International Journal of Veterinary Sciences and Animal Husbandry 2024; 9(5): 581-584

ISSN: 2456-2912
VET 2024; 9(5): 581-584

www.veterinarypaper.com
Received: 13-08-2024
Accepted: 19-09-2024

Krishna B Pawar
Division of Animal Husbandry and Dairy Science, Dr. Sharadchandra Pawar College of Agriculture, Baramati, Maharastra, India

Ashish B Raskar
Aassistant Professor, Division of Animal Husbandry and Dairy Science, Dr. Sharadchandra Pawar College of Agriculture, Baramati, Maharastra, India

Swapnil M Bagul
Division of Animal Husbandry and Dairy Science, Dr. Sharadchandra Pawar College of Agriculture, Baramati, Maharastra, India

Shrikant S Gore
Aassistant Professor, Division of Animal Husbandry and Dairy Science, Dr. Sharadchandra Pawar College of Agriculture, Baramati Maharastra, India

Corresponding Author:
Krishna B Pawar
Division of Animal Husbandry and Dairy Science, Dr. Sharadchandra Pawar College of Agriculture, Baramati, Maharastra, India

Sensory analysis of cheddar cheese: Impact of cow and buffalo milk blends on flavor, texture and overall acceptability

Krishna B Pawar, Ashish B Raskar, Swapnil M Bagul and Shrikant S Gore

Abstract
This article explores the sensory characteristics of Cheddar cheese prepared from different blends of cow and buffalo milk. The study focused on key sensory parameters flavor, texture, color, salt content, packaging and overall acceptability evaluating how different milk compositions influence cheese quality. Findings expose that a blend of 75% cow milk and 25% buffalo milk yields the most favorable balance of flavor, texture and overall acceptability, making it a preferred option for cheese manufacturers. Higher buffalo milk content resulted in lower sensory acceptability.

Keywords: Cheddar cheese, cow milk, buffalo milk, cheese blends, sensory evaluation

1. Introduction
Milk is a highly nutritious food, serving as a complete protein source and providing essential nutrients crucial for human health. It is especially vital for infants, who rely on it for their growth during the first months of life. For adults, seniors, and nursing mothers, milk is a protective food that helps meet important nutrient needs. Rich in high-quality protein, vitamins, and minerals, milk also contains bioactive compounds that enhance health. Studies indicate that milk significantly contributes to global nutrition, particularly in calcium availability (Smith *et al.*, 2021) [5].

The dairy sector plays a critical role in the global agriculture industry, encompassing the production and processing of milk from livestock such as cows, sheep, goats, buffalo, and camels. Dairy products, including cheese, butter, cream, and curd, are integral to the global human diet due to their rich mineral and vitamin content, providing calcium, proteins, zinc, magnesium, vitamin D and vitamin B12. As demand for dairy products continues to rise, the dairy industry significantly contributes to global economic growth (FAO, 2020) [4].

In India, the dairy industry offers a diverse array of products, such as liquid milk, UHT milk, organic milk, curd, lassi, buttermilk, cheese, and condensed milk, catering to both nutritional needs and consumer preferences. Liquid milk, in particular, is a staple in traditional Indian cuisine and daily consumption (IMARC, 2024) [6].

Milk is abundant in essential nutrients, including protein, fat, lactose, and minerals, and contains riboflavin, which is vital for vitamin B12 synthesis. Microorganisms utilize lactose and whey proteins during fermentation, and studies indicate that the addition of riboflavin, niacin and cobalt to fermentation media can enhance vitamin B12 production (Chamlagain *et al.*, 2017) [3].

The Indian cheese industry is projected to grow at a compound annual growth rate of approximately 18.0 percent from 2015 to 2020. With only around 45 types of cheese available in India compared to over 3,000 varieties globally, there is significant potential for market expansion (Jana, 2015) [7].

Cheddar cheese is well-known for its strong, acidic flavor and rich, creamy texture. Its color can range from white to pale yellow or orange, depending on the food coloring added. While some Cheddar cheeses are aged for several years, others are matured for only a few months. Buffalo milk, however, presents certain challenges in producing hard cheeses like Cheddar due

to its unique physico-chemical composition. Research indicates that buffalo milk is better suited for making cheeses like Mozzarella and Domiati.

