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Research Article

Commercial Feed and Dairy Productivity: A Comparative Analysis in Raigad, Maharashtra

Aastha Chouhan*, Hulas Pathak, AK Gauraha, Sanjay Dwivedi and SK Joshi

Department of Agribusiness and Rural Management, Indira Gandhi Krishi Vishwavidyalaya (IGKV) Raipur, India

***Corresponding Author:** Aastha Chouhan, Department of Agribusiness and Rural Management, Indira Gandhi Krishi Vishwavidyalaya (IGKV) Raipur, Chhattisgarh, India.

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Abstract

Background: The livestock feed market is crucial for dairy productivity, animal health, and agricultural sustainability. This study examines the livestock feed market dynamics in five talukas of Raigad district, Maharashtra, focusing on feed consumption patterns, market trends, and the impact of feed quality on livestock productivity and farmers' livelihoods.

Methods: Using a descriptive research design, data were collected through a structured questionnaire via Google Forms, targeting livestock farmers, sellers, and manufacturers. A random sampling technique ensured diverse representation across Panvel, Pen, Roha, Murud, and Alibaug. The questionnaire covered demographic information, livestock inventory, milk production, feed consumption patterns, feed preferences and quality, economic aspects, supply chain dynamics, and knowledge and regulation awareness. Data analysis included descriptive and inferential statistical methods, such as regression analysis.

Results: The survey revealed significant patterns and correlations in dairy farming practices. Higher education levels, especially among women, correlated with openness to innovative farming techniques, improving milk production and efficiency. Farmers using commercial feed, particularly those with larger herds, reported higher productivity. However, there was a notable disparity in regulatory awareness, with more educated farmers showing better knowledge of regulations and feed types. This gap impacted compliance with industry standards and perceptions of feed affordability.

Conclusion: The study emphasizes the role of education and regulatory awareness in influencing dairy farming practices, highlighting the potential for improved productivity, quality, and sustainability, while also highlighting educational disparities and enhancing industry compliance.

Keywords: Livestock Feed; Raigad District; Regulatory Awareness; Commercial Feed; Agricultural Sustainability

Introduction

The livestock feed market represents a critical component of the global agricultural sector, underpinning the health, productivity, and sustainability of livestock farming. As the demand for animal products such as meat, milk, and eggs continue to rise, ensuring the availability and quality of livestock feed has become paramount. Livestock nutrition directly influences not only animal health and productivity but also the economic viability of agricultural enterprises and the sustainability of agricultural ecosystems [1,2]. Proper nutrition enhances growth rates, reproductive performance, and disease resistance in animals, which in turn contributes to the efficiency and profitability of livestock farming operations [3]. The significance of the livestock feed market extends beyond mere animal husbandry. It impacts food security, rural livelihoods, and

the global economy. In regions like India, where agriculture remains a primary occupation for a large segment of the population, the livestock sector plays a crucial role in providing employment and income. The animal feed industry in India is one of the world's largest, with the market reaching INR 1,035.2 Billion in 2023 and projected to grow at a compound annual rate of 7.2% to reach INR 1,964.8 Billion by 2032 [4]. Commonly used animal feeds include pasture grasses, cereal grains, hay, silage crops, and food crop by-products. However, concerns over food safety due to issues like food-borne infections, BSE, and dioxin contamination have arisen [2]. Additionally, raw materials such as soybean meal, sorghum, and maize are increasingly diverted for human consumption, causing a shortage in the feed industry. Factors contributing to this shortage include disease outbreaks, antimicrobial resistance, greenhouse gas emissions, insufficient veterinary services, low animal productivity, low milk prices, disorganized livestock markets, and inadequate livestock extension services [5]. These shortages significantly impact the livestock sector, compounded by macroeconomic, geopolitical, and socioeconomic uncertainties, creating challenges in feed availability and food security, highlighting the extensive effects on both the livestock sector and global food security. Within India, Maharashtra is a leading state in dairying, ranking as the fifth-largest milk producer in India. The establishment of Aarey Milk Colony in the 1960s and the cooperative movement in the 1970s led to the creation of dairy cooperatives, allowing farmers to receive fair prices for their milk and transforming milk production into a commercial enterprise [6]. Crossbred technology has further increased milk production per animal. Between 1985 and 2000, Maharashtra's milk production grew faster than the national average, reaching 67.9 lakh tonnes in 2005-06. This growth is due to increased productivity levels, modern technology, and the efforts of dairy cooperatives providing balanced cattle feed, veterinary and healthcare services [7].

