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Physico-Chemical and Sensory Analysis of Carrot Supplemented Paneer Kheer

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ABSTRACT

Background: Paneer kheer is widely consumed in India to gain health benefits through its compositional characteristics. Carrot is an easily available vegetable and is utilized for various dessert dishes. Therefore, the present study was conducted for the optimization of the process for the development of carrot supplemented paneer kheer.

Methods: Four different levels of paneer and three different levels of carrot was used for the formulation of carrot supplemented paneer kheer. i.e., 100:0 (T0), 80:20g (T1), 60:40 (T2) and 40:60 (T3). Optimization was done based on results obtained from physico-chemical analysis and sensory evaluation. CRD was utilized for experimentation and the significance was shown according to the critical difference at the rate of 5%.

Results: T1 (80:20) was selected as the optimized product after the analysis. The optimized product contained moisture (45.31%), protein (24.21%), ash (3.42%), pH (6.16) and titratable acidity (0.42%). Overall acceptability in terms of the sensory evaluation was found to be highest for T1 (8.5) then, for T0 (8.3) and T2 (6.61). T3 (5.14) was neither liked nor disliked due to the higher proportion of carrot paste.

Conclusion: The composition of T1 was found to have a balanced proximate composition as well as acceptable sensory characteristics; which shows that paneer kheer could be enriched with nutrients of carrot and enhance the palate of the consumers.

Key Words: Paneer, Carrot, Kheer, Milk, Nutrition, Overall acceptability

INTRODUCTION

Milk is considered as the 'wholesome food'. Milk is the source of fat, protein, lactose, vitamins and minerals. Out of the total milk produced, 46% is utilized as fluid milk while 27.50% is converted into traditional products like ghee; 6.50% converted into butter, 7% converted into curd, 6.50% converted into khoa, 3.50% converted into milk powders, 2% converted into paneer and chana and 1.00% converted into other products like ice-cream.¹

Chhana or paneer is a dairy product manufactured by precipitating milk (cow, buffalo or combination of cow and buffalo) with either sour milk or acids, such as citric acid or lactic acid. It shall not contain more than 70 per cent moisture and the milk fat content shall not be less than 50 per cent of the dry matter basis.² Paneer is available commercially at lower costs and is a rich source of animal protein for vegetarians. Khan and Pal reported that paneer is a rich contributor of

minerals such as calcium and phosphorus, vitamins and fat.³ The biological value of paneer ranges from 80 to 86.⁴

Traditional Indian products include several innovative blends used in the preparation of a variety of milk-based delicacies. Among them, *Kheer* (heat desiccated and sweetened milk) is one that is popular in the eastern, north-west and central part of India. Kheer is popularly known and consumed as payasam in the southern part of India. *Kheer* is a semisolid-to-fluid dairy product with partially disintegrated cooked rice grains dispersed in a viscous liquid comprising soluble starch from rice grains.⁵ Kheer is also a type of dairy-dessert consisting of cereal grains particulates. It is conventionally prepared in a karahi by partially dehydrating whole milk with the addition of sugar as sweetener and rice or semolina as cereal.⁶ During the preparation of kheer, gelatinization of rice starch takes place while cooking of it. This starch in turn leaches out in the milk to provide desired taste and consistency.⁷

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India is the second-largest producer of vegetables in the world²³ and vegetables contains numerous medicinal properties.^{8,9} Carrot (*Daucus carota* L.) is one of the most consumed vegetables worldwide. Carrots are a good source of carotenoids (especially, β -carotene), dietary fibre, vitamins, minerals and antioxidants.^{10,11} Carrots have enormously captured its position in preparation of a variety of food products due to its health benefiting properties.¹²⁻¹⁴

Therefore, this study was performed to study the effect of supplementing carrot on the physic-chemical and sensory characteristics of carrot supplemented paneer kheer.

MATERIALS AND METHODS

Materials

Fresh cow milk was procured from the Gowshala, Department of A.H. & Dairying, Banaras Hindu University, Varanasi for the making of paneer and carrot supplemented paneer kheer. Sugar was purchased from the local market of Lanka, Varanasi.

