**Comparative Socio-economic Assessment of Dairy Farmers Across Agro-Climatic Zones in Chhattisgarh, India**

**Abstract:**

Dairy Farming contributes significantly to the national economy and also supports rural development by providing steady income and employment opportunities, especially for small and marginal farmers. This study presents a comprehensive comparative analysis of the socioeconomic profiles of dairy farmers across three agro-climatic zones of Chhattisgarh—Chhattisgarh Plains, Northern Hills, and Bastar Plateau. Dairy farming is a crucial livelihood activity in the region, yet significant disparities exist in farmer characteristics and economic outcomes across these zones. This study adopted the ex-post facto research design. Using a multi-stage sampling method, data were collected from 360 dairy farmers representing diverse ecological and cultural contexts. By combining purposive sampling at broader administrative levels with random sampling at the village and farmer levels, the study achieves a comprehensive and balanced representation of dairy farming practices across Chhattisgarh. The findings reveal that middle-aged males dominate the dairy farming population, with notable caste differences. Tribal communities are predominant in the Northern Hills and Bastar Plateau, whereas the Plains have a higher representation of general caste farmers. Education levels vary sharply, with illiteracy highest in Bastar Plateau (49.16%) and lowest in the Plains (23.33%). Economic indicators show that 70% of Plains farmers have a medium level of income compared to over 54% of low-income earners in Northern Hills and Bastar Plateau. Non-farm income and training exposure also exhibit significant regional gaps, with Bastar Plateau lagging behind. Most farmers operate on small landholdings and use traditional kachha animal shelters. Milk production and sales are strongest in the Plains, while Northern Hills and Bastar show lower productivity and market access. Social participation, mass media exposure, and confidence levels are moderate overall but are notably lower in Bastar. Marketing is dominated by direct sales and middlemen, with cooperative involvement minimal, and payment often delayed. The study highlights the urgent need for targeted, zone-specific interventions to improve education, training, infrastructure, and market connectivity to enhance dairy productivity and livelihoods, particularly in the marginalised Northern Hills and Bastar Plateau regions of Chhattisgarh.

**Keywords:** *Dairy farming, Socioeconomic characteristics, Agro-climatic zones, media exposure, Tribal farmers, Market access*

**INTRODUCTION**

India is the world’s largest milk producer, with dairy farming playing a vital role in the livelihoods of millions of rural families. The sector not only contributes significantly to the national economy but also supports rural development by providing steady income and employment opportunities, especially for small and marginal farmers. The establishment of dairy cooperatives has been a significant development for dairy farmers in India, particularly benefiting those from traditionally marginalised sections of society (Mahishwar et al., 2023).

In this country, a large majority of milk producers have one or two milk animals and account for about 70 per cent of milk production. Often, one or two milk animals allow farmers to generate sufficient additional income to break the vicious agricultural debt situation (Gupta et al., 2020; Jain et al., 2023). Among India’s diverse states, Chhattisgarh stands out as an emerging hub for dairy farming due to its favourable agro-climatic conditions and government initiatives promoting livestock development. In this state, Livestock is an integral and inseparable component of the agricultural system. The rural poor have lived in difficult conditions, and livestock tend to be an active partner in their endeavours (Gupta et al., 2020). Agriculture and allied activities form the backbone of Chhattisgarh’s rural economy, and dairy farming has become an important supplementary source of income for many households. Despite the growth of the dairy sector in the state, the socioeconomic conditions of dairy farmers vary widely across different geographic zones, influenced by factors such as resource availability, cultural practices, market access, and education levels. These differences can impact productivity, income, and overall welfare, making it crucial to understand the regional disparities to effectively support dairy farmers.

This study aims to conduct a comparative analysis of the socioeconomic profiles of dairy farmers in various zones of Chhattisgarh. It seeks to answer key research questions: How do factors like income, education, farm size, and access to services vary among dairy farmers across these zones? What underlying factors contribute to these differences? By addressing these questions, the study intends to provide valuable insights for policymakers, development agencies, and farmers themselves to formulate zone-specific strategies that enhance dairy productivity and improve livelihoods. Ultimately, this research will contribute to the sustainable growth of dairy farming in Chhattisgarh’s diverse rural landscape.

**METHODOLOGY**

This study follows an ex-post facto research design to explore dairy farming practices across the varied agroclimatic zones of Chhattisgarh. A multi-stage sampling method was applied to collect representative data. First, Chhattisgarh was divided into three agro-climatic zones—the Chhattisgarh plains, Northern hills, and Bastar plateau—chosen purposively to reflect the region’s diverse ecological and agricultural conditions affecting dairy farming. Within each zone, districts recognized for their prominent dairy farming activities, including Raipur, Bilaspur, Surguja, Balrampur, Bastar, and Kanker, were purposively selected. Blocks within these districts were also selected purposively to focus on administrative areas significant to the dairy sector.

To minimize bias and enhance representativeness, villages within the selected blocks were randomly chosen. From each village, 15 dairy farmers were randomly sampled, resulting in a total of 360 respondents. By combining purposive sampling at broader administrative levels with random sampling at the village and farmer levels, the study achieves a comprehensive and balanced representation of dairy farming practices across Chhattisgarh. This approach improves the study’s validity and reliability by capturing the diversity of dairy farming in the state.

**RESULT**

This study aimed to extensively profile dairy farmers from the Chhattisgarh Plains, Northern Hills, and Bastar Plateau with respect to their socio-personal, socio-economic, socio-communicational, and socio-psychological characteristics. A comprehensive understanding of these profiles is vital for designing targeted interventions to improve dairy productivity, economic sustainability, and the welfare of farming communities in these diverse Agro-climatic zones.