Raigad district, with its diverse topography and climatic conditions, provides an ideal case study for examining the dynamics of the livestock feed market [8]. This region's unique agricultural landscape includes both coastal and inland areas, presenting varied challenges in terms of feed availability and livestock management practices [9,10]. Understanding the feed consumption patterns, supply chain mechanisms, and the nutritional quality of available feed in Raigad can offer valuable insights for similar regions across India and other developing countries. Despite the growing demand for livestock products, there is limited understanding of the dynamics of the feed market in Raigad district. This lack of comprehensive data on feed consumption patterns hinders informed decision-making for livestock farmers, policymakers, and industry stakeholders. Addressing this gap is essential for optimizing feed resource allocation, enhancing livestock productivity, and ensuring the sustainability of the agricultural sector in Raigad.

This study aims to address the lack of understanding about the livestock feed market dynamics in Raigad district. This study will contribute to bridging the knowledge gap regarding livestock feed dynamics in Raigad. By providing a comprehensive analysis of feed consumption patterns, supply chain mechanisms, and nutritional quality, the findings of this research will inform policymakers, farmers, and industry stakeholders on optimizing feed resources. Improved understanding of the feed market will facilitate better decision-making and strategic planning, ultimately leading to enhanced livestock productivity and sustainability. Moreover, this research is timely and relevant given the increasing emphasis on sustainable agricultural practices and food security. As the global population continues to grow, the demand for animal products will rise, placing greater pressure on the livestock sector to produce more with limited resources. Efficient feed management is a key factor in meeting this challenge, making studies like this one vital for developing practical solutions.

This study stands out as the first systematic analysis of the Raigad livestock feed market. While previous research may have touched upon various aspects of livestock farming in Maharashtra, there has been no comprehensive examination focused specifically on the feed market dynamics within Raigad district. This research will fill that void by providing a detailed and nuanced understanding of feed consumption, supply, and nutritional quality in the region. Furthermore, the study's approach is unique in its integration of nutritive values with market dynamics, offering a holistic view of feed choices available to livestock farmers. By evaluating the nutritional quality of feed supplements alongside their market availability and pricing, the research provides a multi-dimensional analysis that can inform both practical and policy-level interventions.

Materials and Methods

Research design

This study employs a descriptive research design to investigate the dynamics of the livestock feed market in five talukas of Raigad district, Maharashtra (i.e. Panvel. Pen. Roha, Murud and Alibaug). By collecting and analyzing quantitative and qualitative data, the study aims to provide a comprehensive understanding of feed consumption patterns, market trends, and the impact of feed quality on livestock productivity and farmers' livelihoods.

Sampling

The target population for this study includes livestock farmers, sellers, and manufacturers in Raigad district. A stratified random sampling technique was used to ensure that different talukas (sub-districts) within Raigad are adequately represented. This approach helps in capturing the diversity in livestock farming practices and feed consumption patterns across the district. The survey was done based on convenience and approachability to said participants.

Data collection

Data was collected through a structured questionnaire administered via Google Forms. The questionnaire comprises several sections, each focusing on different aspects of livestock feed consumption and market dynamics. The key sections of the questionnaire includes, Demographic Information, Livestock Inventory, Milk Production, Feed Consumption Patterns, Feed Preferences and Quality, Economic Aspects, . Supply Chain Dynamics, Knowledge and Regulation Awareness

Data analysis

The collected data was analysed using both descriptive and inferential statistical methods. The descriptive analysis include calculating frequencies, percentages, means, and standard deviations to summarize the key characteristics of the sample and the main variables of interest. Inferential statistical methods regression analysis was employed to examine relationships between variables and to identify significant factors influencing feed consumption patterns and market dynamics.

