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Production Costs, Profitability, and Challenges in Dairy Farming: Insights from Kaski District, Nepal

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ABSTRACT

Background and Objective: Milk production plays a crucial role in Nepal's agricultural economy, driven by population growth and rising incomes. However, a limited understanding of production cost dynamics restricts sustainable profitability in the sector. This study aims to analyze the costs, productivity, and profitability of milk production in the Kaski District of Nepal. **Materials and Methods:** A total of 120 small-scale dairy farms were surveyed using structured questionnaires, interviews, and telephone surveys. Data were processed and analyzed using Microsoft Excel and SPSS. Key cost components and profitability ratios were calculated to assess economic viability. Pearson's correlation was applied using Microsoft Excel 2016 to assess linear relationships between variables, assuming normal distribution, with significance set at $p<0.05$. **Results:** The cost of producing one liter of milk averaged Rs. 43 for cattle and Rs. 55.8 for buffalo. Despite higher production costs, buffalo farming showed greater profitability with a revenue/cost ratio of 1.81, compared to 1.18 for cattle. Variable costs emerged as the most influential factor on profit margins. Farmers prioritized taste and fat content for pricing and preferred monthly payments. Major challenges identified included high labor requirements with low returns and marketing issues due to limited product diversification and seasonal supply fluctuations. **Conclusion:** Buffalo farming proves more profitable than cattle farming in the Kaski District. The study highlights key economic challenges and offers insights for policymakers, farmers, and stakeholders to enhance the sustainability and profitability of Nepal's dairy sector.

KEYWORDS

Cost analysis, feed costs, milk production, profitability, dairy farming

INTRODUCTION

The economics of milk production in Nepal, particularly in Kaski District, is a crucial area of study given the significant role of milk in the country's economy. Nepalese households, especially in Kaski, heavily rely on dairy farming, with a majority keeping cattle and buffalo for milk production[1]. Interestingly, despite a higher proportion of cattle, buffalo contribute to around 71% of the total milk production in the country[2]. Understanding the costs associated with milk production is vital for both farmers and policymakers. Various expenses such as feed, labor, veterinary services, transportation, and marketing play a crucial role in determining the profitability of dairy enterprises[3]. Studies conducted by organizations like the National Dairy Development Board (NDDB) shed light on these costs, helping stakeholders make informed decisions. Over the year, there has been a noticeable increase in milk production in Nepal, with the volume

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rising steadily. However, there exists a gap between the national milk demand and supply, with projections indicating a further increase in demand by 2025[4]. This underscores the importance of efficient milk production practices to meet the growing demand. The structure of dairy farming in Nepal is evolving, with a shift from traditional, small-scale farming to more organized, commercial setups[3,4]. While traditional methods still dominate, there is a gradual transition towards medium-sized farms. This transition has implications for the cost of milk production, with medium-sized farms potentially achieving economies of scale. Cost differentials between cow and buffalo keeping are observed, with buffalo maintenance costs generally lower than those of cows. This disparity in costs can influence farmers' decisions regarding the type of animal to keep based on their economic viability[5].

The economics of milk production in the Kaski District present several critical challenges. Variations in production costs across regions, coupled with fluctuating market prices, impact profitability. For instance, the cost of milk production is highest in Kailali (Rs. 52.49 L) and lowest in Ilam (Rs. 44.09 L). The differences in cost of milk production and differences in rates of milk production lead to a greater need for cost analysis of milk production. This study aims to investigate factors influencing production efficiency, costs, and returns in milk farming, market access and pricing issues, and the overall impact on farmers' income and livelihoods.

With a growing population and rising income levels, the demand for milk and dairy products in Nepal is increasing. Understanding the cost structure of milk production is crucial in ensuring the sustainability and profitability of the industry. The dairy sector is a significant contributor to the Nepalese economy, providing livelihoods for millions of rural households. A cost analysis of milk production can inform policymakers and industry stakeholders on ways to improve the competitiveness of the sector. A cost analysis study can fill the gap of a lack of data and provide valuable information to the industry.

MATERIALS AND METHODS

Study area and focus: The study focuses on the economics of milk production in Kaski District, Nepal, which is recognized for its small-scale dairy farming activities. The research work was conducted from August, 2024 to October, 2024.