2. Materials and Methods

The research was conducted in 2023-24 at Dr. Sharadchandra Pawar College of Agriculture, Baramati, using fresh cow and buffalo milk. Starter cultures and rennet from the National Dairy Research Institute (NDRI) were used. Various milk blends (100 percent cow milk to 100 percent buffalo milk) were prepared and the process standardized with four replications per treatment. The cheese was evaluated for sensory evaluation by semi-trained judges.

3. Treatment Detail

Table 1: Composition of milk blend in different treatment.

Treatment No	Blends	
T_0 (Control)	Cow milk 100 % +	Buffalo milk 00 %
T_1	Cow milk 75 % +	Buffalo milk 25 %
T_2	Cow milk 50 % +	Buffalo milk 50 %
T_3	Cow milk 25 % +	Buffalo milk 75 %
T_4	Cow milk 00 % +	Buffalo milk 100 %

1. Manufacturing of Cheddar Cheese

Ten liters of indigenous cow and buffalo milk, along with their respective blends, were utilized for the preparation of Cheddar cheese (Table 1). The milk was standardized (cow: 3% fat, 8.5% SNF; buffalo: 6% fat, 9% SNF), heated to 63 °C for 30 minutes and then cooled to 33 °C. A starter culture (1%) was added and the milk was hold for 35 minutes. Rennet (0.2%) was then added and the mixture was left for 45 minutes to allow curd formation. The curd was cut and cooked at 39 °C. The whey was drained and the curd was salted (1-2%) and pressed at 6 bars. The cheese was stored at 4±1 °C. The milk blends were processed according to a standardized procedure outlined by Potter. N. N *et al.*, 1995 [10].

2. Analytical Methods

A. Physcio-Chemical Analysis of Milk:

- **Fat:** Gerber Method as described in IS:1224, Part – II, (1977).
- **Protein:** The Method were given in SP:18 (Part-XI), 1981.
- **Lactose:** The Lactose Percent was determined as per IS: 1479 (Part-II) 1961, By Lane and Eynon method.
- **Total Solids:** As per the gravimetric method given in IS:1479 (Part – II)1961.
- **Acidity:** Titratable acidity of milk samples were determined as per the method given in IS:1479, (Part – I)1960.
- **pH:** The pH was determined by using Digital pH meters as per IS: 1479, Part – II (1961).

B. Sensory Evaluation of Cheddar Cheese

Ten semi-trained judges who work in the Dr. Sharadchandra Pawar College of Agriculture, Baramati conducted the sensory evaluation of the cheddar cheese prepared with different blends of cow and buffalo milk. The judges analyzed to give marks to each treatment as per different sensory parameters and each treatment's outcome and completed using the following ADSA score card.

3. Statistical Analysis

In statistical analysis, Data of different treatments were analysed by Using the Completely Randomized Design (CRD) with four replications and five treatments.

Composition of Milk

Fresh cow and buffalo milk was analyzed for fat, protein, total solid, lactose, Titratable Acidity (%LA) and pH as shown in (Table 2, Fig 1).

Table 2: Chemical composition of cow and buffalo milk with different blends.

Sr. No.	Constituents (%)	Blends (Cow: Buffalo)				
		100 : 00	75 : 25	50 : 50	25 : 75	00 : 100
1.	Fat	4.35	4.54	5.12	6.01	6.66
2.	Protein	3.02	3.18	3.23	3.58	3.80
3.	Total Solids	13.73	13.76	14.69	15.46	16.01
4.	Lactose	4.20	4.30	4.41	4.43	4.50
5.	Titratable Acidity (%LA)	0.13	0.13	0.14	0.15	0.15
6.	pH	6.41	6.50	6.61	6.62	6.64

(Mean of four replications.)