Results and Discussion

Demographic Analysis of Participants

The research study gathered a total of 70 samples from participants across five distinct talukas within the Raigad District. These talukas included Alibaug, Mulund, Panvel, Pen, and Roha. The process of collecting data involved reaching out to the local residents in each of these areas through intermediaries who were familiar with the people. The survey was administered using Google Forms, ensuring a streamlined and efficient method for gathering responses. A visual representation of the distribution of samples obtained from each taluka can be seen in figure 1, providing an overview of how the data was collected from these diverse geographic locations.

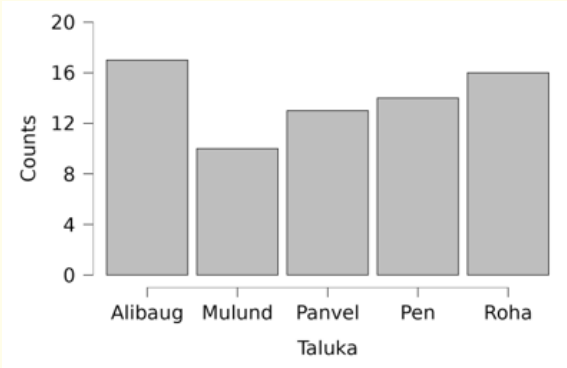

Figure 1: Sample Distribution across Talukas.

Approximately half of the total samples were gathered from the talukas of Alibag and Roha, primarily due to the voluntary nature of the survey and the widespread dissemination of information about the study through established local contacts. This resulted in a higher participation rate in these areas compared to the other talukas.

The gender distribution of the survey participants is presented in figure 2, which features a pie chart and percentage breakdown. This visual representation provides insights into the proportion of male and female participants who took part in the survey, offering a clear picture of the gender ratio within the study sample.

The study revealed notable variations in gender distribution across the five talukas surveyed. In Alibaug and Mulund, female participants constituted less than 15% of the total samples collected. Conversely, the remaining three talukas—Panvel, Pen, and Roha—had a higher representation of female participants, with women accounting for over 30% of the samples in each of these areas.

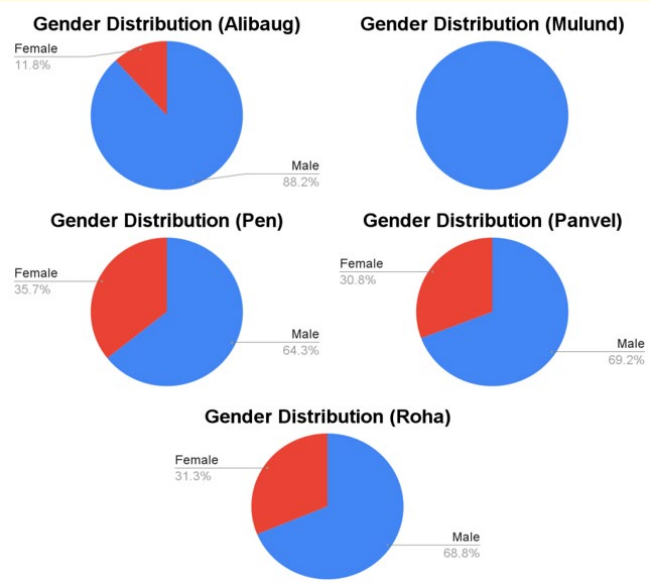

Figure 2: Gender Distribution of participants across the talukas, Red area = Female, Blue area = Male.

Also, the majority of survey participants belonged to the age group of 31-45, averaging around 64% across the talukas. This age demographic is prominently illustrated in figure 3, which provides a clear depiction of the age distribution within the study's sample population. This data highlights the prevalence of middle-aged individuals participating in the survey and their potential influence on the outcomes.

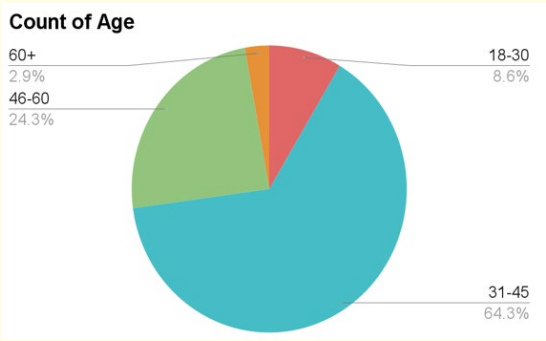

Figure 3: Age Distribution of Participant from all the Talukas.