**1. Socio-Personal Characteristics of Dairy Farmers**

Socio-personal traits determine the human capital foundation for dairy farming. These include age, gender, caste, family size, family type, and education—all factors influencing labour availability, decision-making, cultural practices, and adoption of innovations. Table (1)

**Age**

The age composition in the three regions shows that the middle-aged group is the largest among respondents. In Chhattisgarh Plains, 60% of respondents are between 36 and 55 years old, while Northern Hills and Bastar Plateau have slightly higher percentages at 63.33% and 66.66%, respectively. This pattern suggests that the middle-aged population is either easier to reach for surveys or represents a key demographic actively involved in social and economic activities. On the other hand, the youngest group (up to 35 years) accounts for a smaller share, particularly in the Bastar Plateau, where they make up just 11.66%, compared to 26.66% in the Northern Hills. These differences may reflect variations in population age structure or youth migration trends in the regions.

Meanwhile, the older age group (above 55 years) has a moderate presence, with Bastar Plateau having the highest share at 21.66%, followed by 20% in Chhattisgarh Plains, and a much lower figure of 10% in Northern Hills. This lower percentage in Northern Hills could point to a younger population overall or difficulties in including older people in the survey. In summary, the data reveals a dominant middle-aged demographic, a smaller younger population, especially in Bastar Plateau, and regional differences in the elderly population, possibly shaped by social or economic conditions.

**Gender**

Across the three regions, males clearly make up the majority of respondents. In Chhattisgarh Plains, men constitute 80% of the sample with 96 individuals, while in Northern Hills, male respondents account for 73.33% (88 people), and Bastar Plateau has the highest male representation at 83.33% (100 respondents). Overall, males represent almost 79% of all participants. In contrast, females make up a smaller portion: 20% in Chhattisgarh Plains, 26.66% in Northern Hills, which is the highest female turnout, and just 16.66% in Bastar Plateau. Altogether, women represent slightly over 21% of respondents, indicating a significant gender imbalance that may stem from social, cultural, or access-related challenges influencing participation or demographic factors.

**Caste**

The caste composition of respondents shows clear regional variations and diversity. The General caste is predominantly found in the Chhattisgarh Plains, where it accounts for 53.33% (64 individuals), but it is much less common in the Northern Hills and Bastar Plateau, each with about 10%, making up roughly a quarter of all respondents. The OBC group has a moderate presence across the regions, highest in Chhattisgarh Plains at 31.66%, followed by Bastar Plateau at 17.5% and Northern Hills at 13.33%, totalling just over 20% overall. Scheduled Castes are less represented, especially in Northern Hills (3.33%) and Bastar Plateau (6.66%), with a slightly higher share in the Plains at 11.66%, together forming about 7% of the sample. Scheduled Tribes, however, are the dominant group in Northern Hills and Bastar Plateau, making up 73.33% and 65% of respondents respectively, while their presence is minimal in the Plains at 3.33%. Altogether, nearly half of the respondents belong to the ST category, highlighting the strong tribal population in the hill and plateau areas compared to the plains.

**Family Size**

Medium-sized families dominate across all three regions, with the highest percentage found in Chhattisgarh Plains at 63.33%, followed by Bastar Plateau at 58.33%, and Northern Hills at 56.66%. This indicates that most households prefer to keep family sizes around the average, avoiding very small or very large families. This trend likely reflects a combination of economic factors and cultural habits that favour moderate family sizes.

On the other hand, smaller families are more common in the Northern Hills (33.33%) compared to the other regions, possibly due to geographic challenges or economic conditions typical of hilly areas, such as limited resources or migration trends that encourage smaller households. Large families are the least common across all regions, with Chhattisgarh Plains having a slightly higher proportion (13.33%) than Northern Hills (10.00%) and Bastar Plateau (11.66%). These differences imply that family size varies depending on local cultural practices, economic situations, and environmental factors unique to each region.

**Family Type**

Joint families are the predominant family structure across all three regions, with the highest proportions observed in the Northern Hills and Bastar Plateau at 70%, while Chhattisgarh Plains has a slightly lower but still majority share of 63.33%. This strong presence of joint families likely reflects longstanding cultural traditions where extended family members live together, offering mutual support, pooling resources, and maintaining social and cultural ties within the community.

In contrast, nuclear families make up about one-third of the households overall, accounting for 32.22% cumulatively. This smaller but significant segment may represent families who are embracing more modern or urban lifestyles, possibly driven by economic factors, changing social norms, or the desire for greater independence. The data suggests a gradual but limited shift toward smaller family units alongside the continuing importance of traditional joint family systems.

**Education**

The data reveals marked disparities in educational attainment across the three regions. The illiteracy rate is notably highest in the Bastar Plateau at 49.16%, followed by the Northern Hills at 39.16%, and is comparatively lower in the Chhattisgarh Plains at 23.33%. This significant variation underscores the challenges related to educational access and infrastructure in remote and tribal areas, particularly in Bastar. Primary education constitutes the largest educational category in all regions, with the Chhattisgarh Plains exhibiting the highest proportion at 36.66%, closely followed by the Northern Hills and Bastar Plateau, reflecting a basic level of educational outreach across these populations.

Progression beyond primary education declines substantially, with upper primary education percentages decreasing from 30.00% in the Plains to 20.83% in the Northern Hills and 17.50% in the Bastar Plateau. Secondary education enrollment remains minimal, ranging from 6.66% in the Plains to a mere 2.50% in Bastar, highlighting significant dropout rates and limited opportunities for continued schooling. The representation in college and higher education is negligible, recorded only in the Chhattisgarh Plains at 3.33%, and absent in the other two regions. These findings emphasise the urgent need for targeted interventions to improve educational infrastructure, retention, and access to higher education, especially in underdeveloped and tribal regions.

**Social Participation**

The data on social participation across the three regions—Chhattisgarh Plains, Northern Hills, and Bastar Plateau—reveals that the majority of individuals generally engage at a moderate level, with 57.22% falling within the medium participation category cumulatively. In Chhattisgarh Plains and Northern Hills, around 20% of the population shows low participation, while approximately a quarter demonstrates high social involvement, suggesting relatively strong community cohesion and active engagement. In contrast, Bastar Plateau exhibits a slightly higher proportion of low participation (23.33%) and the lowest high participation rate (15%), indicating potential social or structural barriers limiting deeper involvement. Overall, these patterns highlight that while moderate social participation is common, regional differences exist, with Bastar showing more social disengagement and fewer highly active individuals compared to the other two regions.