4. Results and Discussion

Flavour: The review scores were given to Cheddar cheeses on different taste characteristics like Creamy, Rancid, Acidic, Bitter, Salty, Smoky, Sweet, Moldy and Sour numbering out 45. This characteristic was to be considered under flavor profile in the sensory analysis of cheddar cheese. The study highlights that cheddar cheese flavor is significantly influenced by cow and buffalo milk blends. The T_1 blend (75% cow milk, 25% buffalo milk) notably improved flavor, offering a beneficial option for cheese manufacturers looking to enhance flavor without relying heavily on cow milk (Table 3 & Fig 2). Ali *et al.*, (2016) [1] studied how different starter cultures affect the sensory qualities of cottage cheese made from cow and buffalo milk. Their findings highlight the influence of starter cultures on the flavor and texture of the cheese.

Body & Texture: Cheese body and texture is considered to be determinants by the overall opinion and preference of the semi-expert judges. In this profile, we considered different characters like Firmness, Crumbly, Pasty and Grainy. The study revealed significant differences in the body and texture of cheddar cheese made from different cow and buffalo milk blends. T_1 (75% cow, 25% buffalo) scored the highest (26.90), with T_0 (100% cow) closely matching it, (Table 3 & Fig 2). In contrast, T_2, T_3 and T_4 showed progressively lower scores, indicating a decline in body and texture as the buffalo milk percentage increased. Arnould *et al.*, (2024) [2] investigated how cheese composition affects the production, release, and perception of aroma compounds. The study emphasizes that cheese structure and texture play a crucial role in sensory attributes, particularly flavor perception during mastication.

Color: The significant modifications are shown when the color of the cheese was analyzed by using cheddar cheese prepared by different blends of cow and buffalo milk. In comparison to the other blends, Treatment T_1 found a mean rating color value of 8.78 (Table 3 & Fig 2), which shows a richer yellow and welcoming color. 25 percent buffalo milk in 75 percent cow milk as shown in T_1, seem to have a positive impact on getting a more desirable yellow color profile in cheddar cheese. This aligns with evidence that milk

composition, including protein and carotenoid content, significantly affects cheese color. Olmo *et al.*, (2018) [9] suggested that the lower value of buffalo milk cheddar cheese could be due to blue-green pigments, while the higher value in cow milk cheddar cheese is linked to carotene pigments.

Salt: The results emphasize the significant role milk blend composition plays in determining the salt content of cheddar cheese. Higher cow milk content, as seen in T_0 and T_1, was linked to increased salt levels, which are crucial for flavor and preservation. The statistical similarity between T_0, T_1 and T_2 suggests that small variations in milk blend composition may not greatly affect salt content (Table 3 & Fig 2). Zambon *et al.*, (2019) [12] Cheese with over 4% salt significantly reduces the survival rates of probiotic bacteria during ripening. Lower salt concentrations are suggested to better maintain probiotic viability in cheese products.

Packaging: Analysis of the packaging attributes of cheddar cheese made from different cow and buffalo milk blends showed that Treatment T_1 received the highest mean score (4.7), indicating superior visual appeal. In contrast, Treatment T_4 scored lower (4.35), suggesting a reduced perceived quality in packaging (Table 3 & Fig 2). Solanki P. P. (2020) [11] reported improvements in shelf life, antibacterial and antioxidant activities, and ACE-inhibitory potential of symbiotic creamed cottage cheese. The product was composition-analyzed, stored at 7°C until expiration, and evaluated every five days.

Overall acceptability: It depends on several factors like colour and appearance, flavour, body & texture, saltiness and packaging, etc. In contrast, Treatments T_2 (16.76), T_3 (16.05) and T_4 (15.67) received progressively lower mean scores for overall acceptability, indicating that cheeses with higher buffalo milk proportions (T_3 and T_4) or specific blend ratios (T_2) were less preferred than T_1 and T_0. The cheese made with 75% cow milk and 25% buffalo milk (T_1) scored higher in all five evaluated attributes: body and texture, flavor, salt, color and packaging (Table 3 & Fig 2). Moore *et al.*, (2021) [8] found that sensory properties of Cheddar cheese can be effectively analyzed and predicted using texture profile analysis methods. The research highlights that while differences in sensory scores were noted, they were not statistically significant.