Ethical statement: This study did not involve any animal or human experimentation. Data were collected through surveys, interviews, and secondary sources under institutional and national ethical guidelines. No ethical approval was required as the study did not include animal handling or human subject interventions. However, all participants involved in data provision were informed about the purpose of the study, and their consent was obtained prior to data collection.

Data collection

Primary data: Collected through interviews, key informant discussions, observations, and focus group discussions. Informed consent was obtained from all participants before their involvement in the study, ensuring that they were fully aware of the purpose, procedures, potential risks, and benefits associated with the research. Confidentiality and anonymity of the participants were strictly maintained throughout the study.

Secondary data: Obtained from official reports and records from organizations such as the National Dairy Development Board (NDDB) and Dairy Development Corporation (DDC), with greater emphasis placed on primary sources.

Sampling technique and sample size: Simple random sampling was applied to select participants. Yamane's formula was used to calculate the sample size, with a 10% margin of error (error tolerance)[6].

$$n = N/1+N(e)^2$$

where:

n = Sample size
N = Population size
e = Margin of error

Data processing and analysis tools: Data were organized using Microsoft Excel and analyzed using both Excel and SPSS version 26. Various descriptive statistical tools were employed, including frequency percentages, mean, median, tabulation, and charts to describe socio-demographic and farm characteristics.

Cost estimation

Cost components: The total production cost included both fixed and variable costs:

- **Discounting:** Fixed costs were discounted at a 10% rate
- **Cost per liter:** Estimated by dividing the total annual cost per farm by the average annual milk production per farm

Pearson's correlation: Pearson correlation analysis was used to assess the strength and direction of the linear relationships between variables. The analysis was performed using Microsoft Excel 2016. A significance level of 0.05 ($p<0.05$) was considered for determining statistical significance. The data were assumed to follow a normal distribution.

Profitability assessment: The benefit-cost ratio (BCR) was calculated to evaluate profitability. A BCR greater than 1.0 was considered profitable.

Perception analysis: A five-point Likert scale was used to assess farmers' opinions, ranging from "Strongly disagree" to "Strongly agree".

RESULTS AND DISCUSSION

Demographic and socioeconomic characteristics: In the surveyed area, gender distribution indicates a predominance of males, comprising 59.2% of respondents, possibly reflecting the higher demand for labor in this sector. Regarding age, the majority falls within the 50-60 age group. Ethnicity data highlights a significant presence of the Brahmin community at 66.7%, followed by Chhetri (23.3%), Dalit (2.5%), and Janajati (7.5%). Family structure leans heavily towards nuclear families, constituting 85.8% of respondents, with only 14.2% residing in joint families. Education levels vary, with a notable proportion having completed the School Leaving Certificate (SLC) and a considerable segment being illiterate. Occupation-wise, agriculture dominates, engaging 95% of respondents. Livestock holdings indicate an average of 1.89 milking cows and 2.72 milking buffaloes per respondent. Educational status correlates with livestock ownership, with SLC holders possessing the largest share of livestock. Land ownership averages 0.1886 hectares per respondent, with 0.2038 hectares utilized for grass cultivation.

Average milk yield: Cattle produce an average of 1,800 L per lactation, while buffaloes yield approximately 1,428 L. Early lactation (0-2 months) showed the highest yield, with cows producing 12-18 L/day and buffaloes 9-14 L/day, which gradually declined as lactation progressed in Table 1.

Table 1: Quantity of milk produced in litres per day

	Cow (l/day)			Buffalo (l/day)		
Month after parturition	Mean	Minimum	Maximum	Mean	Minimum	Maximum
0-2 months	12	7	18	9	6	14
2-6 months	8	5	16	6	3	9
> 6 months	5	2	9	4	1	6

Table 2: Distribution of production cost for cattle and buffalo (%)

Distribution of production cost for cattle and buffalo (%)	Cattle (%)	Buffalo (%)
Fixed cost (housing, animal, equipment)	13.2	17.2
Feeds and fodder	60.7	54
Labor cost	3	7.1
Electricity and transportation cost	6.3	7.4
Additives, supplements, and veterinary costs	9.4	10.8
Miscellaneous cost	7.4	3.5

Average cost of rearing cattle and buffalo: The distribution of production costs for cattle and buffalo varies considerably, reflecting their different physiological and management needs. On average, cattle farming amounts NRS 74,836.6 as total cost while the income generated stands at NRS 149,363 resulting in a profit of NRS 74,387.6. On the other hand, buffalo farming involves a slightly higher cost of NRS 78,884, but it yields a significantly higher income of NRS 192,681 resulting in a profit of NRS 113,796.9.