**Land Holding**

Land holding capacity among farmers in the three regions—Chhattisgarh Plains, Northern Hills, and Bastar Plateau—is categorised into five groups: marginal, small, semi-medium, medium, and large farmers, which reflects the size of land ownership and provides insight into agricultural practices, economic status, and social hierarchy. In the Chhattisgarh Plains, the majority of farmers are marginal (40%) or small (27.5%), with a smaller portion being semi-medium (25%), and very few medium farmers (7.5%), while there are no large landholders, indicating a predominance of small-scale farming likely limiting economic power and productivity. The Northern Hills exhibit a slightly more varied distribution, with the largest group being small farmers (36.66%), followed by marginal farmers (33.33%), and a notable presence of medium (10%) and large farmers (3.33%), suggesting a more stratified agricultural economy with diverse farm sizes. Bastar Plateau presents a more balanced spread across categories, with marginal farmers constituting 27.5%, small farmers 30%, and a relatively higher proportion of semi-medium farmers (29.16%) compared to other regions, along with medium (8.33%) and the highest proportion of large farmers (5%), indicating greater variability in land ownership and possibly more pronounced economic differentiation. Cumulatively, about a third of the sample population are marginal farmers (33.62%), with nearly another third as small farmers (31.38%), followed by semi-medium farmers (23.61%), medium farmers (8.62%), and a small minority of large landholders (2.77%). This overall distribution highlights that most farmers across these regions hold relatively small plots of land, reflecting a largely fragmented agricultural landscape, which can impact economic sustainability and social dynamics in rural communities.

**Table 1. Distribution of Respondents According to Their Socio-personal Profiles**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **Category** | **Chhattisgarh Plains**  **N= 120** | | **Northern Hills**  **N= 120** | | **Bastar Plateau**  **N= 120** | | **Cumulative**  **N= 360** | |
| Age: (X1) | Young  (≤35 yrs) | **(Freq)** | **(%)** | **(Freq)** | **(%)** | **(Freq)** | **(%)** | **(Freq)** | **(%)** |
| 24 | 20.0 | 32 | 26.66 | 14 | 11.66 | 70 | 19.44 |
| **Age: Middle**  **(36–55 yrs)** | **72** | **60.0** | **76** | **63.33** | **80** | **66.66** | **228** | **63.33** |
| Age: Old  (>55 yrs) | 24 | 20.0 | 12 | 10.0 | 26 | 21.66 | 62 | 17.22 |
| Gender:(X2) | **Male** | **96** | **80.0** | **88** | **73.33** | **100** | **83.33** | **284** | **78.88** |
| Female | 24 | 20.0 | 32 | 26.66 | 20 | 16.66 | 76 | 21.11 |
| Caste:(X3) | General | **64** | **53.33** | 12 | 10.0 | 13 | 10.83 | 89 | 24.72 |
| OBC | 38 | 31.66 | 16 | 13.33 | 21 | 17.5 | 75 | 20.83 |
| SC | 14 | 11.66 | 4 | 3.33 | 8 | 6.66 | 26 | 7.22 |
| ST | 4 | 3.33 | **88** | **73.33** | **78** | **65.0** | **170** | **47.22** |
| Family Size:  (X4) | Small | 28 | 23.33 | 40 | 33.33 | 36 | 30.0 | 104 | 28.88 |
| **Medium** | **76** | **63.33** | **68** | **56.66** | **70** | **58.33** | **214** | **59.44** |
| Large | 16 | 13.33 | 12 | 10.0 | 14 | 11.66 | 42 | 11.66 |
| Family Type:  (X5) | Nuclear | 44 | 36.66 | 36 | 30.0 | 36 | 30.0 | 116 | 32.22 |
| **Joint** | **76** | **63.33** | **84** | **70.0** | **84** | **70.0** | **244** | **67.22** |
| Education:  (X6) | Illiterate | 28 | 23.33 | **47** | **39.16** | **59** | **49.16** | **134** | **37.22** |
| Primary | **44** | **36.66** | 42 | 35.0 | 37 | 30.83 | 123 | 34.16 |
| Upper Primary | 36 | 30.0 | 25 | 20.83 | 21 | 17.5 | 82 | 22.77 |
| Secondary | 8 | 6.66 | 6 | 5.0 | 3 | 2.5 | 17 | 4.72 |
| College+ | 4 | 3.33 | 0 | 0.0 | 0 | 0.0 | 4 | 1.11 |
| Social Participation:  (X7) | Low | 24 | 20.0 | 24 | 20.0 | 28 | 23.33 | 76 | 21.11 |
| **Medium** | **64** | **53.33** | **68** | **56.66** | **74** | **61.66** | **206** | **57.22** |
| High | 32 | 26.66 | 28 | 23.33 | 18 | 15.0 | 78 | 21.66 |
| Landholding:  (X8) | Marginal | **48** | **40.0** | 40 | 33.33 | 33 | 27.5 | **121** | **33.62** |
| Small | 33 | 27.5 | **44** | **36.66** | **36** | **30.0** | 113 | 31.38 |
| Semi-Medium | 30 | 25.0 | 20 | 16.66 | 35 | 29.16 | 85 | 23.61 |
| Medium | 9 | 7.5 | 12 | 10.0 | 10 | 8.33 | 31 | 8.62 |
| Large | 0 | 0.0 | 4 | 3.33 | 6 | 5.0 | 10 | 2.77 |

**2. Socio-Economic Characteristics**

Economic status directly influences resource availability for inputs, infrastructure, and market participation. Table (2)

**Dairy Income**

Dairy income among respondents is divided into low, medium, and high categories, showing clear regional differences. In the Chhattisgarh Plains, most respondents (70%) fall within the medium income range, reflecting a relatively stable dairy industry, with 13.33% earning low income and 16.66% earning high income. Conversely, the Northern Hills and Bastar Plateau are dominated by low-income earners, accounting for 54.16% and 57.5% respectively, with fewer people in the medium and high-income brackets, indicating a less developed dairy sector in these regions. Overall, 41.66% of respondents are in the low-income group, 50.55% in the medium-income group, and just 7.77% in the high-income group, highlighting the dairy sector’s significance while pointing to the need for focused efforts to increase income levels, especially in the Northern Hills and Bastar Plateau areas.

