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Constraints confronting buffalo milk producers in Kolhapur district of Maharashtra: A response priority index analysis

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Abstract

India, the world's largest milk producer, derives nearly 48.34 per cent of its total milk output from buffaloes. Yet buffalo milk producers continue to face a complex web of economic, institutional, and knowledge-related constraints that limit farm profitability and productivity. The present study systematically identifies and prioritises the problems confronted by buffalo milk producers in Kolhapur district of Maharashtra- the state's leading district in both breedable buffalo population (3,78,731) and annual milk production (6,276.26 lakh kg). Primary data were collected from 90 sample producers stratified into small (up to 2 buffaloes), medium (3-5 buffaloes), and large (more than 5 buffaloes) herd size groups across three tehsils (Karvir, Panhala, and Kagal). The Response Priority Index (RPI) was applied to rank the constraints. Results reveal that low price of liquid milk (RPI: 0.89) and high cost of concentrate feed (RPI: 0.87) are the most critical barriers, followed by low conception rate through artificial insemination (RPI: 0.25), lack of veterinary services (RPI: 0.24), and inadequate knowledge of balanced feeding and disease management. These findings underscore the urgency of remunerative milk pricing policies, subsidised feed supply, revamped AI service delivery, strengthened veterinary infrastructure, and targeted extension training to sustain and scale buffalo dairying in western Maharashtra.

Keywords: Buffalo milk production, constraints, Kolhapur district, Response Priority Index, dairy farming, Maharashtra

Introduction

India is fundamentally an agrarian economy, with agriculture and allied sectors sustaining the livelihoods of approximately 54.60 per cent of the population (Satashia, 2020) ^[15]. The livestock sub-sector occupies a pivotal role within this broader agricultural economy. In 2021-22, the share of livestock in total agriculture and allied sector GVA stood at 30.90 per cent at constant prices, and the livestock sector recorded a compound annual growth rate (CAGR) of 8.15 per cent during 2014-15 to 2019-20 (Anonymous, 2022) ^[2]. By 2023-24, India's total milk production reached an all-time high of 239.3 million tonnes, with per capita milk availability rising to 471 grams per day (DAHD, 2024) ^[5].

The domestic water buffalo (*Bubalus bubalis*), widely recognised as a 'milk machine' of the Indian subcontinent, contributes nearly 48.34 per cent of India's total milk output, making it the single most important dairy species in the country (FAO, 2023) ^[7]. According to the 20th Livestock Census (2019), India's buffalo population stood at approximately 109.85 million, estimated to have grown to 113.3 million by 2023 (USDA-FAS, 2023) ^[18]. Globally, buffalo milk accounts for approximately 15 per cent of world milk production, underscoring the species' international significance. The major buffalo milk producing states in India include Uttar Pradesh, Rajasthan, Gujarat, Madhya Pradesh, Bihar, Andhra Pradesh, Maharashtra, Haryana, and Telangana.

Maharashtra ranks seventh in buffalo population and sixth in buffalo milk production nationally. Among all districts of the state, Kolhapur occupies the foremost position in both breedable buffalo population (3, 78, 731) and annual milk production (6, 276.26 lakh kg), supported by a robust network of dairy cooperative societies and well-developed rural

infrastructure. The major buffalo-concentrated tehsils are Karvir, Panhala, Kagal, Hatkanangale, Shirol, Radhanagari, and Gadhinglaj.

Despite Kolhapur's dominant position in the state's dairy landscape, buffalo milk producers continue to encounter a range of structural, institutional, and economic constraints that limit profitability and long-term sustainability. Rising costs of concentrate feed, unremunerative milk prices, poor AI conception rates, inadequate veterinary infrastructure, and knowledge gaps in animal management are among the key challenges documented in the literature (Narnaware *et al.*, 2023; Bharwar *et al.*, 2020; Nagrale *et al.*, 2015) [12, 3, 11]. Nationally, the average AI conception rate in India is only about 35 per cent- far below the 60-72 per cent achieved in developed dairy economies (ICAR-IIVRI, 2024) [9]. Recent studies from Vidarbha and Marathwada regions of Maharashtra similarly highlight that shortage of quality feed, high concentrate costs, unavailability of veterinary facilities, unstable milk pricing, and inadequate credit support are the foremost constraints for dairy farmers (Narnaware *et al.*, 2023) [12].