Buffalo farming typically incurs higher fixed costs (17.2%) compared to cattle (13.2%), primarily due to their larger size, longer productive lifespan, and higher housing requirements[7] in Table 2. However, cattle have significantly higher feed costs (60.7%) compared to buffaloes (54%), highlighting their greater dependence on high-energy feeds to support faster growth and higher milk yields[8]. Labour costs are also notably higher for buffaloes (7.1%), as they generally require more intensive care, handling, and milking time[9]. Similarly, buffaloes tend to have higher electricity and transportation costs (7.4%) due to their larger body size and greater water requirements, which increase the energy needed for cooling and transport[9]. Additives, supplements, and veterinary costs are another critical component, slightly higher for buffaloes (10.8%) than cattle (9.4%), reflecting their higher susceptibility to nutritional deficiencies and disease[10]. In contrast, miscellaneous costs, including insurance, breeding, and water supply, are higher for cattle (7.4%) than buffaloes (3.5%), potentially due to more intensive breeding programs and higher insurance premiums[11].

Overall, these differences in cost distribution indicate that while buffaloes require higher initial investments and ongoing veterinary care, they may offer long-term economic advantages due to their ability to efficiently convert low-quality roughages into high-fat milk, which often commands a premium price in the market. This economic advantage should be considered when selecting dairy species for specific regional and market conditions.

Average cost of production: The average cost of producing one liter of cattle milk averages 43 Rs, whereas the expense for producing one liter of buffalo milk is slightly greater at 55.8 Rs, which is illustrated in Fig. 1. The average cost of production of milk per litre is higher for buffalo because buffalo have lower milk yield per lactation, while cattle have a higher yield per lactation in Fig. 1.

Profitability analysis of buffalo and cattle milk production: On average, buffalo farming boasts a significantly higher B/C ratio of 1.81, while cow farming shows a respectable but slightly lower B/C ratio of 1.18. Higher B/C ratio for buffalo farming, underscoring its greater economic viability compared to cattle. The reasoning behind the higher B/C ratio for buffalo farming could be the higher price per litre of milk for buffalo milk. Also, the higher fat and SNF content in buffalo milk attracts more consumers

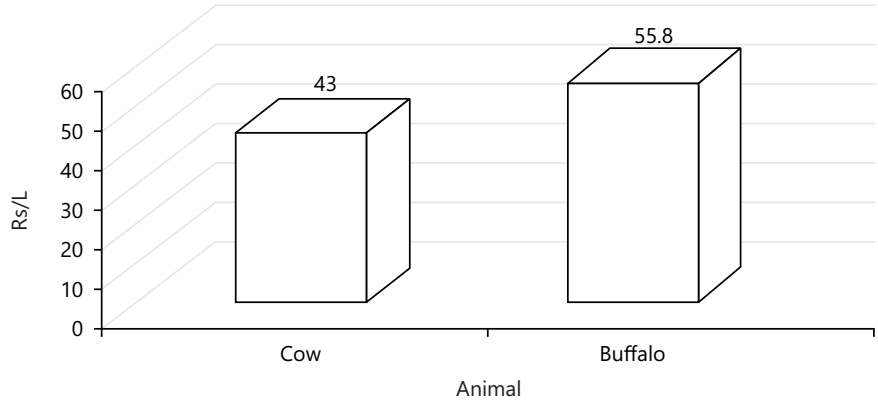

Fig. 1: Average cost of production for cattle and buffalo

Table 3: Ranking of problems in marketing

Variables	Ranking (respondents (%))
Limited diversification of milk products	I (54.2 %)
Seasonal variation in milk production	II (33.3 %)
Lack of storage and processing facilities	III (9.2 %)
Limited market access	IV (3.3 %)

