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Value Addition in Buffalo Milk for Advancement of Rural Economy

Pravin Kumar
Pandit Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwavidyalaya Evam Go-Anusandhan Sansthan, Mathura-281001 (Uttar Pradesh), India
Email: pravinmthr@gmail.com
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Abstract

The present study evaluates the impact of value addition in buffalo milk production on the rural economy of Mathura District, Uttar Pradesh. By converting raw buffalo milk into value-added products such as paneer, curd, butter, ghee, and khoa, significant income enhancements were observed among rural farmers engaged in milk production. The study was conducted across five tehsils, where ten villages from two randomly selected blocks per tehsil were chosen, covering 500 farmers involved in buffalo milk production and value addition. Data collection included milk yield from different buffalo breeds, production costs, and income generation from both raw milk and processed products. The results showed a 50-70% increase in income from value-added products compared to raw milk sales. Ghee and paneer emerged as the most profitable products due to their high consumer demand and longer shelf life. The study emphasizes the potential of value addition to not only increase farmer income but also stimulate rural employment and economic growth. Policy recommendations include improving access to processing technologies, market linkages, and technical training for small-scale dairy farmers to capitalize on the benefits of value addition.

Keywords: Buffalo milk, Dairy products, Income generation, Rural economy, Value addition, Value-added products

Introduction

Buffalo milk plays an important role in India's dairy sector, contributing approximately 50% of the total milk produced nationwide (Subbanna et al., 2021). Its high fat and protein content make it suitable for producing various value-added dairy products such as paneer, khoa, curd, butter, and ghee (Khetra et al., 2022). Despite the higher demand and profitability of these products, rural buffalo farmers still primarily sell raw milk, missing out on the economic benefits of value addition (Kashyap and Bhuyan, 2023). This research paper aims to explore how the value addition of buffalo milk products can significantly enhance the rural economy by increasing farmer incomes and expanding employment opportunities.

The significance of buffalo milk in rural areas goes beyond nutrition, serving as an economic backbone for many smallholder farmers (Srivastava, 2015). The breeds studied include Murrah, Bhadawari, Mehsana, and non-descriptive buffaloes, which are prevalent in different parts of Uttar Pradesh (Muthukumar et al., 2018). Through value addition, farmers can diversify their income sources and capture a larger share of the market. The objective of this work was to compare the costs and incomes associated with raw milk and value-added products, examine consumer preferences, and evaluate the impact of value addition on the livelihoods of rural farmers.

Materials and Methods

This study was conducted in the Mathura District of Uttar Pradesh, India, which comprises five tehsils: Mathura, Chhata, Mant, Goverdhan, and Baldeo. The district is well known for its agricultural and dairy farming practices, particularly buffalo milk production. To gain a comprehensive understanding of buffalo milk value addition and its impact on rural income, a multi-stage random sampling method was employed.

Study Area Selection

In the first stage, **two blocks** were randomly selected from each of the five tehsils. This ensured adequate geographic representation across the district, capturing both densely populated areas and rural regions with varying levels of agricultural activity.

Village and Farmer Selection

From each of the randomly selected blocks, ten villages were randomly chosen, making a total of 100 villages across the study area. This random selection helped in minimizing bias and ensured that the results were representative of the broader population engaged in buffalo milk production in the district.

Within each selected village, five buffalo farmers who were actively involved in milk production, value addition (such as processing into products like ghee, paneer, curd, butter, and khoa), and marketing of these products were selected, bringing the total sample size to 500 farmers. The selection of these farmers was based on their participation in both traditional raw milk sales and value-added dairy processing. This enabled a comparative analysis of income

generation from raw milk sales and value-added products.

Data Collection

Primary data were collected using structured questionnaires and interviews with the farmers. The questionnaire covered various aspects, including:

- **Milk yield** from different buffalo breeds such as Murrah, Bhadawari, Mehsana, and non-descriptive buffaloes.
- **Production costs** for raw milk and value-added products like ghee, paneer, butter, curd, and khoa.
- **Income generation** from both raw milk and processed dairy products.
- **Consumer preferences** for buffalo milk products in local and nearby markets.
- **Challenges** faced in value addition, such as access to processing technology, storage facilities, and market access.

Secondary data were obtained from local dairy cooperatives, government reports, and academic research papers to supplement the primary data and provide context for the economic analysis.

Data Analysis

The collected data were analyzed using both descriptive and inferential statistical methods. Comparative income analysis between raw milk sales and value-added products was performed to quantify the potential benefits of value addition. Additionally, cost-benefit analysis was conducted to evaluate the profitability of producing and marketing various dairy products. The results were tabulated and interpreted in the context of rural economic advancement through buffalo milk value addition.