A review of earlier studies from Kolhapur district, including Shinde *et al.* (2019) [16], identified that economics of milk production were unfavourable for small herd producers, with input costs frequently exceeding returns. Given the importance of buffalo dairying to the district's rural economy and the scarcity of recent, district-specific constraint analyses using RPI methodology, the present study was undertaken to systematically identify and rank the major problems faced by buffalo milk producers across different herd size categories in Kolhapur district.

The findings aim to provide an evidence base for policymakers, cooperative societies, and extension agencies.

Objectives of the Study

The specific objectives of the study were:

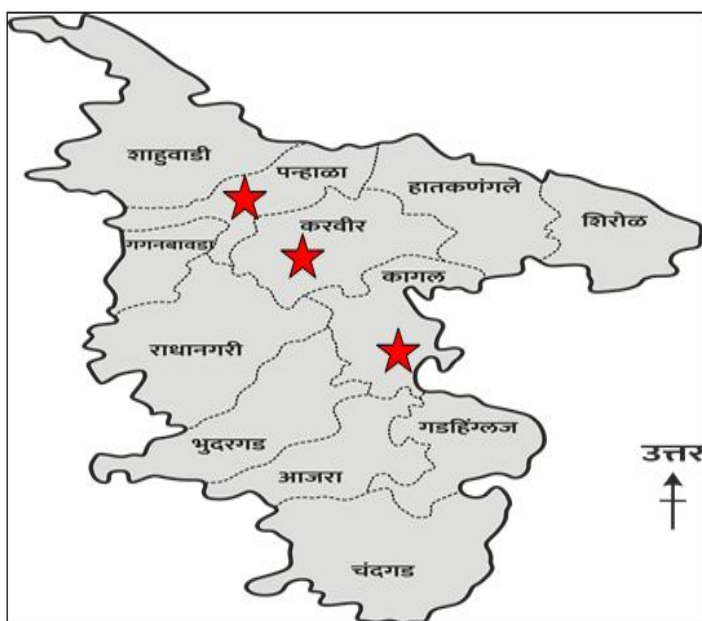
1. To identify the major problems faced by buffalo milk producers in Kolhapur district.
2. To prioritise these problems using the Response Priority Index (RPI) across different herd size groups.
3. To suggest policy measures to address the identified constraints.

2. Material and Methods

2.1 Study Area and Sampling Design

The study was conducted in Kolhapur district of Maharashtra, selected purposively as it ranks first in the state both in breedable buffalo population and annual milk production. Buffalo population is predominantly concentrated in the tehsils of Karvir, Panhala, Kagal, Hatkanangale, Shirol, Radhanagari, and Gadhinglaj. From these, three tehsils were selected based on the highest number of milch buffaloes: Karvir (80,903), Panhala (57,603), and Kagal (55,392). Two villages were randomly selected from each tehsil, yielding six sample villages.

The list of buffalo milk producers was obtained from cooperative dairy societies in each village. Producers were stratified into three herd size categories: small (up to 2 buffaloes), medium (3 to 5 buffaloes), and large (more than 5 buffaloes). Five producers were randomly selected from each size group per village, yielding a total sample of 90 buffalo milk producers (15 per village × 6 villages). Primary data were collected through personal interviews using a pre-tested, structured questionnaire.