Standardization of formulation of carrot supplemented paneer kheer

Fresh cow milk was obtained daily (4% fat and 8.5% SNF) from the Gowshala, Department of A.H. & Dairying, Banaras Hindu University, Varanasi to perform the preliminary trials till the final optimization was performed.

Process for the preparation of carrot supplemented paneer kheer

Paneer was prepared from the cow milk by the procedure given by⁷. The carrot was finely grated and fried in ghee and ground to a smooth paste with little addition of milk before blending it in paneer kheer. Carrot supplemented paneer kheer was made according to the standard method for making of kheer^{8,28} (i.e. the procedure for the preparation of carrot kheer). Figure 1 shows here the preparation of carrot supplemented paneer kheer.

Details of treatments

Four treatments were studied, and each treatment was replicated three times during the investigation. In the initial treatment, i.e. T_0 the quantity of paneer was taken 100g because a quantity of paneer more than 100g yielded paneer-some taste of the kheer. It is because of this reason the quantity of paneer in later treatment was kept less than 100g of initial treatment at 50g, 60g and 80g for T_1 , T_2 and T_3 , respectively which is represented in **Table 1**. Cow milk and sugar were kept constant@ 1000mL and 12g, respectively. All these formulations were then subjected to proximate analysis and sensory evaluation.

Proximate analysis

The ash and moisture content was analyzed according to AOAC method³. Protein content was analyzed by Kjeldahl method¹⁵. pH was measured by the method of AOAC⁴. Titratable acidity was calculated by the method given by AOAC².

Sensory evaluation

The sensory evaluation of paneer kheer enriched with the addition of carrot was done by a semi-trained panel consisting of 9 judges from the staff and students of the Department of A.H. and Dairying, Banaras Hindu University, Varanasi, India. The sensory evaluation was based on 9-point Hedonic scale rating where 1 represents dislike extremely and 9 represents like extremely¹⁸. Following sensory attributes were evaluated by the judges: colour and appearance, body and texture, taste and overall acceptability. Sensory evaluation was performed at 25°C and 60% relative humidity. The judges were given fresh water to rinse their mouth after tasting of each treatment.

Statistical analysis

Completely randomized design (CRD) was applied to carry out this experiment with 4 treatments and 3 replications. Data obtained was analyzed statistically by the method of f^{33} . The significance of the analyzed data was evaluated based on CD @5%.

RESULTS AND DISCUSSION

Standardization of formulation of carrot supplemented paneer kheer

Table 1 shows the composition of all the four formulations of carrot supplemented paneer kheer. The optimization was done based on the results of proximate analysis (**Table 2**) and sensory evaluation (**Figure 1**).

Proximate analysis of carrot supplemented paneer kheer

Moisture content

Highest moisture content was observed in T_0 (62.01%) followed by T_3 (58.01%), T_2 (56%) and T_1 (45.31%) (**Table 2**). 55.26% moisture content has been reported when paneer was made from cow milk standardized at 4.5% fat¹⁹ and 55.97% moisture content reported at 3.5% fat³⁵. In this study control (T_0) has shown the moisture content of 62.01% that is quite more than as cited by the above two authors; this difference might be due to the difference in the breed of cow. However, T_1 showed the least moisture content; it may be because carrot addition was lowest i.e. 20g. Carrot has moisture content ranging between 86-89%^{1,14,10,12}. As the percentage of carrot was increased and paneer decreased, moisture content also increased in T_2 and T_3 , significantly ($p < 0.05$).

Protein content

Highest protein content was observed in T₁ (24.21%) followed by T₀ (22.87%), T₂ (21.12%) and T₃ (20.88%) (**Table 2**). The data obtained were found significant ($p < 0.05$). 18.43% protein content reported in paneer made from cow milk standardized at 4.5% fat [35]. 13.96% protein content observed in control paneer kheer; but when the almond paste was added in the paneer kheer, protein content increased to 16.80%, significantly¹³. Protein content in carrot is quite low, i.e. 0.9%¹². Therefore, the increase in protein content in this study is highest in T₁ due to the 80:20 ratio of paneer and carrot.