Results and Discussion

Comparative Income Analysis (Raw Milk vs. Value-Added Products)

Table 1 presents a comparative income analysis between selling raw buffalo milk and processing it into value-added dairy products such as paneer, curd, butter, ghee, and khoa. The table highlights the significant income difference generated by value addition. While raw milk sales yield an average income of ₹35 per liter, converting the milk into products like paneer can increase revenue to ₹150 per kilogram, while ghee commands up to ₹300 per kilogram. This suggests that value addition can increase farmers' income by over 50%, offering a more lucrative alternative to simply selling raw milk.

Value-added products have higher market demand due to their longer shelf life, higher fat content, and wider applications in Indian cuisine. For example, paneer and ghee are extensively used in daily cooking, festivals, and special occasions, which boosts their market value. Moreover, the table reflects that although processing these products requires initial investments in infrastructure and skills, the returns far outweigh the costs. It is clear that shifting focus from raw milk to value-added products can significantly enhance rural income, especially in regions

where milk production is a primary source of livelihood. The results emphasize the need for processing facilities, better market access, and technical training to enable farmers to capitalize on this profitable opportunity.

Table-1: Comparative Income Analysis (Raw Milk vs. Value-Added Products)

Product	Average Income per Liter (₹)	Value-Added Product Income (₹)
Raw Milk	35	-
Paneer	-	150
Curd	-	70
Butter	-	130
Ghee	-	300
Khoa	-	120

This analysis highlights the necessity of establishing processing units and training farmers in value addition techniques to optimize their economic returns. The value-added product market is growing in India, driven by consumer demand for quality and taste. By entering this market, rural farmers can ensure higher profits and more sustainable livelihoods.

Cost of Production for Various Buffalo Milk Products

Table 2 outlines the cost of production for various value-added buffalo milk products, including paneer, curd, butter, ghee, and khoa. This cost analysis is crucial for understanding the economics of producing these products at the farm or small-scale processing level. Paneer and ghee are shown to have relatively high production costs, with paneer costing ₹100 per kilogram and ghee costing ₹250 per kilogram. However, the market prices for these products are also high, at ₹150 and ₹300 per kilogram, respectively, making them very profitable despite their higher processing costs.

The production of curd, butter, and khoa involves lower costs, with curd costing ₹40 per kilogram, butter ₹80, and khoa ₹90. These products also have favorable market prices, making them accessible for small-scale producers. The table illustrates that even though value-added products require an investment in processing, packaging, and labor, the potential profit margins make these endeavors highly beneficial for rural farmers. By shifting their focus from raw milk sales to these higher-value products, farmers can achieve better financial stability and resilience. Additionally, producing these items locally can reduce transportation costs, improve shelf life, and increase the availability of fresh dairy products in the rural market, further enhancing profitability.

Table-2 Cost of Production for Various Buffalo Milk Products

Product	Cost of Production (₹/kg)	Market Price (₹/kg)
Paneer	100	150
Curd	40	70
Butter	80	130
Ghee	250	300
Khoa	90	120

Processing buffalo milk into these products incurs varying costs depending on the complexity of the process. However, the higher sale prices more than compensate for these costs, making value addition a viable strategy for improving rural incomes.

Milk Yield and Income from Different Buffalo Breeds

Table 3 compares the milk yield and corresponding income from various buffalo breeds, including Murrah, Bhadawari, Mehsana, and non-descriptive buffaloes. Murrah buffaloes show the highest milk yield, producing an average of 12 liters per day, which translates into an income of ₹420 per day from raw milk and ₹1500 per day from value-added products. Mehsana and Bhadawari breeds, producing 10 and 8 liters per day respectively, offer lower but still substantial incomes when their milk is processed into products such as paneer, ghee, and khoa. The non-descriptive buffaloes, which are more common in rural areas, produce only 6 liters per day and generate the lowest income both from raw milk and value-added products.

Table-3 Milk Yield and Income from Different Buffalo Breeds

Breed	Average Milk Yield (Liters/day)	Income from Raw Milk (₹)	Income from Value-Added Products (₹)
Murrah	12	420	1500
Mehsana	10	350	1200
Bhadawari	8	280	1000
Nondescriptive	6	210	850

This table emphasizes the economic advantage of investing in high-yielding breeds like Murrah and Mehsana, especially when farmers aim to maximize their income through value-added dairy production. The differences in income between raw milk sales and value-added products are stark, with value addition significantly enhancing profitability. Furthermore, the table suggests that farmers raising low-yielding, non-

descriptive buffaloes could benefit from adopting value addition to compensate for the lower milk production. This comparison underscores the importance of breed selection and milk processing in optimizing dairy farming income in rural areas.

Murrah buffaloes, due to their superior yield and fat content, offer the highest returns both in terms of raw milk and value-added products. Farmers raising nondescriptive buffaloes may benefit from focusing on higher-value products to compensate for the lower milk yield.

