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Bhushan N Dhangar
PG Scholar, Animal Husbandry and Dairy Science Section, College of Agriculture, Nagpur, Maharashtra, India

VG Atkare
Associate Dean, Animal Husbandry and Dairy Science Section, College of Agriculture, Mul, Maharashtra, India

DT Undratwad
Professor, Animal Husbandry and Dairy Science Section, College of Agriculture, Nagpur, Maharashtra, India

Abhishek V Yelne
PG Scholar, Animal Husbandry and Dairy Science Section, College of Agriculture, Nagpur, Maharashtra, India

Piyush A Sontakke
PG Scholar, Animal Husbandry and Dairy Science Section, College of Agriculture, Nagpur, Maharashtra, India

Corresponding Author:
Bhushan N Dhangar
PG Scholar, Animal Husbandry and Dairy Science Section, College of Agriculture, Nagpur, Maharashtra, India

Development and sensory evaluation of Chakka whey-based beverage fortified with orange juice

Bhushan N Dhangar, VG Atkare, DT Undratwad, Abhishek V Yelne and Piyush A Sontakke

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Abstract
The present investigation was undertaken during the year 2024-2025 at the Section of Animal Husbandry and Dairy Science, College of Agriculture, Nagpur (Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola), with the primary objective of assessing the feasibility of incorporating orange juice into chakka whey for the enhancement of its sensory attributes. The experimental design comprised four treatment groups: T_1 (control) consisting of plain chakka whey, and T_2, T_3, and T_4 formulated by blending chakka whey derived from cow milk with 4.0%, 8.0%, and 12.0% orange juice, respectively. All treatment formulations were subjected to organoleptic evaluation to determine the impact of orange juice incorporation on the overall sensory acceptability of the beverage.

Keywords: Cow milk, Chakka whey, Orange juice, Sensory attributes

Introduction
India is the largest milk producer globally, generating 239.30 million tonnes in 2023-24 (Anonymous, 2024) [1]. A significant by-product of chakka and shrikhand production is chakka whey, which retains valuable nutrients like lactose, whey proteins, and water-soluble vitamins (Rananavare, 2022) [5]. Due to its high organic load, improper disposal of whey poses environmental concerns (Perasiriyan *et al*., 2013) [4]. Utilizing whey in fruit-based beverages adds nutritional value and reduces waste. Orange juice (*Citrus sinensis*), rich in vitamin c and antioxidants, is widely consumed and cultivated in india (Fao, 2013; iifpt, 2020) [2, 3]. Its combination with chakka whey can result in a nutritious, appealing beverage with health and economic benefits (Chavan *et al*., 2017; Saraswathi, 2019) [7, 6].

Materials and Methods
Fresh, clean, cow milk was used for chakka whey preparation. Cow milk was procured for every trial from Section of Animal Husbandry and Dairy Science, College of Agriculture, Nagpur. Fresh clean, orange fruit was purchased from local market. stabilizer, muslin cloth and few glassware were also used during the experiment.