Ash content

Ash content represents the total solid content²⁹. Highest ash content was observed in T₀ (4.29%) followed by T₃ (4.11%), T₂ (3.93%) and T₁ (3.42%) (**Table 2**). The data obtained varied significantly ($p < 0.05$). Carrot has a total ash content of 1.1%¹². 1.38% ash content has been observed in paneer made with cow milk standardized at 4.57% fat²². Ash content of 1.94% in control paneer kheer; however, upon supplementation of almond paste in paneer kheer, ash content increased to 2.25%, significantly¹³. Increase in ash content in kheer mix to 2.64%¹⁶.

pH

It was observed that the highest pH was found in T₁ (6.16) followed by T₂ (6.10), T₃ (6.01) and T₀ (5.96) (**Table 2**). Control, i.e., paneer kheer was found to be lowest in pH; however, when carrot paste was added, pH increased significantly in T₁, T₂ and T₃. Similar results have also been reported by in almond supplemented paneer kheer. pH increased from 5.69 (control) to 6.22 (almond supplemented paneer kheer)¹³. pH increased from 1.54 to 2.00 when carrot shreds were added in an increased manner in the formulation of carrot kheer²⁷. Similar findings have also been reported in case of basundi²⁴.

Titrateable acidity

The results obtained for TA in terms of lactic acid is as follows: T₀ (0.58%) followed by T₃ (0.52%), T₂ (0.51%) and T₁ (0.42%) (**Table 2**). Control (T₀) was found to be highest in TA percentage; as it does not contain carrot paste. Although, there was a significant decreasing difference ($p < 0.05$) found in T₀, T₃, T₂ and T₁ as a result of variation in paneer content and addition of carrot paste as shown in Table 2. Similar findings were also quoted in the case of almond supplemented paneer kheer. TA in control (paneer kheer) was 0.46% and it reduced to 0.31% in the optimized sample of almond supplemented paneer kheer¹³.

Sensory evaluation

The sensory analysis leads to the consumer acceptance of the food products. The sensory evaluation was performed based

on Hedonic rating.

Color and appearance

Figure 1 shows the score for colour and appearance varied from 8.8 ± 0.16 for T₀ to the lowest score of 6.12 ± 0.23 for T₃. The reason could be the higher ratio of carrot paste which gave a dark red appearance to the kheer and was slightly liked by the semi-trained panel members. However, T₁ scored 8.5 ± 0.31 and T₂ scored 6.84 ± 0.22 . The results varied significantly ($p < 0.05$).

Body and texture

Body and texture relate to the viscosity and consistency of the food products. The highest score was obtained by T₀ i.e., 8.6 ± 0.32 followed by T₁ (8.33 ± 0.16), T₂ (7.14 ± 0.11) and T₃ (6.57 ± 0.08) (**Fig.1**). Due to the increase in carrot paste and decrease in paneer, the scores decreased significantly ($p < 0.05$). T₃ was neither liked slightly by the judging members because of the very thick consistency of kheer due to the addition of the higher amount of carrot paste.

Taste

Taste is an important sensory characteristic that decides the marketability of a food product. Addition of carrot paste highly affected the taste of kheer. T₀ obtained the highest score (8.91 ± 0.28), signifying that control was most liked by the semi-trained panel members; followed by T₁ (8.62 ± 0.13), T₂ (6.32 ± 0.21) and T₃ (5.13 ± 0.17) (**Fig.1**). The scores varied significantly ($p < 0.05$). T₂ was slightly liked; whereas T₃ was neither liked nor disliked by the panel members. This shows that higher concentration of carrot paste decreases the tasting quality of carrot supplemented paneer kheer.