**Non-farm Income**

Non-farm income among respondents is divided into low, medium, and high groups, showing distinct regional differences. In the Chhattisgarh Plains, most respondents (80%) fall within the medium income range, with 13.33% earning low income and 6.66% earning high income, suggesting a good diversification of income beyond agriculture. However, in the Northern Hills and Bastar Plateau, a majority of respondents earn low non-farm income—66.66% and 67.5% respectively—with fewer individuals in the medium and high-income categories, indicating limited opportunities for income outside farming. Overall, almost half of the respondents (49.16%) earn low non-farm income, 46.11% have medium income, and only a small portion (4.72%) fall into the high-income bracket, highlighting the significant but varied impact of non-farm income on their livelihoods.

**Animal Shed Structure**

The type of animal housing among respondents is categorized into kachha, pakka, and mixed houses, reflecting varying levels of durability and construction materials. Kachha houses, which are typically temporary or semi-permanent structures made from locally available materials, dominate across all regions, with 80% of respondents in the Chhattisgarh Plains, 73.33% in the Northern Hills, and 83.33% in the Bastar Plateau living in such shelters. Pakka houses, made from more durable materials, are the least common, especially absent in the Northern Hills, with only 6.66% in Chhattisgarh Plains and 8.33% in Bastar Plateau having them. Mixed houses, combining features of both types, are more prevalent in the Northern Hills (26.64%) and less so in other regions. Overall, 78.89% of respondents live in kachha houses, 5% in pakka houses, and 16.11% in mixed houses, highlighting a strong reliance on traditional, less permanent animal shelters, likely due to economic constraints or regional customs.

**Milk Consumption**

Milk consumption in the three regions of Chhattisgarh is divided into low, medium, and high categories. In the Chhattisgarh Plains, most people (70%) consume milk at a medium level, indicating a generally stable and average consumption pattern, with only a small portion (6.66%) consuming low amounts and a moderate number (23.33%) consuming high amounts. In the Northern Hills, medium consumption is less prevalent at 56.66%, while a notable 35.83% consume low amounts of milk, which may point to limited milk availability or less dairy use, and only 7.5% consume high amounts. The Bastar Plateau stands out with the largest share of low consumers at 47.5%, half of the population consuming a medium amount (50%), and very few consuming high amounts (2.5%), possibly due to ecological or economic limitations. Overall, combining all regions, the majority (58.88%) consume milk at a medium level, 30% consume low amounts, and only 11.11% consume high amounts, indicating that most households consume milk around or below the average level.

**Herd Size**

In Chhattisgarh, herd sizes vary across regions. In the Chhattisgarh Plains, most farmers (49.16%) have small herds, with fewer having medium (36.66%) or large herds (14.16%), likely due to limited land or resources. In the Northern Hills, herd sizes are more balanced, with about one-third having small, medium, or large herds. In the Bastar Plateau, more farmers (45%) have large herds, while fewer have medium (30.83%) or small herds (24.16%), possibly because of more grazing land or cultural reasons. Overall, across the state, herd sizes are fairly evenly split between small, medium, and large.

**Experience in Dairying**

Dairy farming experience in the regions is grouped into low, medium, and high levels. In the Chhattisgarh Plains, most farmers (73.33%) have medium experience, showing a strong knowledge base, while equal smaller groups (13.33%) are beginners or highly experienced. The Northern Hills have a slightly lower proportion of medium-experienced farmers at 66.67%, with the same percentage (13.33%) for both low and high experience, indicating a similar but slightly more varied skill level. In the Bastar Plateau, fewer farmers (56.66%) fall into the medium experience category, but there is a higher number of both experts (20%) and beginners (23.33%), showing a broader range of expertise. Overall, combining all regions, the majority (68.89%) have medium experience, with 13.33% low and 17.77% high, reflecting a well-balanced level of dairy farming knowledge throughout Chhattisgarh.

**Milk Sale**

The milk sale data, divided into low, medium, and high categories, shows notable differences among the Chhattisgarh Plains, Northern Hills, and Bastar Plateau regions. In the Chhattisgarh Plains, most respondents (40.83%) have medium-level milk sales, indicating average sales, while 31.66% have low sales and 27.50% have high sales. The Northern Hills have a larger share of low sales (46.66%) and fewer high sales (13.33%), suggesting generally lower milk sales in this area. The Bastar Plateau exhibits the highest percentage of low sales at 50.83%, with medium and high sales accounting for smaller proportions of 35.00% and 14.16%, respectively. In total, 43.05% of respondents fall into the low sales group, 38.61% in medium sales, and only 18.33% in high sales, indicating that the majority of people in these regions sell milk at low to moderate levels.

**Milk Products**

The consumption patterns of milk products vary significantly across the regions. Ghee is most widely consumed in the Bastar Plateau (40.83%), followed by the Northern Hills (33.33%) and Chhattisgarh Plains (31.66%), with an overall consumption of 35.27%. Khoa consumption is highest in the Plains at 16.66%, but it drops sharply in the Northern Hills (5.00%) and Bastar Plateau (3.33%), indicating its limited popularity outside the Plains. Paneer is most favoured in the Plains (37.50%) and least popular in the Bastar Plateau (6.66%), with a cumulative consumption of 19.71%. Dahee (yoghurt) shows a different trend, being more popular in the Northern Hills (36.66%) and Bastar Plateau (34.16%) compared to the Plains (10.83%), totalling 27.22%. Rabri is uniquely consumed in the Bastar Plateau (15.00%), making it a regional speciality, while Lassi sees minimal consumption overall, with a small preference in the Northern Hills (10.00%) and very little presence in the other areas.