Table 4: Sensory Score of cheddar cheese prepared from different blends of Cow & Buffalo milk.

Treatment	Blends	Mean					
	Cow : Buffalo	Flavour	Body & Texture	Color	Salt	Packaging	Overall acceptability
T_0	100 : 00	37.68^{ab}	26.52^{ab}	8.38^{b}	8.38^{ab}	4.52	17.26^{ab}
T_1	75 : 25	40.20^{a}	26.90^{a}	8.78^{a}	8.55^{a}	4.70	17.86^{a}
T_2	50 : 50	37.40^{b}	24.67^{bc}	8.23^{b}	8.08^{b}	4.58	16.76^{bc}
T_3	25 : 75	36.05^{bc}	24.12^{c}	7.50^{c}	7.58^{c}	4.48	16.05^{cd}
T_4	00 : 100	34.38^{c}	22.72^{c}	7.43^{c}	7.35^{c}	4.35	15.67^{d}

Mean score of Sensory properties of cheddar cheese prepared from different blends of Cow and Buffalo milk.

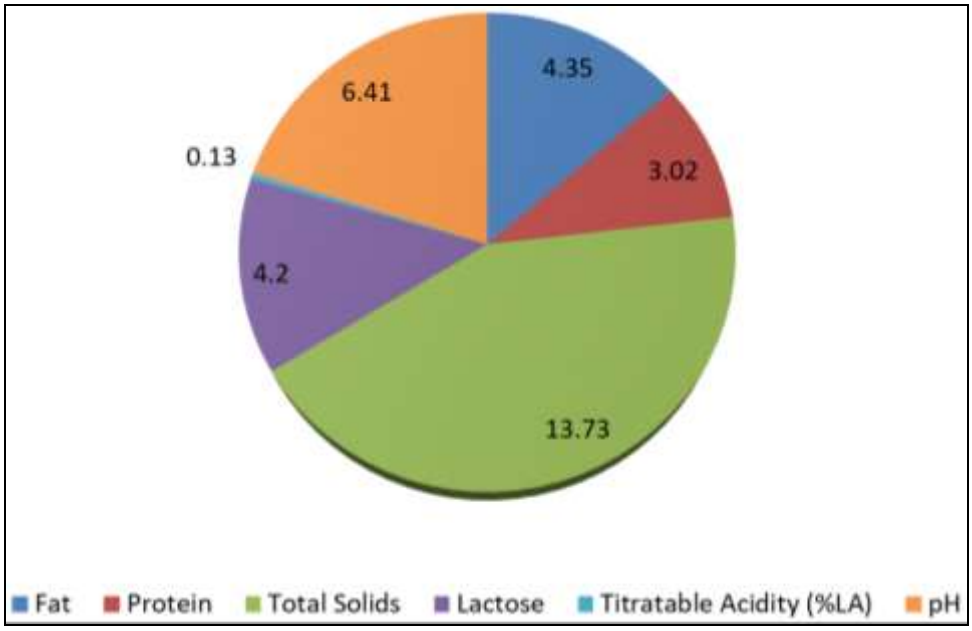

Fig 1: Chemical composition of cow and buffalo milk with different blends

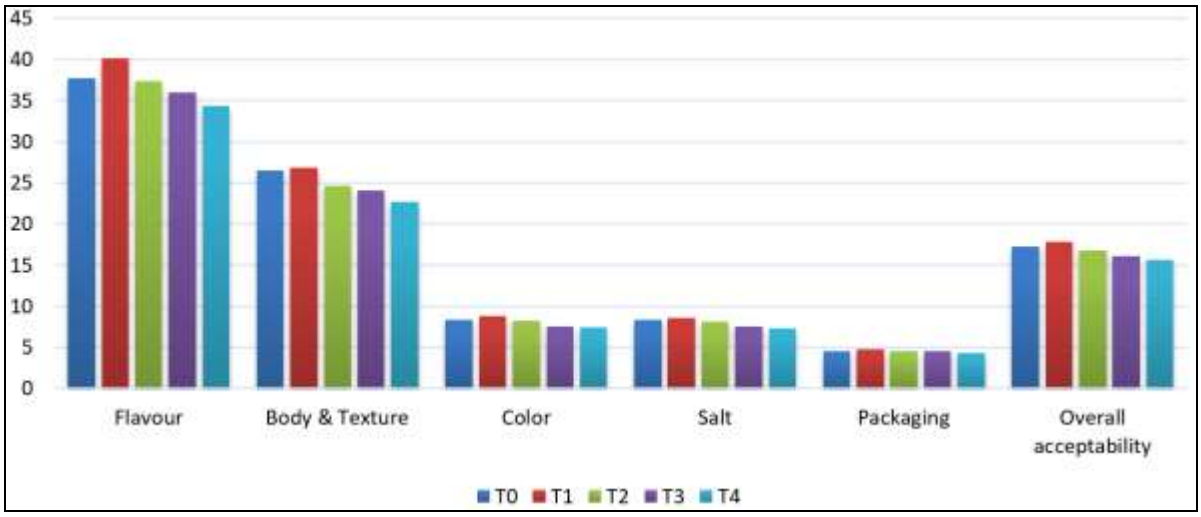

Fig 2: Sensory Score of cheddar cheese prepared from different blends of Cow & Buffalo milk

5. Conclusion: Blending cow and buffalo milk in a 75:25 ratio results in the best Cheddar cheese, offering a balance between flavor, texture and overall acceptability. Pure buffalo milk cheese was found to have higher fat and protein content but was less acceptable in terms of sensory characteristics.

6. References

1. Ali S, Tariq M, Qureshi M. Comparative study of cottage cheese prepared from various sources of milk and the impact of starter cultures on sensory characteristics. Food Sci Technol J. 2019;42:334-340.
2. Arnould C, Buchin S, Salles C. Influence of cheese composition on aroma content, release and perception. Molecules. 2024;29(14):3412.