The age distribution of respondents varied significantly across the different talukas in the study. In Panvel, the sample showcased the most diverse age group, encompassing a wide range of ages, thereby providing a broad spectrum of perspectives and experiences from the local population. This diversity may offer valuable insights into the various views and behaviors prevalent within this taluka.

In contrast, the responses from Mulund exhibited a more limited age range, with participants falling exclusively within the 31 to 60 years age group. Figure 4 visually represents this focused age distribution, demonstrating the restricted scope of age categories present in the Mulund samples. This may suggest a more homogeneous demographic in Mulund compared to other talukas, potentially impacting the study's findings related to this area.

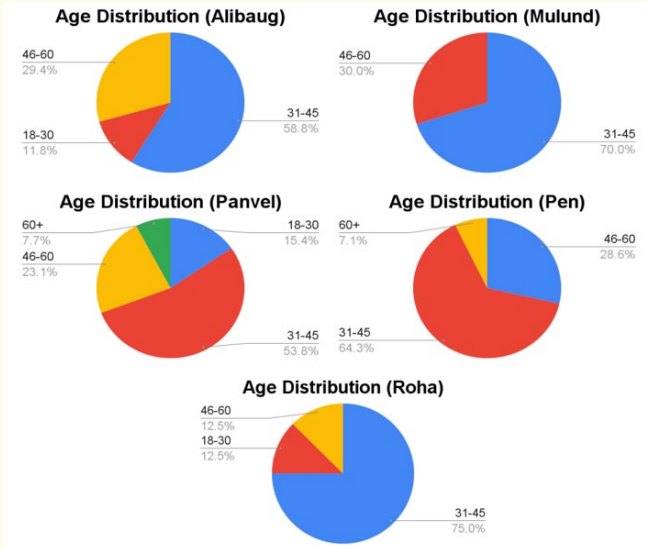

Figure 4: Age distribution of participant of the survey from individual taluka.

The survey data indicates a strong correlation between education levels and openness to new ideas in both the business sector and yield improvement. As detailed in table 1 and depicted visually in Figure 5, the educational backgrounds of the respondents were diverse, with the majority having completed high school. This group comprised over 60% of the total participants, suggesting that a solid high school education may provide a foundation for embracing innovative concepts and practices in these areas.

Total Milk (Liters per Day)				
	Elementary schools	Secondary schools	Graduate	Post graduation or Higher
Valid	1	43	19	7
Percentage Share	1.42	61.42	27.14	10
Missing	0	0	0	0
Mean	8	111.953	45.737	284.857
SD		128.433	51.06	284.14
Minimum	8	4	4	0
Maximum	8	640	209	700

Table 1: Relationship between The Milk production and Educational Qualification.

The next largest group of respondents held graduate degrees, accounting for approximately 27% of the sample. This level of education may enable individuals to engage more deeply with emerging trends and approaches within the business and agricultural sectors.

A smaller portion of participants had pursued higher education beyond a graduate degree, such as postgraduate studies, representing around 7% of the sample. This advanced education could further enhance their ability to understand and apply new techniques and ideas.

Finally, a small segment of respondents, around 2%, had only primary school education. This group may face greater challenges in accessing and implementing novel concepts due to their limited educational background.

Overall, the survey results suggest that higher education levels may contribute to a greater receptivity to new ideas and practices, particularly in business and yield improvement.

The overall relationship between education levels and milk production may not provide a comprehensive picture, as the survey data suggests varying patterns across individual talukas. This complexity is illustrated in figure 5, which shows that respondents from Mulund with a high school education are achieving similar levels of milk production as postgraduates from other talukas, such as Panvel and Roha.

This unexpected finding suggests that the correlation between education and milk production may be influenced by factors other than education alone. Local practices, access to resources, and cultural influences within each taluka could play significant roles in determining productivity levels. For instance, Mulund's high school-educated respondents may have access to superior techniques or resources that allow them to produce as much milk as those with higher educational qualifications in other talukas.

The variations observed across talukas highlight the importance of considering regional context when analysing the relationship between education and milk production. A more nuanced approach that accounts for these local differences may provide better insights into the factors driving milk production levels in each area.