**Milk Production**

Milk production differs significantly among the three regions, with the Chhattisgarh Plains performing the best—only a small percentage (6.66%) produce low milk quantities, while the majority (73.33%) fall into the moderate production range, and 20% are high producers. On the other hand, Northern Hills and Bastar Plateau have a much larger share of low producers, at 29.16% and 43.33% respectively, indicating generally lower milk output in these areas. Although moderate production remains the most prevalent category in these regions (56.66% in Northern Hills and 48.33% in Bastar Plateau), the proportion of high producers is lower compared to the Plains. This trend suggests that milk production is stronger in the Plains, whereas Northern Hills and Bastar Plateau have more farmers with lower milk yields, possibly due to variations in environmental factors, farming practices, or livestock breeds.

**Market Distance**

The distance to markets, which influences economic opportunities and accessibility, varies among the regions. In the Chhattisgarh Plains, no respondents live close to markets, whereas 13.33% in Northern Hills and 30% in Bastar Plateau do. Most respondents in all regions reside at moderate distances from markets—80% in the Plains, 73.33% in Northern Hills, and 57% in Bastar Plateau—showing that the majority are neither very near nor very far from market access. Those living far from markets account for 20% in the Plains and around 13% in both Northern Hills and Bastar Plateau. Overall, medium-distance market access is most common, with Bastar Plateau having the largest proportion of people close to markets, likely due to better infrastructure or smaller community sizes, while the Plains have the highest percentage living far away, which could hinder their milk sales and economic returns.

**Milk Price**

Milk prices are grouped into three categories: below Rs 40, between Rs 40 and 50, and above Rs 50 per litre. In the Plains, 10% of people sell their milk for less than Rs 40, while Northern Hills and Bastar Plateau have slightly higher percentages at 13.33% and 12%, respectively. The majority of sellers—around 70% in the Plains, 73% in Northern Hills, and 68% in Bastar Plateau—sell their milk in the Rs 40 to 50 range, which is the most common price. Fewer sellers get prices above Rs 50, with 20% in the Plains, 13.33% in Northern Hills, and 20% in Bastar Plateau. Overall, 18% of respondents receive higher prices, likely due to better milk quality, closer markets, or higher demand. This shows that while most milk is sold at moderate prices, more producers in the Plains and Bastar Plateau are able to get premium prices.

**Economic Motivation**

Economic motivation across the regions is divided into low, medium, and high categories based on average values and standard deviation. A small segment, about 17.22% overall, shows low economic motivation—20% each in the Chhattisgarh Plains and Northern Hills, and slightly less at 15% in Bastar Plateau—indicating limited economic drive in this group. Most individuals or businesses, roughly 72.22%, fall into the medium motivation range, reflecting moderate economic incentives shaped by typical conditions; this includes 70% in Chhattisgarh Plains, 63.33% in Northern Hills, and 73.33% in Bastar Plateau. Those with high economic motivation are the fewest, making up just 10.55% of the total, with Northern Hills having the highest proportion (16.66%) and Bastar Plateau the lowest (11.66%). Overall, this pattern forms a bell-shaped curve, showing that economic motivation is mainly concentrated at moderate levels, with fewer people at the extremes of low or high motivation.

**Mode of Transport**

The mode of transport significantly influences economic activity and accessibility across the regions, with bikes emerging as the dominant choice, especially in Bastar Plateau (78.33%) and Northern Hills (70.83%), and to a lesser extent in Chhattisgarh Plains (58.33%). Overall, 69.16% prefer motorcycles or bikes, likely due to their affordability, manoeuvrability in rural or difficult terrains, and efficiency. Bicycles, while less common, still play an important role, particularly in Chhattisgarh Plains, where usage is highest at 29.16%, with an overall 23.88% reflecting their continued importance as traditional or cost-effective transport. Rickshaw use is minimal or nonexistent in Northern Hills and Bastar Plateau, while e-rickshaws have a modest presence in Chhattisgarh Plains (9.16%) and Northern Hills (8.33%) but are absent in Bastar Plateau, indicating a slow and uneven adoption of electric transport. This pattern highlights a transport system primarily reliant on motorised two-wheelers, supported by bicycles, with limited use of rickshaws, reflecting the underlying socio-economic conditions and infrastructure limitations of the regions.

**Place of Sale**

The place where goods or services are sold greatly influences market reach and consumer habits. Direct sales to consumers are the most common, making up over 60% of sales across all regions, which shows a strong consumer-focused market. Middlemen account for about a quarter of sales, indicating the presence of intermediaries that help with distribution, but to a lesser extent. Local markets have a smaller role, contributing around 6.66% of sales, while cooperatives are the least used channel at only 7.5%, reflecting limited dependence on collective or cooperative selling methods. Overall, the market relies mainly on direct consumer sales, with middlemen as important but secondary players, and local markets and cooperatives playing minor roles.

**Terms & Conditions of Sale**

In the case of milk sales, the terms and conditions of payment show a clear preference for delayed payments over immediate cash transactions. Only about 21.11% of milk sales involve payment at the time of sale, indicating that paying upfront is not very common. Instead, the majority—78.88%—of sales are made with payment after the sale, meaning buyers often pay on credit or at a later time. This trend likely reflects strong trust within the community, limited cash availability at the moment of purchase, or traditional customs where deferred payment is accepted and expected.