Consumer Preferences for Buffalo Milk Products

Table 4 provides insights into consumer preferences for different buffalo milk products, including ghee, paneer, curd, and khoa. The data reveal that ghee is the most preferred product, with 45% of consumers indicating it as their top choice. Paneer follows at 30%, curd at 15%, and khoa at 10%. This consumer preference is largely driven by the cultural and culinary significance of ghee and paneer in Indian households. Ghee is a staple in many Indian diets and is often used for cooking, religious ceremonies, and medicinal purposes. Paneer, similarly, is widely used in Indian cuisine, particularly in vegetarian dishes.

The relatively lower preference for curd and khoa suggests that while these products are also popular, they may be more regionally consumed or used in specific dishes. The table highlights the importance of focusing on products that align with consumer demand when adding value to buffalo milk. Producers aiming to maximize profits should prioritize the production of ghee and paneer, as these products have a more robust market demand. Understanding consumer preferences is key to aligning production efforts with market needs, thereby enhancing sales and profitability in rural dairy markets.

Table-4 Consumer Preferences for Buffalo Milk Products

Product	Percentage of Consumers Preferring (%)
Ghee	45
Paneer	30
Curd	15
Khoa	10

The preference for ghee and paneer reflects their widespread use in Indian cuisine and festivals. This indicates the need for farmers and small-scale dairy processors to focus on these high-demand products.

Shelf Life of Buffalo Milk Products

Table 5 examines the shelf life of various buffalo milk products, an important factor in determining the logistics of production, storage, and market distribution. Ghee has the longest shelf life at 180 days, making it the most durable product for rural producers, particularly those who lack advanced refrigeration and transportation

infrastructure. Butter has a shelf life of 30 days, which still provides flexibility in storage and sales. Paneer and khoa, on the other hand, have shorter shelf lives of 7 and 15 days respectively, which necessitates faster turnover and more efficient market distribution to prevent spoilage.

Curd, with a shelf life of 10 days, also requires prompt marketing but is easier to store than paneer or khoa due to its fermented nature. The table suggests that products like ghee and butter, with longer shelf lives, are more suitable for rural producers who wish to expand their market reach, as these products can be transported over longer distances without the risk of spoilage. Shorter shelf-life products, while still profitable, require better infrastructure, such as cold storage facilities, to maintain product quality. This analysis underscores the need for strategic planning in the production and distribution of buffalo milk products, particularly in regions where infrastructure may be underdeveloped.

Table-5 Shelf Life of Buffalo Milk Products

Product	Shelf Life (Days)
Ghee	180
Paneer	7
Curd	10
Butter	30
Khoa	15

A longer shelf life allows for greater flexibility in transportation and marketing, which is crucial for rural areas with less developed infrastructure. Farmers should consider producing products like ghee that have fewer storage challenges.

Economic Impact of Value Addition on Rural Farmers

Table 6 evaluates the economic impact of value addition on rural farmers, focusing on income enhancement and employment generation. Farmers engaged in value-added processing experience a significant increase in income, with an average rise of 50-70% compared to those who sell raw milk. This increase is largely attributed to the higher market prices of processed products such as ghee, paneer, and butter, which have strong consumer demand. Additionally, value addition creates new employment opportunities in processing, packaging, and distribution, thereby contributing to rural job growth.

The table also highlights the multiplier effect of value addition on the rural economy, as the increased income allows farmers to invest more in their businesses, purchase better feed for their animals, and improve their overall standard of living. Employment generated through dairy processing further strengthens the local economy by providing additional

income sources for families involved in ancillary activities like packaging and transportation. The data clearly show that value addition has a transformative impact on rural livelihoods, not only by increasing direct income for farmers but also by stimulating broader economic growth in rural communities. This underscores the importance of promoting value-added dairy production as a strategy for rural development.

Table-6 Economic Impact of Value Addition on Rural Farmers

Impact Metric	Raw Milk Farmers	Value-Added Producers
Average Income Increase (%)	0	50
Employment Opportunities	Minimal	High

Conclusion

The study underscores the significant economic benefits of value addition in buffalo milk production for rural farmers in Mathura District, Uttar Pradesh. By transforming raw milk into products like ghee, paneer, butter, curd, and khoa, farmers experienced a substantial increase in income, with value-added products generating 50-70% higher earnings compared to raw milk sales. Ghee and paneer emerged as the most profitable due to their longer shelf life and high consumer demand, while curd and khoa, though profitable, required rapid market turnover. The data demonstrate that value addition can not only improve farmers' incomes but also stimulate rural employment and enhance the local economy.

However, the study also identified challenges such as limited access to modern processing technologies, inadequate market linkages, and a lack of technical training. Addressing these barriers through government policies and support systems can help maximize the benefits of value addition. Investments in dairy processing infrastructure, market access, and capacity building for small-scale farmers are essential to unlock the full potential of buffalo milk production. Overall, value addition represents a viable strategy for advancing the rural economy and improving the livelihoods of dairy farmers in India.

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