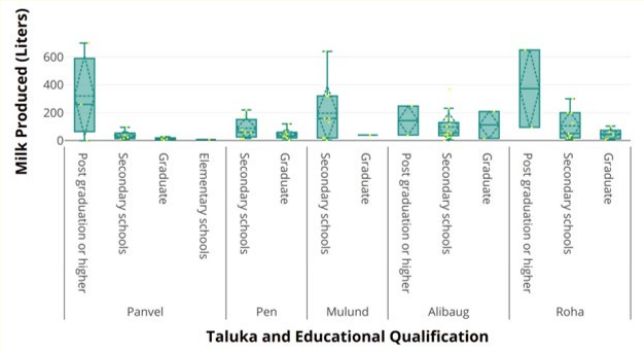

Figure 5: Relationship between The Milk production and Educational Qualification in each talukas.

After conducting a Pearson correlation test, the results indicate that there is a non-significant relationship between milk production and years of experience, as presented in table 2. This suggests that these factors do not strongly influence each other and that other elements are likely playing a more substantial role in determining milk production outcomes.

The lack of significant correlation implies that factors such as Experience, while potentially important, may not be the primary drivers of productivity in this context. Other variables such as access to advanced farming techniques, quality of cattle, availability of resources, or environmental conditions might have a more pronounced impact on milk production.

Further analysis will be necessary to identify these additional factors and their potential relationships with milk production. This deeper investigation could involve examining variables such as the quality and quantity of feed, herd management practices, infrastructure, or market access, among others. By exploring these aspects in greater detail, the study may be able to uncover the underlying factors influencing milk production across the different talukas.

Pearson's Correlation Test					
Variable 1	Variable 2	r	p	Lower 95% CI	Upper 95% CI
Experience	Total Milk	-0.047	0.697	-0.279	0.19

Table 2: Pearson Correlation between Experience and Milk Production.

Although Experience may not have a strong direct correlation with milk production overall, the data suggests that Education does play a notable role in certain contexts. Specifically, some talukas show that educated women are making significant contributions to the dairy industry, as illustrated in figure 6.

The Education and participation of educated women in the dairy industry may be a key driver of productivity and innovation in these regions. Educated women might bring a fresh perspective and new knowledge to dairy farming, potentially leading to the adoption of more efficient practices and technologies. Their involvement could also contribute to improved herd management, enhanced yield, and the implementation of advanced techniques in dairy production.

The presence of educated women in the industry may also indicate a shift towards more equitable participation in agricultural sectors, which could have long-term positive effects on productivity and community development. Moreover, educated women may serve as role models for others, inspiring further engagement and progress within the dairy industry.

Given these observations, further research into the impact of educated women's involvement in dairy farming could provide deeper insights into how their participation influences productivity and drives improvements in the industry.

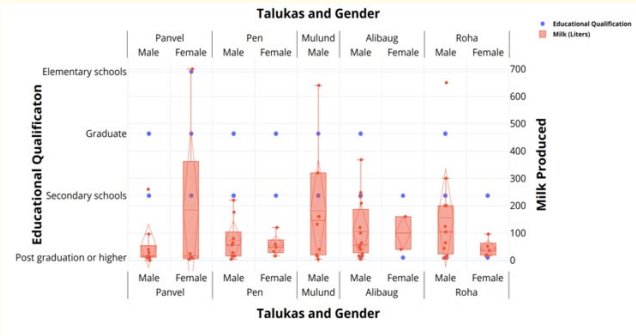

Figure 6: The plot shows educational qualification (blue dots) and gender as well as milk production (bar plot).

Livestock feed and produce

The survey data provides a clear picture of the feeding practices among dairy farmers and their impact on milk production (Figure 7). Individuals who purchased livestock feed were among the top producers in their respective talukas, suggesting a direct correlation between the use of commercial feed and increased productivity. In contrast, those who did not purchase feed relied on homemade supplements in combination with green or dry fodders. While this approach may offer cost savings, it may also limit the nutritional diversity available to the livestock, potentially affecting overall milk production. On the other hand, the farmers who purchased feed utilized a variety of diverse brands, as shown in figure 8. These included brands such as Maharashtra Feeds, Godrej Fodders, Occamy Bioscience Feed, and concentrated feed products. The use of different brands and types of feed allows farmers to tailor the nutrition provided to their livestock, catering to specific dietary needs and stages of lactation.

