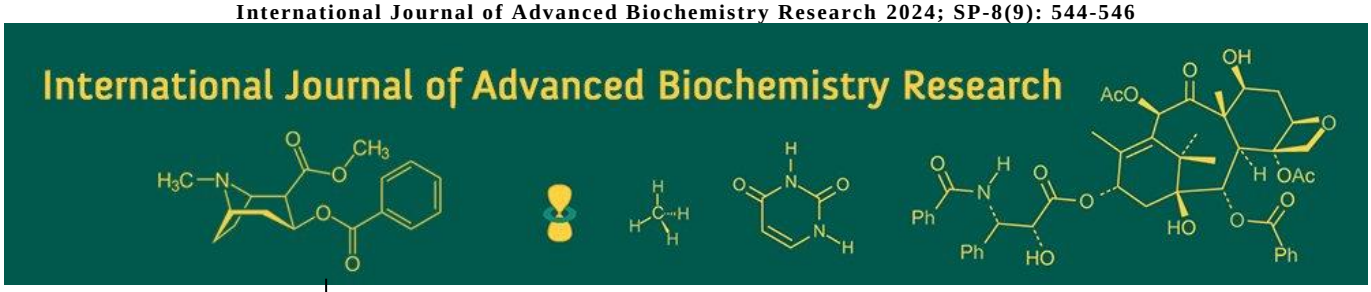

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Studies on sensory qualities of shrikhand incorporated with orange (*Citrus sinensis*) peel powder

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Abstract
The present investigation was conducted at Section of Animal Husbandry and Dairy Science, College of Agriculture, Nagpur (Dr. PDKV, Akola) during 2023-2024.The investigation was undertaken to explore the possibilities of utilizing orange peel powder in shrikhand manufacture to improve sensory quality of product. The obtained product was subjected for physico- chemical properties, sensory qualities and cost structure. The present study was carried out with five treatments including control T_1 and shrikhand prepared from cow milk chakka with different proportion of orange peel powder i.e. 4.0 per cent, 8.0 per cent, 12.0 per cent and 16.0 per cent in treatment T_2, T_3, T_4 and T_5 respectively. The mean score of flavour of shrikhand in treatment T_2 was highest (8.60) and lowest in T_5 (5.80). The average score for body and texture of shrikhand was highest in T_2 (8.80) and lowest in T_5 (5.60). As regard for colour and appearances showed the highest score in T_2 (8.40) and lowest in T_5 (5.80). Treatment T_2 (8.20) showed highest overall acceptability score over other treatments. It is concluded that, acceptable quality shrikhand can be prepared by adding T_2 (4.0 per cent) orange peel powder.

Keywords: Cow milk, chakka, orange peel powder, shrikhand, sensory quality

Introduction
The importance of milk and milk products in India is realized since Vedic period. Milk has always vital status in human nutrition because of its palatability and digestibility. It supplies milk sugar, minerals, and carotene whose deficiency may lead to night blindness. Milk has been described as most ideal food, which referred as "Bank of Nutrients" (Anonymous, 2014) [2].

Shrikhand has semi solid consistency, typical sweetish sour taste and very popular dessert of Gujarat, Maharashtra and part of Karnataka. Shrikhand is prepared by fermentation of milk with lactic acid bacteria, expulsion of whey from the curd, followed by mixing with sugar, flavouring, spices and other ingredients like fruit pulp, nuts etc. to form soft homogenous mass. (Sonawane *et al*., 2007) [8]. Indian fermented milk products utilize 7% of total milk produced and mainly includes three product dahi, shrikhand (sweetened concentrated curd) and lassi which may be considered the western equivalent to yogurt, quarg and stirred yogurt, respectively (Swapna and Suvarna, 2013) [9]. Shrikhand is made by blending chakka with 50-100 per cent sugar. Despite shrikhand's popularity and growing market in India and beyond, organised marketing choices are limited due to a lack of systematic packaging and shelf-life studies (Khojare *et al*., 2018) [5].

Orange peels are rich in phenolic compounds, vitamins, minerals and dietary fibre with good antioxidant properties (Ajila *et al*., 2007; Omoba *et al*., 2015) [1, 7]. Dietary Fiber (DF), which is an important component of orange peel, is the indigestible portion of food derived from plant and it helps in the movement of food and waste efficiently through the digestive system (Tabernero *et al.*, 2011) [10].