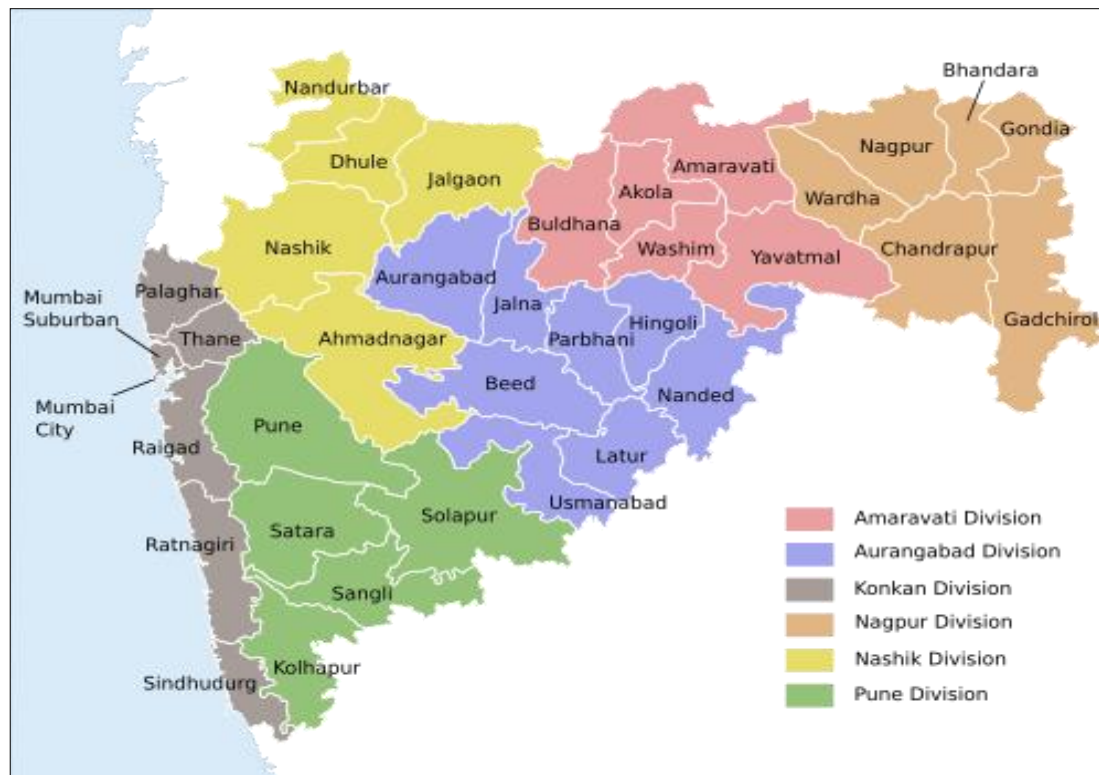


Fig 1: Location of research

2.2 Analytical Method: Response Priority Index (RPI)

The problems identified by respondents were prioritised using the Response Priority Index (RPI), a composite measure that incorporates both the frequency of responses and their assigned priority weights. It was developed as a product of the Proportion of Responses (PR) and Priority Estimate (PE), where PR for the i^{th} constraint gave the ratio of number of responses for a particular constraint to the total responses as per equation given below:

$$(RPI)_i = \frac{\sum_{j=1}^k f_{ij} \cdot X_{[(k-1)-j]}}{\sum_{i=1}^1 \sum_{j=1}^k f_{ij}} \quad (0 \leq RPI \leq 5)$$

Where;

- $(RPI)_i$ = Response priority Index for i^{th} constraints,
- $f_{(ij)}$ = Number of responses for the j^{th} priority of the i^{th} constraints. ($i=1,2,\dots$; $j=1,2,3,\dots,k$)
- $\sum_{j=1}^k f_{ij}$ = Total number of responses of the i^{th} constraints
- $X_{[(k-1)-j]}$ = scores for the j^{th} priority, k = number of priorities, i.e.5,
- $\sum_{i=1}^1 \sum_{j=1}^k f_{ij}$ = total number of responses to all constraints and
- $\sum_{i=1}^1 (RPI)_i$ = summation of RPI indices for all constraints.
- A higher RPI value indicates a more severe and widely perceived constraint. The index simultaneously accounts for how many respondents reported a given problem and the priority they assigned to it relative to other problems.

3. Results and Discussion

3.1 Profile of Sample Buffalo Milk Producers

The 90 sample producers were spread equally across three tehsils (30 each) and three herd size groups. Small producers (up to 2 buffaloes) represented the largest segment, reflecting the predominantly smallholder character of buffalo dairying in the district. The presence of a strong cooperative infrastructure, particularly the Kolhapur District Co-Operative Milk Producers' Union (Gokul), provides an organised milk procurement channel but has not insulated producers from persistent market and input cost pressures.

3.2 Problems Faced by Buffalo Milk Producers

The RPI values and ranks for the ten identified constraints are presented in Table 1.