**Table2. Distribution of Respondents According to Their Socio-economic Profiles**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Variables** | **Category** | **Chhattisgarh Plains**  **N= 120** | | **Northern Hills**  **N= 120** | | **Bastar Plateau N= 120** | | **Cumulative**  **N= 360** | |
| **(Freq)** | **(%)** | **(Freq)** | **(%)** | **(Freq)** | **(%)** | **(Freq)** | **(%)** |
| DairyIncome: (X9) | Low Income | 16 | 13.33 | 65 | 54.16 | 69 | 57.50 | 150 | 41.66 |
| **Medium Income** | **84** | **70.00** | **50** | **41.66** | **48** | **40.00** | **182** | **50.55** |
| High Income | 20 | 16.66 | 5 | 4.16 | 3 | 2.50 | 28 | 7.77 |
| Non-farm Income: (X10) | Low Income | 16 | 13.33 | 80 | 66.66 | 81 | 67.50 | 177 | 49.16 |
| **Medium Income** | **96** | **80.00** | **35** | **29.16** | **35** | **29.16** | **166** | **46.11** |
| High Income | 8 | 6.66 | 5 | 4.16 | 4 | 3.33 | 17 | 4.72 |
| Animal shed structure:  (X11) | **Kachha house** | **96** | **80.00** | **88** | **73.33** | **100** | **83.33** | **284** | **78.89** |
| Pakka house | 8 | 6.66 | 0 | 0 | 10 | 8.33 | 18 | 5.00 |
| Mixed house | 16 | 13.33 | 32 | 26.64 | 10 | 8.33 | 58 | 16.11 |
| Milk Consumption:(X12) | Low consumption | 8 | 6.66 | 43 | 35.83 | 57 | 47.50 | 108 | 30.00 |
| **Medium consumption** | **84** | **70.00** | **68** | **56.66** | **60** | **50.00** | **212** | **58.88** |
| High consumption | 28 | 23.33 | 9 | 7.50 | 3 | 2.50 | 40 | 11.11 |
| Herd Size  :(X13) | Small | **59** | **49.16** | 38 | 31.66 | 29 | 24.16 | **126** | **35.00** |
| Medium | 44 | 36.66 | 40 | 33.33 | 37 | 30.83 | 121 | 33.61 |
| Large | 17 | 14.16 | **42** | **35.00** | **54** | **45.00** | 113 | 31.38 |
| Experience in dairying  :(X14) | Low | 16 | 13.33 | 24 | 20.00 | 28 | 23.33 | 48 | 13.33 |
| **Medium** | **88** | **73.33** | **80** | **66.67** | **68** | **56.66** | **248** | **68.89** |
| High | 16 | 13.33 | 16 | 13.33 | 24 | 20.00 | 64 | 17.77 |
| Milk sale (liters/day)  :(X15) | Low sale | 38 | 31.66 | **56** | **46.66** | **61** | **50.83** | **155** | **43.05** |
| Medium sale | **49** | **40.83** | 48 | 40.00 | 42 | 35.00 | 139 | 38.61 |
| High sale | 33 | 27.50 | 16 | 13.33 | 17 | 14.16 | 66 | 18.33 |
| Milk Products  :(X16) | Ghee | 38 | 31.66 | 40 | 33.33 | **49** | **40.83** | **127** | **35.27** |
| Khoa | 20 | 16.66 | 6 | 5.00 | 4 | 3.33 | 30 | 8.33 |
| Paneer | **45** | **37.50** | 18 | 15.00 | 8 | 6.66 | 71 | 19.71 |
| Dahee | 13 | 10.83 | **44** | **36.66** | 41 | 34.16 | 98 | 27.22 |
| Rabri | -- | -- | -- | -- | 18 | 15.00 | 18 | 5.00 |
| Lassi | 4 | 3.33 | 12 | 10.00 | -- | -- | 16 | 4.44 |
| Milk Production  :(X17) | Low level | 8 | 6.66 | 35 | 29.16 | 52 | 43.33 | 95 | 26.38 |
| Medium level | **88** | **73.33** | **68** | **56.66** | **58** | **48.33** | **214** | **59.44** |
| High level | 24 | 20.00 | 17 | 14.16 | 10 | 08.33 | 51 | 14.16 |
| Market Distance: (X18) | Short distance | 0 | 0 | 16 | 13.33 | 36 | 30.00 | 18 | 5.00 |
| **Medium distance** | **96** | **80.00** | **88** | **73.33** | **68** | **57.00** | **308** | **86.00** |
| Long distance | 24 | 20.00 | 16 | 13.33 | 16 | 13.00 | 34 | 9.00 |
| Milk Price (litre/day)  : (X19) | < Rs40/litre | 12 | 10.00 | 16 | 13.33 | 14 | 12.00 | 42 | 11.00 |
| **Rs 40-50/litre** | **84** | **70.00** | **88** | **73.33** | **82** | **68.00** | **254** | **71.00** |
| > Rs. 50/litre | 24 | 20.00 | 16 | 13.33 | 24 | 20.00 | 64 | 18.00 |
| Economic Motivation  : (X20) | Low level | 24 | 20.00 | 24 | 20.00 | 18 | 15.00 | 62 | 17.22 |
| Medium level | 84 | **70.00** | **76** | **63.33** | **88** | **73.33** | **260** | **72.22** |
| High level | 12 | 10.00 | 20 | 16.66 | 14 | 11.66 | 38 | 10.55 |
| Mode of Transport:  (X21) | Bike | **70** | **58.33** | **85** | **70.83** | **94** | **78.33** | **249** | **69.16** |
| By-cycle | 35 | 29.16 | 25 | 20.83 | 26 | 21.66 | 86 | 23.88 |
| Rickshaw | 4 | 3.33 | 0 | -- | 0 | -- | 4 | 1.11 |
| E-Rickshaw | 11 | 9.16 | 10 | 8.33 | 0 | -- | 21 | 5.83 |
| Place of Sale  :(X22) | Consumer | **65** | **54.16** | **72** | **60.00** | **80** | **66.66** | **217** | **60.27** |
| Middle men | 37 | 30.83 | 30 | 25.00 | 25 | 20.83 | 92 | 25.55 |
| Local market | 6 | 05.00 | 8 | 06.66 | 10 | 08.33 | 24 | 06.66 |
| Cooperative | 12 | 10.00 | 10 | 08.33 | 05 | 04.16 | 27 | 07.50 |
| Terms & Conditions of the sale: (X23) | Immediate payment at the time of sale | 32 | 26.66 | 25 | 20.83 | 19 | 15.83 | 76 | 21.11 |
| Payment after sale | **88** | **73.33** | **95** | **79.16** | **101** | **84.16** | **284** | **78.88** |

