in the investigation viz. Whole milk (6.0 % Fat and 9.0 % SNF), Standardized Pasteurized milk (4.5 % Fat and 8.5 % SNF), Tonned milk (3 % Fat and 8.5 % SNF) and Double Tonned milk (1.5 % Fat and 9.0 % SNF) procured from the same brand.

2.1.2 Rice (Oryza sativa)

Basmati long grain and Gujarat - 17 variety of rice were used for the preparation of kheer and obtained from the local market of Anand. The rice were added in concentrated milk at the rate of 5, 6, 7, 8 and 9 % of concentrated milk.

2.1.3 Sugar

A fine crystalline sugar (sucrose) of commercial grade was obtained from the local market of Anand. The sugar was added in concentrated milk at the rate of 9, 10, 11, 12 and 13 % of concentrated milk.

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2.1.4 Additives

Good quality green cardamom, nutmeg and charoli were obtained from the local market of Anand.

2.2 Concentration of milk

2.2.1 Open Pan Concentration

A Batch type open pan (Khoa Kettle) was used for concentration of milk. The capacity of kettle was 40 liter and 10 liter of milk was taken for the concentration. A steel scrapper was used for continuous agitation of milk to avoid burning of particle at the surface of kettle.

2.2.2 Scraped Surface Heat Exchanger

SSHE used for concentration of milk was installed in the laboratory of Dairy Engineering, SMC College of Dairy Science, AAU, Anand. The milk was concentrated 1.5, 1.75, 2.0, 2.25 and 2.5 times for different trials.

2.3 Method of manufacture of kheer

The milk was standardized first for different Fat and SNF content followed by concentration at different level. Similarly the rice were cooked at different time temperature combination in water (water: rice = 6:1 (v/w)). The concentrated milk, cooked rice, sugar and other flavoring additives are mixed in different proportions followed by heating and cooling to storage temperature. The final product was analyzed for sensory evaluation.

3. Result and Discussion

Kheer was prepared using the method described in section 2.3. The different processing parameters and level of ingredients were used in different trials. The effect of the parameters are discussed as-

3.1.1 Type of Rice

Rice is an important ingredient of kheer responsible for the typical body and other attributes. Kheer quality is likely to be affected by the type of rice used, because different types in terms of variety etc. have widely varying cooking characteristics. Rice is available in many different variety like viz. Basmati (long grain), Gujarat-17. Selection of rice variety for kheer preparation was decided on basis of trials. Both varieties of rice were used and kheer was manufactured. The results for preference of kheer using both variety of rice for manufacture of kheer is presented in Table 1.

Table 1: Results of preference of kheer prepared using different variety of rice

Variety	Observations recorded
Basmati	Basmati with long grain gave proper cooking, consistency; the separation of each grain from one another as well as aesthetic as compared to Gujarat-17 and gave higher sensory score.
Gujarat17	

It can be seen from the Table 1 that products prepared using Gujarat-17 and basmati had significantly low preference compared to products prepared using Basmati long grain. Hence, basmati long grain was selected and used throughout the study.

3.1.2 Rice Level

This part of the study was conducted to select the range of rice for the manufacture of acceptable flavor and body characteristics in kheer. Preliminary trials were taken in that five level of rice viz. 5, 6, 7, 8, and 9% were employed. Kheer was prepared using the method given in Section 2.3. The results are presented in Table 2 and it can be seen that a highly acceptable kheer was obtained when a rice level of 5 to 9% was used. Hence, the level of rice selected was 7 %.