The present investigation on "Preparation of shrikhand incorporated with orange (Citrus sinensis) peel powder" was undertaken to find out the sensory quality of the developed shrikhand.

Materials and Methods
Fresh, clean, whole cow milk was used for shrikhand preparation. Cow milk was procured for every trial from Livestock Instructional Farm of Section of Animal Husbandry and Dairy

Science, College of Agriculture, Nagpur. Oranges, crystalline cane sugar and dahi culture was procured from local market. The muslin cloth, electric mixer andglass wares were also used during experiment. The method suggested by Sukumar de (2013) [3] with slight modification was used for the preparation of shrikhand.

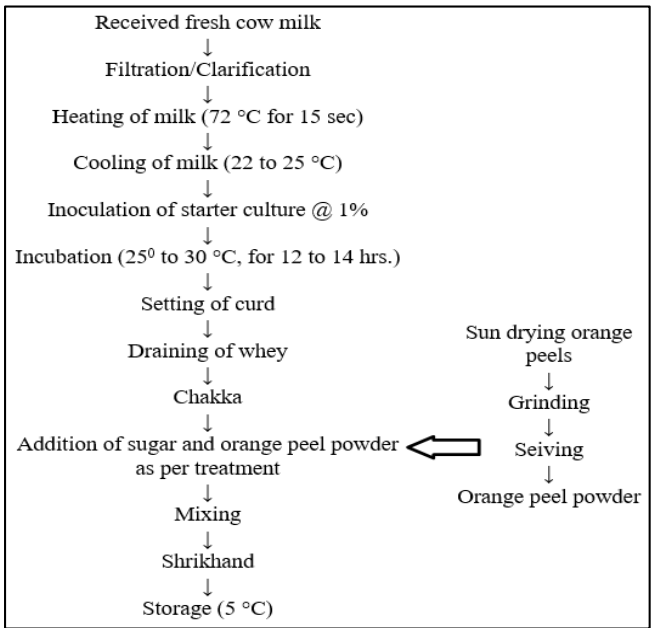

Fig 1: Flow chart for preparation of shrikhand incorporated with orange (*Citrus sinensis*) peel powder

Treatment details

T_1	100 % shrikhand as per standard (Control)
T_2	T1 + 4 % OPP
T_3	T1 + 8 % OPP
T_4	T1 + 12 % OPP
T_5	T1 + 16 % OPP

(OPP: - Orange peel powder)
(In all treatments sugar was used @ 45% by wt. of chakka)

Statistical analysis
The data obtained during different phases of this study was analyzed by using RBD (Randomized Block Design) with five treatments and five replications.

Sensory evaluation
Sensory evaluation of shrikhand samples were carried out by a well-trained panel of 5 judges by using 9-point hedonic scale described by Nelson and Trout (1964) [6]. Flavour, Body and Texture, Colour and appearance and Overall acceptability sensory parameters were included in the study.

Result and Discussion
The present study and investigation on "Preparation of shrikhand incorporated with (*Citrus sinensis*) peel powder" were analysed for the sensory qualities including (Flavour, Body and Texture, Colour and Appearance and Overall acceptability). Present study shifts in consumption pattern of the Indian consumers from milk to innovative milk products brings a large scope for dairy processing in the country. It is a great challenge to innovate methodologies and technologies at the same time encouraging the value addition as well as the by-product utilization of these commodities.

Flavour Score

Table 1: Flavour score for orange peel powder added Shrikhand

Treatment	Replication					Mean
	I	II	III	IV	V	
T_1	8.00	8.00	7.00	8.00	7.00	7.60
T_2	8.00	9.00	9.00	8.00	9.00	8.60
T_3	8.00	8.00	7.00	7.00	6.00	7.20
T_4	7.00	6.00	7.00	6.00	5.00	6.20
T_5	7.00	6.00	6.00	5.00	5.00	5.80
'F' test						Sig
SE (m)±						0.279
CD at 5 %						0.839

The mean flavour score of shrikhand added orange peel powder for treatment T_1, T_2, T_3, T_4 and T_5 were 7.60, 8.60, 7.20, 6.20 and 5.80 respectively. The treatment T_2 i.e 8.60 was significantly superior over T_1, T_3, T_4 and T_5 treatments. Scores allotted by the judges for flavour of shrikhand samples the effect of orange peel powder on flavour score of shrikhand was significantly different. It was clear from present finding that, 4 per cent orange peel powder used for preparation of shrikhand observed acceptable flavour.