Additionally, many feed buyers combined purchased feeds with homegrown green or dry fodders. This mixed approach allows farmers to optimize the nutritional balance in their livestock's diet, blending the benefits of commercial feed with their own farm-produced fodders. This strategic combination can lead to improved health and productivity in livestock, ultimately resulting in higher milk production.

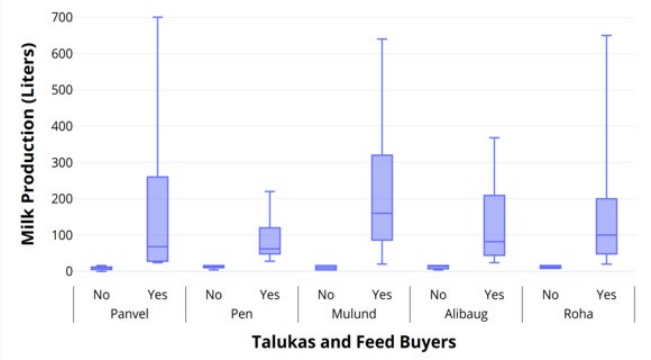

Figure 7: Influence of feed purchase on Milk production.

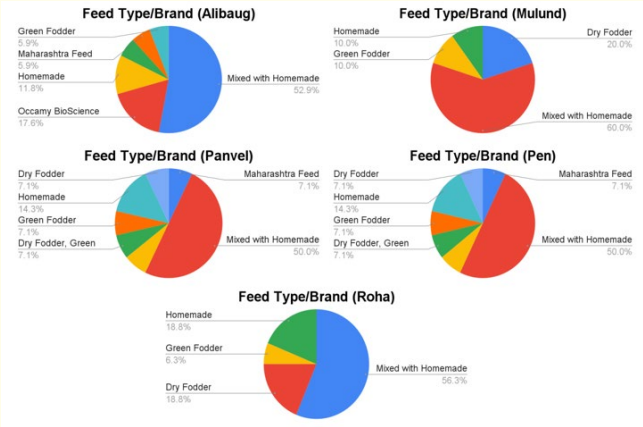

Figure 8: Diversity of feed utilized by farmers of various talukas in Raigad District.

One of the key factors driving the decision to purchase feed is closely related to the size of the herd. Figure 9 highlights the distribution of herd sizes among survey respondents and reveals a correlation between herd size and the likelihood of purchasing commercial feed.

The data shows that the majority of respondents (77%) managed small herds, consisting of fewer than 20 animals. A smaller proportion of respondents (13%) had medium-sized herds, ranging from 21 to 40 animals, while 10% had large herds. Notably, all of those with larger herd sizes fell into the category of feed buyers.

This correlation suggests that farmers with larger herds face greater challenges in managing the nutritional needs of their livestock through traditional feed sources alone. As herd size increases, it becomes more challenging to maintain consistent and high-quality nutrition using only homegrown green or dry fodders and homemade supplements. Therefore, these farmers are more likely to purchase commercial feeds, which offer a reliable and efficient way to meet the dietary requirements of their livestock.

Commercial feeds also provide the advantage of being specifically formulated to support different stages of lactation and herd health, which can be particularly important for farmers managing larger herds. By ensuring a consistent supply of balanced nutrition, these feeds can contribute to better productivity and overall herd performance.

In summary, the data indicates a strong relationship between herd size and the decision to purchase commercial feed. Larger herds tend to require more resources and consistent nutrition, leading farmers to invest in purchased feeds to optimize milk production and maintain the health and productivity of their livestock.

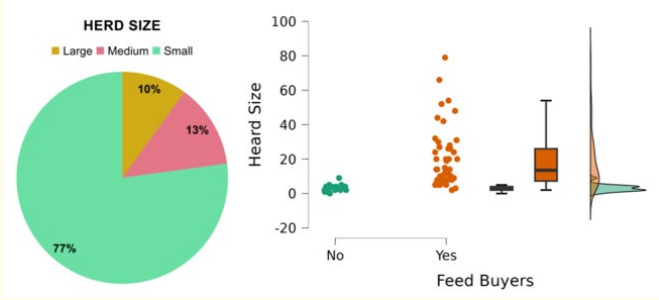

Figure 9: Herd size distribution and the feed buyers relation with herd size.