Table 2: Effect of rice level on the acceptability of kheer

Rice% of concentrated milk	Preference based on organoleptic evaluation	Observations recorded
5	-	Very less rice
6	-	Less rice
7	++	Optimum rice level
8	+	Slightly higher rice level
9	-	Excess of rice level

++ acceptable; + fair; - not acceptable

3.1.3 Processing of Rice

In the method for preparation of kheer rice were pre-cooked at 90°C for 10 min. This resulted in kheer having good body properties. In preliminary studies it was observed that higher pre cooking temperature i.e. higher than 95°C and longer cooking periods (more than 10 min) resulted to adverse change in its length and showed very soft rice grain (over cooked). While lower pre-cooking temperature below 90˚C and shorter cooking period (less than 10 min.) resulted in hard rice grain (under cooked) and had less length. Moreover, kheer prepared from such rice had unacceptable body. Water up take capacity of basmati long grain is higher as compare to other variety of rice viz. Gujarat-17. Therefore in trials it is observed that basmati rice need 6 times higher water for cooking. Kheer prepared from such ice had good consistency and there were no any lumps in the product. In literature it has been reported that the kheer made from basmati grains was most acceptable textural quality as compare to that from other rice variety (Chaudhary, 1989; Bandhopadhyay, 1995). Kheer was prepared using the method described in Section 2.3 and rice was pre-cooked at 90˚C for 10 min. this treatment for processing of rice was selected in the study.

3.1.4 Selection of Milk

Trials were conducted for selection of milk for kheer preparation. In that four types of milk were used to prepare kheer and according to sensory attributes effect of type milk on sensory score was observed. There was significant difference between flavour score of the product prepared from different type of milk. The preference for flavour was in order: standardized milk > whole milk > toned milk > double toned milk. There was no significant difference between colour and appearance score of samples prepared using different type of milk. There was a significant difference between overall acceptability score of product. The preference for overall acceptability was in order of standardized milk > whole milk > toned milk > double toned milk. The standardized milk with 4.5 % fat and 8.5 % SNF was found more suitable for the manufacture of acceptable quality of kheer.

3.1.5 Concentration of Milk

This part of the study was conducted to select the range of concentration of milk for the manufacture of acceptable flavour and body and texture characteristics in kheer. The five concentrations of milk viz. 1.5, 1.75, 2, 2.25 and 2.5, were employed in the manufacture of kheer. The results are presented in Table 3 and it can be seen that a highly acceptable kheer was obtained when a milk concentration of 1.5 to 2.5 times was used. Hence, the level of concentration of milk selected was 2 times.

Table 3: Effect of milk concentration on the acceptability of kheer

Concentration of milk	Preference based on organoleptic evaluation	Observations recorded
1.5	-	Very thin body (consistency)
1.75	-	Slightly thick body(consistency)
2	++	Good body (consistency)
2.25	+	Good body (consistency)
2.5	-	Highly thick body (consistency)

++ acceptable; + fair; - not acceptable

3.1.6 Level of Sugar

In order to select the level of suagr with a view to achieve acceptable flavour and body and texture characteristics in kheer, 5 levels of sugar were used viz. 9, 10, 11, 12 and 13%. Kheer was prepared using the method given in Section 2.3. The results are presented in Table 4 and it can be seen that an acceptable kheer was obtained when level of sugar used was between 9 and 13%. Hence, the level of sugar selected was 11 to 12 per cent.

Table 4: Effect of level of sugar on the acceptability of kheer

Sugar % of concentrated milk	Preference based on organoleptic evaluation	Observations recorded
9	-	Very less sweet, lacks desired sweetness and desired flavour
10	+	Less sweet
11	++	Optimum sweetness and flavour
12	++	Desired sweetness and flavour
13	+	Excess in sweetness

++ acceptable; + fair; - not acceptable

4. Conclusions

The present investigation was carried out to optimize the processing parameters and level of different ingredients for manufacture of Kheer. It is concluded that there is significant effect on type and level of rice, precooking temperature, type of milk and level of concentration of milk and sugar percentage. The good quality kheer can be manufacture from standardized pasteurized milk with 2 time concentration to be mixed with 7% Basmati ling grain rice precooked at 90 ^{0}C for 10 min in water (water to rice ratio = 6:1 (v/w) and 11% sugar followed by heating and cooling at storage temperature.

References

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[2] De S. Studies on method of preparation and Preservation of kheer. Indian J. Dairy Sci., 29**(**4), 1976, 316-318.