3.2.1 Low Price of Liquid Milk (RPI: 0.89, Rank I)

Low price of liquid milk emerged as the most critical constraint (RPI: 0.89), a finding that is both economically significant and practically urgent. Despite the strong cooperative presence in Kolhapur, producers consistently reported that procurement prices fail to adequately compensate for total production costs. Inflationary pressures in 2022-24 widened the input-output price gap, with dairy input costs in India estimated to have risen by approximately 15 per cent in 2022-23, primarily driven by feed prices (Zenodo, 2023) [21]. The margin between the cost of producing a litre of buffalo milk and the price received at farm gate has narrowed significantly. Similar findings have been reported by Narnaware *et al.* (2023) [12] for Marathwada and Vidarbha regions, and by Adhikari *et al.* (2020) [1] for the hill region of Uttarakhand, confirming that unremunerative milk pricing is the dominant, pan-Indian constraint for dairy producers.

Table 1: Problems Faced by the Buffalo Milk Producers

Sr. No.	Problems	Numbers in Respective Priorities					Total Recorded Responses	RPI	Rank
		I	II	III	IV	V			
1	High cost of concentrate feed	26	27	24	29	24	130	0.87	II
2	Low price of liquid milk	28	26	27	25	24	130	0.89	I
3	Low conception rate through AI	10	8	5	5	4	32	0.25	III
4	Lack of veterinary doctor/hospital	6	7	9	6	5	33	0.24	IV
5	Inadequate knowledge about balanced feeding	7	8	6	5	9	35	0.23	V
6	Inadequate knowledge of diseases & control	3	4	7	5	6	25	0.15	VI
7	Non-availability of green/dry fodder round the year	2	4	6	7	6	25	0.14	VII
8	High labour cost	2	3	4	3	4	16	0.10	VIII
9	Lack of technical knowledge on dairy	4	2	1	2	4	13	0.09	IX
10	Unavailability of labour	2	1	1	3	4	11	0.06	X
	Total	90	90	90	90	90	450		

3.2.2 High Cost of Concentrate Feed (RPI: 0.87, Rank II)

High cost of concentrate feed ranked second (RPI: 0.87), a finding consistent across virtually all dairy constraint studies in India. Feed and fodder constitute 60-70 per cent of the total cost of milk production (Athare *et al.*, 2023) ^[4]. Studies on the economics of buffalo milk production in Kolhapur district confirm that concentrate feed is the largest single variable cost component for buffalo producers (Shinde *et al.*, 2019) ^[16]. The situation is aggravated by the seasonal unavailability of affordable green fodder, compelling producers to rely disproportionately on expensive commercial concentrates. Bharwar *et al.* (2020) ^[3] and Nagrale *et al.* (2015) ^[11] similarly identified high concentrate cost and fodder scarcity as leading constraints for dairy farmers in Karnataka and Vidarbha respectively.

3.2.3 Low Conception Rate through AI (RPI: 0.25, Rank III)

Low conception rate through artificial insemination (AI) ranked third (RPI: 0.25). The national average AI conception rate in India is approximately 35 per cent, far below the 60-72 per cent achieved in developed dairy economies (ICAR-IIVRI, 2024) ^[9]. Field-level factors depressing conception rates include inadequate heat detection by farmers, improper timing of insemination, suboptimal semen handling, and thermal stress during summer months, with conception rates reported to vary between 23.9 per cent in winter and 39.1 per cent in summer (BioChem Journal, 2023) ^[6]. Prolonged inter-calving intervals arising from poor AI success directly reduce annual milk output per animal and elevate per-litre production costs. The Government of India's Rashtriya Gokul Mission and the Multipurpose AI Technicians in Rural India (MAITRI) scheme under the National Artificial Insemination Programme aim to address this gap, with AI services being provided free of cost across 605 districts (DAHD, 2024) ^[5], but effective implementation at the farm level remains uneven.