Knowledge of Feed Brands and effect on affordability

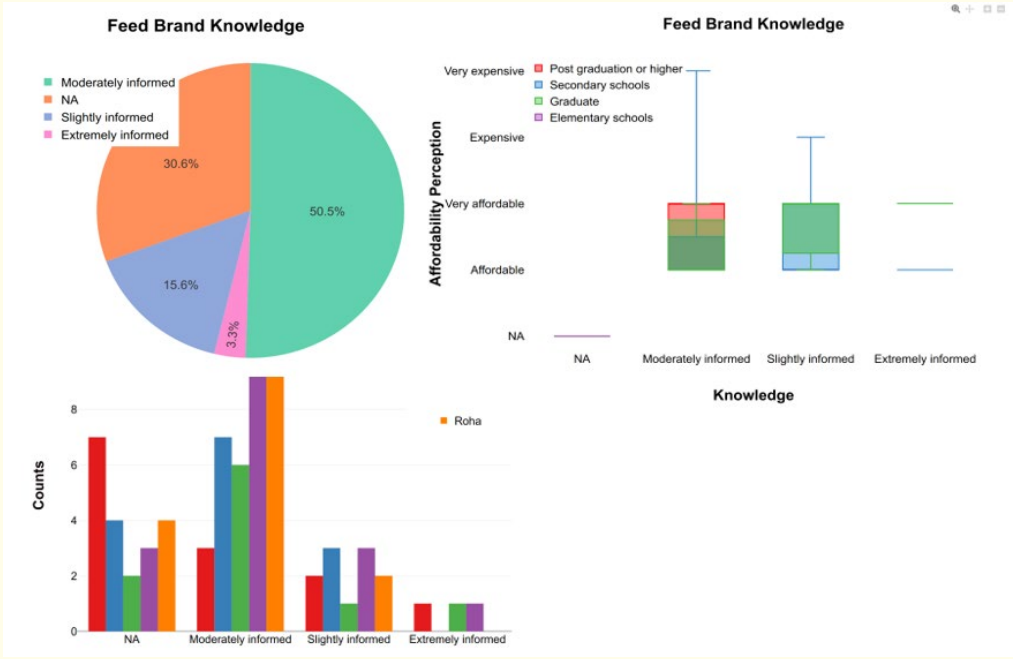

Figure 10: Brand knowledge in population and its effect on perception of affordability

The survey data presented in figure 10 reveals insights into the level of knowledge respondents have regarding feed brands and its correlation with dairy farming practices. A significant portion of respondents (50.5%) possessed a medium level of knowledge about feed brands, indicating a moderate understanding of the different options available for feeding their livestock. Following this group were respondents who did not buy feed, possibly due to a reliance on traditional feeding methods such as homegrown green or dry fodders. Meanwhile, the remaining respondents were distributed between low and high levels of knowledge regarding feed brands.

Whereas, the data shows that most of the large-scale farmers fell into the medium to high categories of this trait. This finding suggests that larger-scale farmers are more likely to possess a deeper understanding of various feed brands and the benefits they offer. This greater knowledge may be associated with their need to manage larger herds effectively and maintain high productivity levels at an affordable price.

The moderate to high levels of knowledge among larger farmers could also be attributed to their exposure to industry trends and best practices, as well as their access to resources and information. As they navigate the complexities of dairy farming on a larger scale, their competence in the technical aspects of feed management becomes increasingly important.

Knowledge of regulation and services

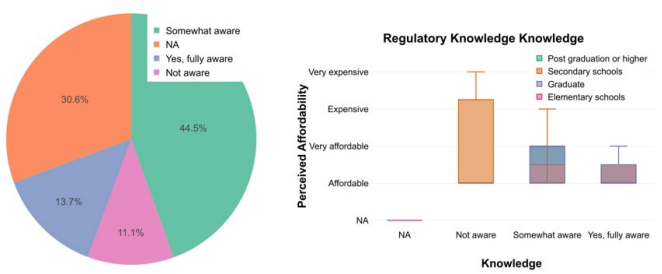

Figure 11: Regulation awareness among population and their perception on affordability of livestock feed.