**3. Socio-Communicational Characteristics**

Effective communication is essential for knowledge dissemination and behavioural change. Table (3)

**Mass Media Exposure**

The distribution of mass media exposure among farmers reveals important insights. Approximately one-third of farmers, especially those in the Bastar Plateau region (45%), have low exposure to mass media, which may limit their access to vital information on modern dairy practices, animal health, and market trends. A significant portion of farmers, nearly half overall, fall into the medium exposure category, with Chhattisgarh Plains farmers leading at 54.16%, indicating moderate engagement with information sources that could support better farming decisions. However, only a small fraction, about 21.27%, have high exposure to mass media, with Bastar Plateau again showing the lowest proportion (15%), suggesting that very few farmers in this area receive extensive information that could enhance productivity and innovation in dairy farming. This disparity in media exposure highlights the need for targeted communication strategies to improve information access, especially in regions like the Bastar Plateau, to boost dairy farming outcomes.

**Training Exposure**

Training exposure among dairy farmers varies greatly between regions. A large number of farmers remain untrained, particularly in Bastar Plateau, where 70.83% have not received any training, and Northern Hills, with 45.83% untrained, compared to only 16.66% in Chhattisgarh Plains. Overall, nearly half of the respondents (44.44%) lack formal training. For those who have been trained, most have only participated in a short, one-day session—70.83% in Chhattisgarh Plains, 54.16% in Northern Hills, and 29.16% in Bastar Plateau—making up just over half (51.38%) of all farmers surveyed. Longer training periods of 2-3 days or 5-7 days are uncommon, reported only by a small number of farmers in Chhattisgarh Plains, with none in the other regions. This situation underscores the urgent need to enhance and extend training opportunities, especially in Bastar Plateau, to better prepare farmers with essential skills for improved dairy farming.

**Table 3. Distribution of Respondents According to their Socio-communicational Profiles**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variables | Category | **Chhattisgarh Plains**  **N= 120** | | **Northern Hills**  **N= 120** | | **Bastar Plateau N= 120** | | **Cumulative**  **N= 360** | |
| **(Freq)** | **(%)** | **(Freq)** | **(%)** | **(Freq)** | **(%)** | **(Freq)** | **(%)** |
| Mass Media Exposure  :(X24) | Low level | 25 | 20.83 | 40 | 33.33 | **54** | **45.00** | 119 | 33.05 |
| Medium level | **65** | **54.16** | **55** | **45.83** | 48 | 40.00 | **168** | **46.66** |
| High level | 30 | 25.00 | 25 | 20.83 | 18 | 15.00 | 73 | 21.27 |
| Training Exposure  :(X25) | Untrained | 20 | 16.66 | 55 | 45.83 | **85** | **70.83** | 160 | 44.44 |
| **1 day training** | **85** | **70.83** | **65** | **54.16** | 35 | 29.16 | **185** | **51.38** |
| 2-3 days training | 10 | 08.33 | -- | -- | -- | -- | 10 | 2.77 |
| 5-7 days training | 05 | 04.16 | -- | -- | -- | -- | 05 | 1.38 |

**4. Socio-Psychological Characteristics**

Psychological factors such as confidence influence innovation adoption, risk-taking, and persistence. Table (4)

**Confidence Level**

In terms of confidence levels among dairy farmers, 20% of respondents in Chhattisgarh Plains, 31.66% in Northern Hills, and 42.5% in Bastar Plateau exhibit low confidence, totalling 31.38% overall. The majority of farmers have a moderate level of confidence, with 66.66% in Chhattisgarh Plains, 65% in Northern Hills, and 56.66% in Bastar Plateau, making up 62.77% of all respondents. Only a small fraction shows high confidence: 13.33% in Chhattisgarh Plains, 3.33% in Northern Hills, and just 0.83% in Bastar Plateau, for an overall total of 5.83%. This data indicates that while most farmers feel moderately confident, a considerable number, especially in Bastar Plateau, lack confidence, which could affect their willingness to adopt new dairy farming methods.

**Table 4. Distribution of Respondents According to their Socio-psychological variables**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variables | Category | **Chhattisgarh Plains N= 120** | | **Northern Hills**  **N= 120** | | **Bastar Plateau**  **N= 120** | | **Cumulative**  **N= 360** | |
| **(Freq)** | **(%)** | **(Freq)** | **(%)** | **(Freq)** | **(%)** | **(Freq)** | **(%)** |
| Level of confidence  :(X26) | Low | 24 | 20.00 | 38 | 31.66 | 51 | 42.50 | 113 | 31.38 |
| **Medium** | **80** | **66.66** | **78** | **65.00** | **68** | **56.66** | **226** | **62.77** |
| High | 16 | 13.33 | 04 | 03.33 | 01 | 0.83 | 21 | 5.83 |

**Discussion**

The present study provides a comprehensive comparative analysis of the socioeconomic profiles of dairy farmers across the three agro-climatic zones of Chhattisgarh: Chhattisgarh Plains, Northern Hills, and Bastar Plateau. The findings reveal substantial regional disparities that reflect the diverse ecological, cultural, and infrastructural contexts shaping dairy farming in the state.

The dominance of middle-aged males among dairy farmers is consistent across all zones, indicating the active participation of this demographic in dairy activities. However, the gender imbalance—with females constituting just over 21%—suggests persistent socio-cultural barriers limiting women’s engagement in formal dairy enterprises, a challenge also noted in similar studies across rural India (Joshi & Deshmukh, 2020; Singh, Patel, & Kumar, 2020). Contrastingly, some studies in other Indian regions report greater female involvement in dairy activities due to women's pivotal role in household dairy management (Kumar & Singh, 2019), indicating regional socio-cultural differences influencing gender participation.

