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Formulation and sensory quality evaluation of tomato juice enriched paneer whey beverage

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Abstract
This investigation was carried out during 2024–2025 at the Section of Animal Husbandry and Dairy Science, College of Agriculture, Nagpur (Dr. PDKV, Akola). The objective of the study was to examine the potential of incorporating tomato juice into paneer whey to enhance the sensory attributes of the final product. The experiment included four treatments: T_1 served as the control (plain paneer whey), while T_2, T_3, and T_4 consisted of paneer whey prepared from cow milk blended with 4.0%, 8.0%, and 12.0% tomato juice, respectively. All formulations were evaluated for their sensory characteristics to determine overall acceptability.

Keywords: Cow milk, paneer whey, tomato juice, sensory attributes

Introduction
Milk is a nearly complete source of nutrition, essential for growth and development in humans and animals. India, one of the world's leading milk producers, has seen rapid expansion in its dairy sector, resulting in large quantities of by-products such as whey. Whey, the liquid left after milk coagulation during paneer, chhana, or cheese production, is rich in lactose, high-quality proteins, vitamins, and minerals (Maurya, 2024; De Jesus *et al*., 2015) [3, 1]. However, despite its nutritional value, whey remains underutilized due to processing costs and environmental disposal concerns.

To address this, innovative uses of whey are being explored-especially in beverages. Combining paneer whey with tomato juice, which is rich in lycopene, antioxidants, and essential nutrients (Kavya, 2013; Mehanna *et al*., 2017) [2, 4], offers potential for a functional, health-promoting drink. Such a product not only enhances nutritional value and taste but also contributes to waste reduction and product diversification in the dairy industry.

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

Treatment Details used for the study

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

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

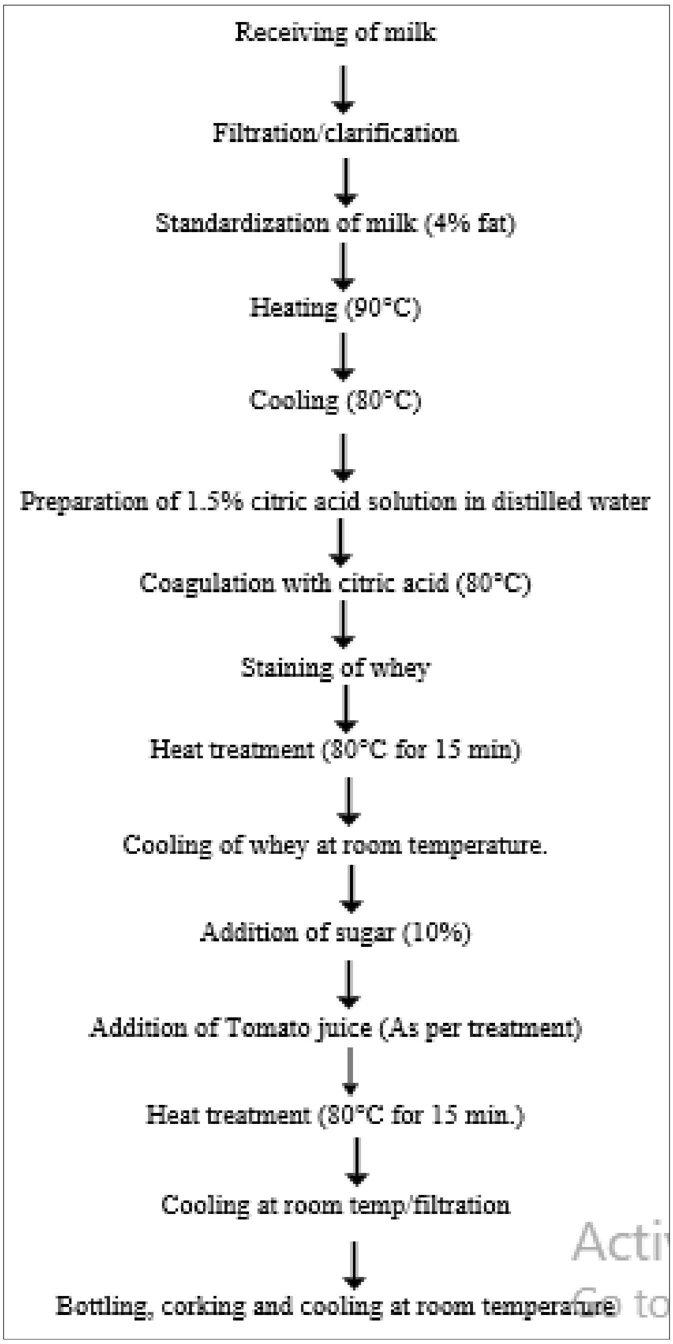

Fig 1: Flow chart for manufacture of Paneer whey beverage

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) [5]. 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 "Utilization of tomato juice in paneer 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 paneer 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	6.5	6.3	6.7	7.3
T_2	7.3	7.0	7.5	6.5
T_3	8.5	8.5	8.5	8.0
T_4	6.8	6.5	7.0	6.0
SE(m) ±	0.27	0.23	0.31	0.19
C.D. 5%	0.81	0.72	0.94	0.57

Flavour Score

The overall score of beverage in treatment T_1, T_2, T_3 and T_4 were recorded as 6.5, 7.3, 8.5 and 6.8, respectively. The highest score (8.5 out of 9) was obtained by beverage prepared with 92:8 proportion of paneer whey to tomato juice (T_3) while, the lowest score (6.5 out of 9) secured by beverage prepared with proportion 100:0 paneer whey to tomato juice (T_1). The beverage prepared with 92:8 proportion of paneer whey to tomato juice was superior over 96:4 proportion of paneer whey to tomato juice and 88:12 proportion of paneer whey to tomato 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 6.3, 7.0, 8.5 and 6.5, respectively. Beverage prepared in proportion of 92:8 (T_3) paneer whey to tomato juice, scored the highest marks (8.5 out of 9) while, the lowest score (6.3 out of 9) was secured by the beverage of plain whey (T_1). Statistically, treatment T_3 with 8 parts tomato 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 6.7, 7.5, 8.5 and 7.0, respectively. The highest (8.5) score was obtained by the beverage prepared in proportion of 92:8 paneer whey to tomato juice (T_3) while, the lowest score (6.7) was secured by treatment T_1 beverage prepared with 0 parts tomato juice. Treatment (T_3) was superior over 0 parts of tomato 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 7.3, 6.5, 8.0 and 6.0, respectively. The highest score (8.0) 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 paneer whey to tomato juice was superior over 100:0 proportion of paneer whey to tomato juice, 96:4 and 88:12 proportion of paneer whey to tomato juice.

Conclusion

The present study was undertaken to develop a value-added beverage by incorporating tomato juice into paneer whey at different levels (0%, 4%, 8%, and 12%). Sensory evaluation revealed that the beverage containing 8% tomato 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 tomato juice enhanced the organoleptic qualities of the beverage. Higher or lower concentrations were less preferred by the panelists. These findings suggest that 8% tomato juice is the optimal level for improving the quality of paneer 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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