Table 4: Likert scale responses

Variables	Mean	Mode	Std. Deviation	Minimum	Maximum
Overall cost of milk production is reasonable	1.45	1	0.606	1	3
Feed for dairy animals is reasonably priced	1.14	1	0.373	1	3
Access to the market for milk is simple	4.28	4	0.638	2	5
Cost of veterinary services is affordable	3.16	3	0.953	1	5

compared to cattle milk. The variable costs and profitability exhibit a significant negative correlation ($r = -0.359^{**}$, $p<0.01$), suggesting that as variable costs rise, profitability tends to decrease. As variable costs increase, the total cost of production increases, which decreases the total profitability. There exists a significant negative Pearson correlation of -0.465** between variable cost (Cow) and income (Cow). This finding indicates that as variable costs associated with cow milk production increase, the income generated from cow farming tends to decrease. As variable costs increase, there is an increase in the total cost of production, which reduces the income from cow milk.

Major problems faced during the marketing of milk and milk products: The primary challenge in milk marketing, as identified by 54.2% of respondents, is the limited diversification of milk products, reflecting a critical need to expand product varieties to better meet consumer preferences. Seasonal variations in milk production were cited as the second most significant issue, with 33.3% of respondents highlighting this as a key concern, emphasizing the importance of strategies for managing production fluctuations. Additionally, 9.2% of respondents identified the lack of adequate storage and processing facilities as a major constraint, pointing to the need for improved infrastructure to reduce post-harvest losses and maintain milk quality. Finally, limited market access, mentioned by 3.3% of respondents, remains a minor but relevant issue, suggesting that better distribution channels and market connectivity are necessary for industry growth in Table 3.

Farmers' perception of milk production cost: On average, of total respondents' mean score of 1.45, with a Mode of 1 for the overall cost of milk production, signifying that the majority of respondents perceive it as unreasonable. Similarly, feed pricing for dairy animals receives a mean score of 1.14 and a Mode of 1, suggesting that feed pricing is highly unreasonable. On the other hand, participants strongly agree (mean score 4.28) that accessing milk markets is easy. In contrast, the affordability of veterinary services, with a mean score of 3.16 and a Mode of 3, reflects a neutral response. Standard deviations reveal response variability, with lower values indicating greater agreement shown in Table 4.

CONCLUSION

The survey in the Kaski District of Nepal provided critical insights into the economics of milk production. It revealed that buffalo farming is more economically viable than cow farming, with variations in production costs, profitability, and income. Despite this, the dairy industry remains a significant part of the local economy, employing a majority of respondents engaged in agricultural professions. Challenges such as high labor requirements and low profitability were identified as major concerns in milk animal rearing, and limited diversification of milk products and seasonal production variations posed challenges in marketing. To enhance the sector, the study recommended addressing feed pricing, diversifying products, and tackling seasonal variations. Respondents highlighted the importance of feed subsidies and increased services in animal health and production as key factors for enhancing milk production. Additionally, the findings emphasized the need for government support, including subsidies for feed and investments in animal health services, to potentially boost milk production. In conclusion, the survey's findings are invaluable for informing policymakers, farmers, and stakeholders in making decisions to improve the sustainability and profitability of the dairy industry in Kaski District, Nepal.

SIGNIFICANCE STATEMENT

Milk production is a key agricultural activity in Kaski District, supporting the livelihoods of smallholder farmers and contributing to local food security and income generation. Despite its potential, the dairy sector in Kaski faces numerous challenges such as low productivity, high input costs, inadequate veterinary services, and limited access to organized markets. This study holds significance as it provides a detailed analysis of the current status of milk production, cost structures, profitability, and marketing practices in the district. The findings will serve as a valuable resource for policymakers, local governments, cooperatives, and development agencies aiming to strengthen the dairy value chain in the region. By identifying existing gaps and recommending practical solutions, this research can guide efforts to enhance productivity, promote farmer-friendly policies, and improve the economic resilience of rural households. Ultimately, the study supports sustainable dairy development in Kaski, contributing to both local economic growth and national dairy goals.

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