The predominance of tribal communities in the Northern Hills and Bastar Plateau contrasts sharply with the Plains, where General caste farmers are more prevalent. This demographic distribution influences access to resources, education, and social capital, as tribal farmers often face historical marginalisation and infrastructural deficits (Singh et al., 2020; Das & Nath, 2019). Similar findings by Tiwari and Singh (2021) in Central India underline how tribal status correlates with limited market integration and infrastructural challenges, whereas studies from more developed states show less pronounced caste-based disparities (Mehta & Sharma, 2019).

Education levels exhibit stark contrasts, with illiteracy nearly doubling in the Bastar Plateau compared to the Plains. This gap highlights systemic challenges in educational access for tribal and remote populations, likely limiting the adoption of improved dairy practices and access to market information (Department of Animal Husbandry, Chhattisgarh, 2022; Banerjee, Mukherjee, & Saha, 2020). Contrastingly, some research in Eastern India indicates improving literacy trends due to targeted educational programs (Reddy, Kumar, & Ramesh, 2018), suggesting opportunities for policy interventions in Chhattisgarh.

Economic indicators reveal that dairy incomes are significantly higher in the Plains, where 70% of farmers enjoy medium income levels, compared to the Northern Hills and Bastar Plateau, which are dominated by low-income groups. This disparity is compounded by the greater reliance on non-farm income in the Plains, reflecting more diversified livelihood options and better market connectivity (Kumar, Nair, & Singh, 2019; Sharma & Singh, 2021). These results align with studies by Goswami, Sarma, and Baruah (2016), highlighting that market accessibility strongly influences dairy income levels. However, Rathore and Gupta (2019) reported economic constraints as pervasive even in areas with better infrastructure, indicating multifaceted financial challenges for smallholders.

The widespread use of traditional kachha animal shelters across all zones points to economic constraints and a lack of infrastructural support, which may affect animal health and productivity (Singh & Sharma, 2017). This concurs with findings from Rao, Reddy, and Kumar (2017) in tribal dairy farming areas, where poor housing is linked to higher disease incidence. Conversely, research from more urbanised regions indicates a higher prevalence of pakka animal sheds associated with better productivity (Kumar & Singh, 2019).

Milk production and sales data further emphasise regional inequalities, with the Plains showing higher productivity and better market access. In contrast, the Northern Hills and Bastar Plateau report lower production and sales, possibly due to ecological constraints, smaller herd sizes, and poorer market infrastructure (Tiwari & Singh, 2021; Singh, Patel, & Kumar, 2020). The heavy reliance on direct consumer sales and middlemen, coupled with delayed payments, reflects underdeveloped marketing channels that limit farmers’ bargaining power and income stability, a common issue in tribal and remote regions (Sharma & Singh, 2021). Similar marketing constraints have been documented by Jha, Sahu, and Kumar (2015) in Eastern India, whereas Mishra and Joshi (2020) highlight how cooperative marketing models can enhance farmer incomes, which remain underutilised in Chhattisgarh.

Socio-communicational characteristics underscore the crucial role of information access in dairy development. The high proportion of farmers with low mass media exposure and limited training, particularly in Bastar Plateau, indicates significant knowledge gaps that hinder the adoption of modern practices. This situation aligns with findings by Banerjee et al. (2020), who stressed the need for enhanced extension services and targeted training programs in marginalised areas. The predominance of short-duration training sessions also suggests limited capacity-building efforts, underscoring the need for more comprehensive and sustained educational interventions. Contrastingly, some regions have benefited from longer, more intensive training models that have improved adoption rates (Joshi & Deshmukh, 2020).

Psychologically, confidence levels among farmers are moderate overall but notably lower in Bastar Plateau, where nearly 43% exhibit low confidence. This lack of confidence may restrict innovation adoption and risk-taking, limiting productivity gains and economic advancement (Sharma & Joshi, 2017). Building farmer confidence through participatory extension and peer learning could be critical for improving dairy outcomes, as supported by research on behavioural change in rural farming communities (Das & Nath, 2019).

In summary, the study highlights significant socioeconomic and infrastructural disparities across Chhattisgarh’s agro-climatic zones, with the Plains outperforming the Northern Hills and Bastar Plateau in most indicators. These findings call for targeted, zone-specific interventions focusing on improving education, training, infrastructure, market access, and empowerment of tribal and marginalised farmers. Strengthening cooperative institutions and enhancing access to veterinary and extension services could mitigate many of the challenges identified, promoting more inclusive and sustainable dairy development in the region.

**Conclusion**

This comparative study reveals significant socioeconomic differences among dairy farmers in Chhattisgarh’s agro-climatic zones. Farmers in the Chhattisgarh Plains benefit from better infrastructure, market connectivity, and institutional support, demonstrated by lower illiteracy rates (23.33% compared to 49.16% in Bastar Plateau) and higher dairy incomes, with 70% earning medium and 16.66% earning high incomes. In contrast, more than half of farmers in the Northern Hills (54.16%) and Bastar Plateau (57.5%) fall into the low dairy income category. Non-farm income also shows disparity, as 66.66% and 67.5% of farmers in Northern Hills and Bastar Plateau, respectively, report low earnings, compared to just 13.33% in the Plains. Training exposure varies widely, with 70.83% of farmers in Bastar Plateau remaining untrained, while 70.83% of Plains farmers have received at least a day of formal training. Similarly, mass media access is limited in Bastar, where 45% have low exposure, restricting access to vital farming knowledge. Confidence, an important factor for adopting new techniques, is lower in marginalised areas, with 42.5% of Bastar farmers exhibiting low confidence, compared to 20% in the Plains.

Marketing methods are dominated by direct consumer sales (60.27%) and middlemen (25.55%), with only a small share (7.5%) using cooperatives, which limits farmers’ market influence. Payment practices mainly involve delayed payments (78.88%), which may restrict immediate income availability for farmers. Overall, the study emphasises the need for targeted regional initiatives to improve infrastructure, expand training and education, increase cooperative engagement, and enhance market access, especially in the Bastar Plateau and Northern Hills. Such focused strategies are crucial to reduce regional inequalities, boost dairy productivity, and improve livelihoods for Chhattisgarh’s dairy farmers.

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