3.2.4 Lack of Veterinary Doctor/Hospital (RPI: 0.24, Rank IV)

Lack of accessible veterinary services ranked fourth (RPI: 0.24). Timely veterinary care is essential for managing reproductive disorders, mastitis, metabolic diseases, and infectious conditions common in high-producing buffaloes. Inadequate access to qualified veterinarians leads to delayed treatment, elevated animal mortality and morbidity, and compromised productive performance. This systemic gap in Maharashtra's livestock health infrastructure has been highlighted by Chakravarthi *et al.* (2017) ^[8] and Hamadani

et al. (2019) ^[14], who similarly identified unavailability of veterinary facilities as a major constraint for dairy farmers.

3.2.5 Inadequate Knowledge of Balanced Feeding (RPI: 0.23, Rank V)

Inadequate knowledge about balanced feeding ranked fifth (RPI: 0.23). Despite Kolhapur's cooperative dairy infrastructure, many producers particularly in the small and medium herd groups lacked awareness of species-specific nutritional requirements, mineral and vitamin supplementation, and least-cost ration formulation. This results in suboptimal feeding practices that restrict milk yield, impair reproductive efficiency, and increase the risk of metabolic disorders. Hamadani *et al.* (2019) ^[14] reported similar knowledge deficiencies among dairy farmers in urban fringe areas.

3.2.6 Other Constraints (Ranks VI-X)

Inadequate knowledge of diseases and their control (RPI: 0.15, Rank VI) and non-availability of green/dry fodder round the year (RPI: 0.14, Rank VII) reflect persistent gaps in extension outreach and fodder resource development. High labour cost (RPI: 0.10, Rank VIII) reflects the rising opportunity cost of farm labour in rural Maharashtra as non-farm employment expands. Lack of technical knowledge on dairy (RPI: 0.09, Rank IX) and unavailability of labour (RPI: 0.06, Rank X) were the least critical but nonetheless relevant constraints, particularly for large-herd producers. The overall constraint profile reflects a dual challenge: economic pressures at the top (price and cost), and institutional/knowledge gaps further down the ranking. This pattern aligns closely with the findings of Narnaware *et al.* (2023) ^[12] for Marathwada and Vidarbha, Chakravarthi *et al.* (2017) ^[8] for Andhra Pradesh, and Nagrale *et al.* (2015) ^[11] for Vidarbha, confirming that economic and institutional constraints are the most persistent barriers to sustainable buffalo milk production across diverse agro-climatic settings in India.

4. Conclusion

The study identifies low price of liquid milk (RPI: 0.89) and high cost of concentrate feed (RPI: 0.87) as the two dominant constraints confronting buffalo milk producers in Kolhapur district. Low AI conception rates, inadequate veterinary infrastructure, knowledge gaps in balanced feeding and disease management, and seasonal fodder scarcity are the other significant bottlenecks. Together, these constraints operate across economic, institutional, and human capital dimensions, making single-intervention approaches insufficient. A co-ordinated policy response

addressing pricing reform, input cost relief, AI service revamp, veterinary infrastructure expansion, and extension education is essential to enhance the profitability, productivity, and long-term sustainability of buffalo dairying in Kolhapur district and across western Maharashtra.

5. Policy Implications

The following targeted policy measures are recommended based on the study findings:

- 1. Remunerative Milk Pricing:** Milk procurement prices should be periodically revised to reflect input cost inflation. Strengthening dairy cooperative societies and linking procurement prices to a transparent input cost index would protect producer margins.
- 2. Input Cost Relief:** Targeted subsidies on balanced concentrate feed rations, promotion of on-farm fodder cultivation under the Rashtriya Krishi Vikas Yojana (RKVY), and establishment of community fodder banks would ease the feed cost burden on small and medium producers.
- 3. Revamping AI Service Delivery:** Full deployment of trained MAITRI personnel, improvement of cold chain infrastructure for semen quality maintenance, and farmer training on oestrus detection and insemination timing would significantly improve AI conception rates.
- 4. Veterinary Infrastructure:** Increasing the density of functional veterinary polyclinics, mobile veterinary units, and para-veterinary service centres at the village level would reduce animal health risks and productivity losses.
- 5. Capacity Building and Extension:** Regular farmer training programmes and field demonstration camps on scientific buffalo management, balanced ration formulation, disease prevention, and adoption of improved breeding practices with special focus on small-herd producers are essential to bridge the knowledge gap.

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