Overall acceptability

Overall acceptability represents the acceptance level of the food products. In this study, the highest score for OA has been achieved by T₁ (8.5 ± 0.16) followed by T₀ (8.3 ± 0.11) and T₂ (6.61 ± 0.18). T₃ (5.14 ± 0.2) was neither liked nor disliked by the semi-trained panel members due to the higher concentration of carrot paste (**Fig.1**). The difference in the data varied significantly ($p < 0.05$). Similar findings were reported by²⁷ in case of carrot kheer, i.e. on increasing the concentration of carrot shreds, the OA score decreased significantly. Similar results for OA in case of basundi¹¹.

CONCLUSION

The present research shows that the addition of carrot is feasible in the formulation of carrot supplemented paneer kheer. T₁ was found to be the optimized formulation and it also gained the highest OA. Thus, it may be concluded that the minimum addition of carrot is capable to enhance the

nutritional composition and sensory characteristics of paneer kheer. This study is not only limited to the optimization of the product; further studies could be performed to make this product as ready-to-serve with aiming its focus on the shelf-life stability of the product.

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Table 1: Treatment details for carrot supplemented paneer kheer

Treatments	Cow Milk(ml)	Paneer(g)	Carrot(g)	Sugar (g)
T ₀	1000	100	-	12
T ₁	1000	80	20	12
T ₂	1000	60	40	12
T ₃	1000	40	60	12

Table 2: Proximate composition of carrot supplemented paneer kheer

Treatment Details	Proximate composition				
	Moisture Content (%)	Protein Content (%)	Ash Content (%)	pH	TA (% Lactic acid)
T ₀	62.01±0.19	22.87±0.13	4.29±0.09	5.967±0.24	0.58±0.13
T ₁	45.31±0.22	24.21±0.16	3.42±0.12	6.16±0.31	0.42±0.09
T ₂	56.00±0.11	21.12±0.18	3.93±0.16	6.10±0.18	0.51±0.16
T ₃	58.03±0.15	20.88±0.17	4.11±0.12	6.01±0.23	0.52±0.21

Data represented as Mean±SE

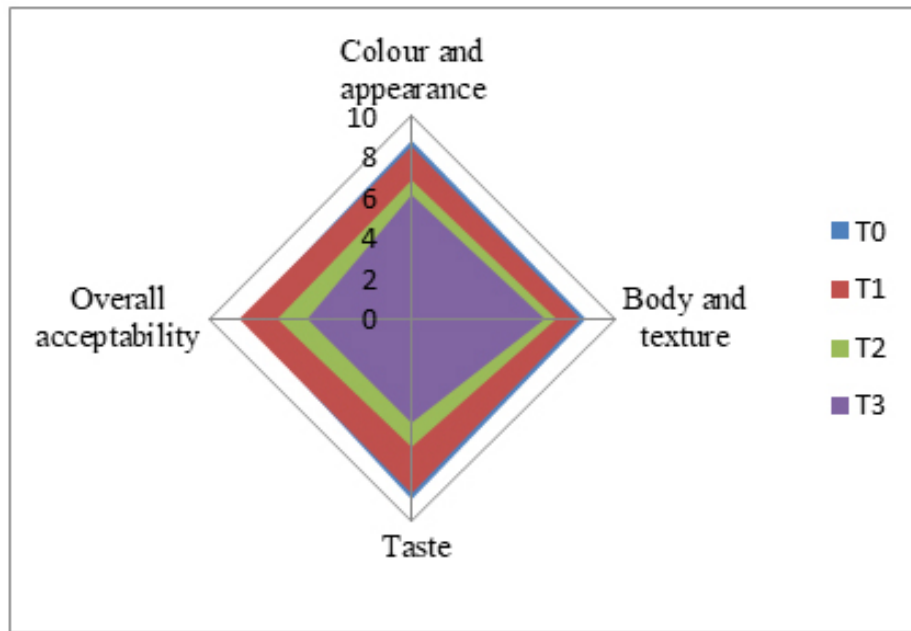


Figure 1: Sensory analysis of carrot supplemented paneer kheer.