Body and Texture Score

Table 2: Body and texture score for orange peel powder added Shrikhand

Treatments	Replication					Mean
	I	II	III	IV	V	
T_1	8.00	7.00	8.00	7.00	8.00	7.60
T_2	9.00	9.00	9.00	8.00	9.00	8.80
T_3	7.00	8.00	8.00	7.00	7.00	7.40
T_4	7.00	8.00	7.00	6.00	7.00	7.00
T_5	6.00	6.00	6.00	5.00	5.00	5.60
'F' test						Sig.
SE (m)±						0.192
CD at 5 %						0.577

The mean score of body and texture of shrikhand using orange peel powder for treatment T_1, T_2, T_3, T_4 and T_5 were as 7.60, 8.80, 7.40, 7.00 and 5.60 respectively. The highest body and texture score was recorded for treatment T_2 (8.80) for shrikhand prepared using 4 per cent orange peel powder while the lowest score was observed for treatment T_5 (5.60) prepared using 16 per cent orange peel powder. Treatment T_2 (8.80) was found significantly superior over T_1, T_3, T_4 and T_5 treatments.

Colour and Appearance Score

Table 3: Colour and appearance score for orange peel powder added Shrikhand

Treatments	Replication					Mean
	I	II	III	IV	V	
T_1	8.00	9.00	7.00	8.00	7.00	7.80
T_2	8.00	9.00	8.00	9.00	8.00	8.40
T_3	8.00	8.00	7.00	8.00	7.00	7.60
T_4	7.00	6.00	5.00	7.00	6.00	6.20
T_5	6.00	7.00	6.00	5.00	5.00	5.80
'F' test						Sig.
SE (m)±						0.251
CD at 5 %						0.755

The variation in colour and appearance score was significantly varies in shrikhand incorporated with orange peel powder. It was observed that, mean score of colour and appearance of orange peel powder added shrikhand for treatments T_1, T_2, T_3, T_4 and T_5 were as 7.80, 8.40, 7.60, 6.20 and 5.80, respectively. The treatment T_2 (8.40) was significantly superior over T_1, T_3, T_4 and T_5 treatments. It was revealed from present finding that, 4 per cent orange peel powder incorporated shrikhand evolve rich colour and appearance whereas, the lowest recorded in shrikhand prepared with 16 per cent orange peel powder. T_5 indicates that as the proportion of orange peel powder increases the sensory quality in respect of colour and appearance decreases. Gupta *et al.* (2018) [4] prepared shrikhand by blending papaya and banana pulp. Shrikhand was prepared with whole milk chakka, varied levels of papaya and banana pulp, and varying levels of sugar (30 percent by weight of chakka) at the rate of quantity of chakka 50, 40, and 30% treatment. Shrikhand from treatment T1 was found to have the best organoleptic features and received the highest organoleptic score (colour & appearance, body & texture, flavour & taste, overall acceptability).

Overall Acceptability Score

Table 4: Overall acceptability score for orange peel powder added Shrikhand

Treatment	Replication					Mean
	I	II	III	IV	V	
T_1	7.00	8.00	7.00	8.00	7.00	7.40
T_2	8.00	9.00	8.00	8.00	8.00	8.20
T_3	7.00	8.00	7.00	8.00	8.00	7.60
T_4	6.00	7.00	7.00	6.00	5.00	6.20
T_5	6.00	7.00	6.00	6.00	5.00	6.00
'F' test						Sig.
SE(m)±						0.216
CD at 5 %						0.649

The overall acceptability score between the treatments was statistically significant. It was indicated that, mean score of overall acceptability of shrikhand incorporated with orange peel powder for treatments T_1, T_2, T_3, T_4 and T_5 were as, 7.40, 8.20, 7.60, 6.20 and 6.00 respectively. The treatment T_2 (8.20) was significantly superior over T_1, T_3, T_4 and T_5 treatments. It was clear that 4 per cent orange peel powder added with shrikhand recorded highest score for overall acceptability whereas shrikhand prepared with 16 per cent orange peel powder showed lowest score.

Conclusion

Shrikhand prepared with adding 4 per cent orange peel powder results in good flavour, body and texture, colour and appearance and overall acceptability having highest score. Hence, it is concluded that acceptable shrikhand can be prepared by incorporating 4 per cent orange peel powder. The orange peel powder could be successfully utilized for preparation of Shirkhand.

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