The survey data reveals that education levels significantly impact farmers' awareness of dairy industry regulations and perceptions of feed affordability in India. According to the survey (Figure 11), about 44.5% of respondents, particularly those with post-graduate or graduate degrees, reported being somewhat aware of these regulations. This group's higher education likely contributes to a greater understanding of regulatory requirements, enabling them to navigate industry standards and practices more effectively. As a result, these individuals are better equipped to ensure compliance with quality and safety standards, enhancing product quality and market opportunities. Conversely, respondents with only high school education demonstrated lower regulatory awareness, highlighting a knowledge gap that can impede their ability to comply with industry standards. Additionally, regulatory awareness influences perceptions of feed affordability; educated farmers recognize the long-term benefits of investing in high-quality feed, while less informed farmers perceive feed as more expensive, possibly due to a lack of understanding of its benefits. These findings underscore the importance of educational initiatives in improving the dairy industry.

The data suggests that education plays a critical role in shaping farmers' awareness of regulations and perceptions of feed affordability. Increasing access to education and information on industry standards can help farmers make informed decisions regarding feed choices and comply with regulations. By understanding the benefits of high-quality feed and efficient feeding practices, farmers may be better positioned to improve productivity and profitability in their dairy operations.

Furthermore, targeted educational initiatives could help close the knowledge gap among farmers with lower educational qualifications, potentially leading to improved productivity and sustainability within the dairy industry [11,12]. Extension services, workshops, and training programs can provide farmers with the knowledge and skills they need to navigate regulatory requirements and make informed decisions about feed and other aspects of their operations. In addition to education, support from industry stakeholders, government agencies, and non-governmental organizations can play a pivotal role in empowering farmers with the resources and information they need to succeed. This support can include access to credit, subsidies, and market information, as well as guidance on best practices in dairy farming. Ultimately, addressing the educational disparities among farmers and providing them with the necessary tools and resources can have far-reaching benefits for the dairy industry in India [13-15]. By improving regulatory awareness and perceptions of feed affordability, farmers can enhance the quality and safety of their products, increase their competitiveness in the market, and contribute to the overall growth and sustainability of the industry. As the dairy sector continues to evolve, it will be essential to prioritize education and support for farmers to ensure their success and the long-term health of the industry.

Conclusion

The survey findings provide valuable insights into the factors that influence dairy farming practices and outcomes across different talukas in the Raigad District of India. Through the collection of data from various participants, a range of patterns and correlations were observed that shed light on how education, feed sourcing, and awareness of regulations impact dairy productivity and sustainability.

One significant observation from the survey is the impact of education on dairy farming practices. Higher levels of education, particularly among women, were associated with increased

openness to new ideas and innovative approaches in the industry. Educated individuals appeared to be more receptive to modern farming techniques, which can contribute to improved milk production and efficiency. Additionally, the survey highlighted the role of commercial feed in driving productivity. Farmers who purchased livestock feed were among the top producers in their respective talukas. The use of diverse brands and types of feed allowed these farmers to tailor the nutrition provided to their livestock, resulting in higher yields. This was especially evident among farmers with larger herd sizes, who were more likely to rely on purchased feed to meet the needs of their animals. However, the survey also revealed that there are variations in farmers' awareness of regulatory bodies and affairs, as well as knowledge of feed brands and types. While some respondents demonstrated a moderate to high level of understanding in these areas, others, particularly those with lower educational qualifications, reported less awareness. This knowledge gap can impact compliance with regulations and perceptions of feed affordability.

The correlation between education levels and awareness of regulations suggests that efforts to improve access to education and information can have a positive effect on farmers' ability to navigate industry standards and practices. By addressing the disparities in educational backgrounds and providing targeted support, farmers may be better equipped to make informed decisions about feed sourcing and compliance with regulations.

Overall, the survey underscores the importance of education and awareness in shaping dairy farming practices and outcomes. By empowering farmers with the knowledge and resources they need, the industry can achieve higher levels of productivity, quality, and sustainability. This will ultimately benefit not only the farmers themselves but also the broader agricultural sector and the economy as a whole.

Conflict of Interest

Authors have no conflict of interest.

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