3. Chamlagain B, Sugito TA, Deptula P, Edelmann M, Kariluoto S, Varmanen P, *et al*. In situ production of active vitamin B_{12} in cereal matrices using *Propionibacterium freudenreichii*. Food Sci Nutr. 2017;6(1):67-76.
4. Food and Agriculture Organization. The state of dairy production: Trends and issues. FAO; c2020.
5. Smith NW, Fletcher AJ, Hill JP, McNabb WC. Modeling the contribution of milk to global nutrition. Front Nutr. 2021;8:716100.
6. IMARC. Dairy Industry in India 2024 Edition: Market Size, Growth, Prices, Segments, Cooperatives, Private Dairies, Procurement and Distribution. c2024.
7. Jana AH. Indian cheese industry – Status and future scope. Food Bev News. c2015;8(19 December 2015).
8. Moore KM, Munoz AM, Lammers PJ. Sensory properties of Cheddar cheese: Predictive modeling using texture profile analysis. J Dairy Sci. 2021;104(2):1185-1195.
9. Olmo D, Picon A, Nuñez A. Cheese supplementation with five species of edible seaweeds: Effect on microbiota, antioxidant activity, colour, texture and sensory characteristics. Int Dairy J. 2018;84:36-45.
10. Potter NN, Hotchkiss JH. Introduction: Food science as a discipline. In: Food Science Text Series. Springer US; c1995. p. 1-12.
11. Solanki Pintaben P. Development and functional evaluation of synbiotic creamed cottage cheese.
12. Zambon MD, Tavares TS, Rosa CS. Effect of salt concentration on the survival of probiotic bacteria in cheese during ripening. Int Dairy J. 2019;90:39-45.

How to Cite This Article
Krishna BP, Raskar AB, Bagul SM, Gore SS. Sensory analysis of cheddar cheese: Impact of cow and buffalo milk blends on flavor, texture and overall acceptability. International Journal of Veterinary Sciences and Animal Husbandry. 2024; 9(5): 581-584.