Treatment Details used for the study

Treatment	Chakka Whey (%)	Orange Juice (%)
T_1	100	0
T_2	96	4
T_3	92	8
T_4	88	12

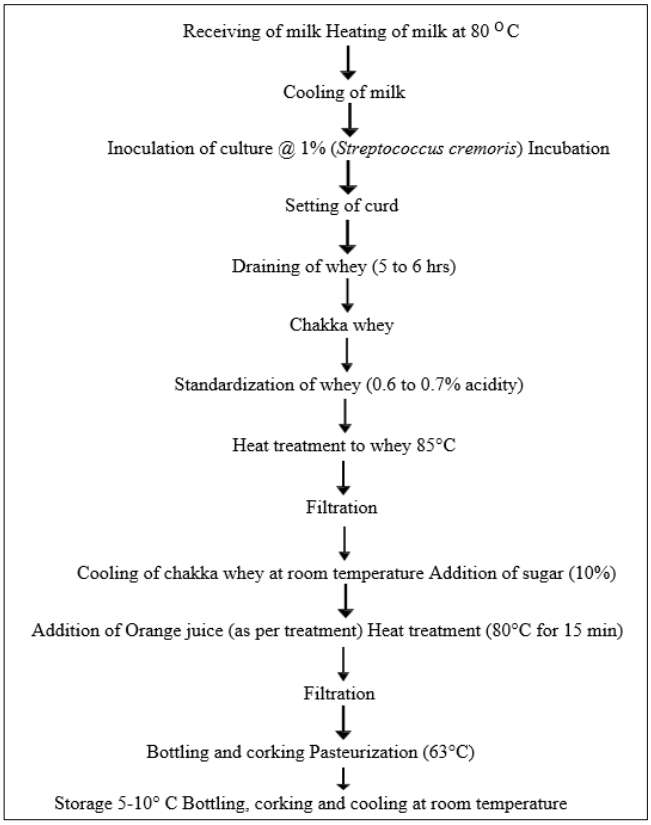

Fig 1: Flow chart for manufacture of chakka whey beverage

Sugar @ 10% by weight will be common in all treatments.
No. of treatment = 04
No. of Replication = 04
Statistical Design - CRD (Completely Randomized Design)

Statistical analysis

The data obtained during different phases of this study was analyzed by using CRD (Completely Randomized Design) with four treatments and four replications.

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

Results and Discussion

The present study and investigation on " Utilization of orange juice chakka whey beverage" were analysed for the sensory qualities including (Flavour, Body and Texture, Colour and Appearance and Overall acceptability).

Table 1: Table for sensory evaluation of chakka whey beverage (Score out of 9)

Treatments	Flavour (Out of 9)	Body and structure (out of 9)	Colour and appearance (out of 9)	Overall acceptability (out of 9)
T_1	6.3	6.2	6.3	6.2
T_2	6.8	6.6	7.5	7.2
T_3	8.3	8.3	7.5	8.5
T_4	7.5	7.25	8.2	7.4
SE(m) ±	0.168	0.100	0.159	0.116
C.D. 5%	0.507	0.030	0.480	0.350

Flavour Score

The flavour score of beverage in treatment T_1, T_2, T_3 and T_4 were recorded as 6.3,6.8,8.3 and 7.5, respectively. The highest score (8.3 out of 9) was obtained by beverage prepared with 92:8 proportion of chakka whey to orange juice (T_3) while, the lowest score (6.3 out of 9) secured by beverage prepared with proportion 100:0 chakka whey to orange juice (T_1). The beverage prepared with 92:8 proportion of chakka whey to orange juice was superior over 96:4 proportion of chakka whey to orange juice and 88:12 proportion of chakka whey to orange juice.

Body and Texture Score: The average sensory score for body and texture in treatment T_1, T_2, T_3 and T_4 were recorded as 6.2, 6.6, 8.3 and 7.25, respectively. Beverage prepared in proportion of 92:8 (T_3) chakka whey to orange juice, scored the highest marks (8.3 out of 9) while, the lowest score (6.2 out of 9) was secured by the beverage of plain whey (T_1). Statistically, treatment T_3 with 8 parts orange juice was superior over rest of the treatments T_1, T_2 and T_4.

Colour and Appearance Score

The average sensory score for colour and appearance in treatment T_1, T_2, T_3 and T_4 were recorded as 6.3,7.5,7.5, and 8.2, respectively. The highest (8.2) score was obtained by the beverage prepared in proportion of 82:12 chakka whey to orange juice (T_4) while, the lowest score (6.3) was

secured by treatment T_1 beverage prepared with 0 parts orange juice. Treatment (T_3) was superior over 0 parts of orange juice (T_1), 4 parts (T_2) and 12 (T_4) parts of tomato juice.

Overall Acceptability Score

The overall acceptability score of beverage in treatment T_1, T_2, T_3 and T_4 were recorded as 6.2, 7.2, 8.5 and7.4 respectively. The highest score (8.5) was obtained by beverage prepared with 92:8 proportion of paneer whey to tomato juice (T_3) as compared to other treatments. The beverage prepared with 98:2 proportion of chakka whey to orange juice was superior over 100:0 proportion of chakka whey to orange juice, 96:4 and 88:12 proportion of chakka whey to orange juice.

Conclusion

The present study was undertaken to develop a value-added beverage by incorporating orange juice into chakka whey at different levels (0%, 4%, 8%, and 12%). Sensory evaluation revealed that the beverage containing 8% orange juice (T_3) received the highest scores in flavour, body and texture, colour and appearance, and overall acceptability. This formulation was significantly better than the control and other treatments. The addition of orange juice enhanced the organoleptic qualities of the beverage. Higher or lower concentrations were less preferred by the panelists. These findings suggest that 8% orange juice is the optimal level for improving the quality of chakka whey beverage. This approach promotes the effective utilization of whey, a nutritious dairy by-product. It also offers scope for innovation and product diversification in the dairy industry.

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