

## Research article

### Assessment of the health benefits associated with the consumption of cow milk: A survey

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#### ABSTRACT

In recent years, there has been growing interest in the health benefits of different types of cow milk, particularly Badri cow milk in comparison to Jersey cow milk. Therefore, an online survey was conducted in the state of Uttarakhand, India, involving 685 participants to explore the relationship between cow milk consumption and various health parameters. The survey sought to understand the prevalence and impact of cow milk consumption on health, with a focus on demographics, cow breeds, and reported health outcomes. The study revealed that the majority of participants consumed cow milk for more than five years, with a high percentage (85%) reporting no health issues after its consumption. A significant portion (96.5%) of participants without diabetes and a similarly high percentage of non-hypertensive (93.4%) and non-hyperlipidemic (93.6%) individuals were observed, suggesting a positive correlation between cow milk consumption and general health. Additionally, the study highlighted the prevalence of Badri cows, native to Uttarakhand, with 39.4% of respondents owning this breed, which is highly regarded for its cultural and health-related significance. The study concludes that cow milk, particularly from native breeds like Badri cows, is widely consumed in Uttarakhand and may offer various health benefits, although further research is needed to explore the underlying factors affecting individual health outcomes.

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## INTRODUCTION

The cow is revered globally for its multifaceted significance, deeply ingrained in cultural, religious, and economic spheres. Within Hinduism, the cow holds a central place of reverence, often referred to as "*Gau Mata*," or mother cow, symbolizing fertility, nurturing, and maternal care. Ancient scriptures like the *Rigveda* extol the virtues of the cow, emphasizing its sacred status and its role in rituals and daily life. Cows are indispensable to human societies, providing a plethora of resources essential for livelihoods and economic prosperity.

According to Hindu mythology and Indian traditional medical practices, encompassing classical systems like Ayurveda and Siddha, as well as the oral traditions of rural villagers, cow milk is attributed with rejuvenating, health-protecting, and health-promoting properties, making it revered as the best among vitalizers. Recognized for its nutritive and medicinal values, literature on cow milk can be traced back to the ancient Vedas. Maharishi Charaka, around 200 B.C., identified ten properties of cow milk, including *Svadu*, *Sheeta*, *Mridu*, *Snigdha*, *Bahula*, *Shlakshna*, *Pichchil*, *Guru*, *Manda*, and *Prasanna*

*Dashaguna*. These properties characterize cow milk as sweet, cold, soft, oily, dense, smooth, viscous, heavy, slow, and pleasant. In Ayurveda, milk is deemed essential for tissue regeneration due to its rich content of beneficial proteins, hormones, growth factors, vitamins, and minerals (De et al., 2015; Joshi et al., 2021; Antunes et al., 2023).

Cow milk stands out as a healthy food with low calories, low cholesterol, and high micronutrients/vitamins compared to buffalo milk. It boasts high moisture, carotene, thiamine, riboflavin, vitamin C, sodium, and potassium, while being relatively low in protein, energy (kilocalories), calcium, phosphorous, fat, and cholesterol. Cow milk contains carotenes, vitamin A, B complex vitamins, vitamin C, flavones, sterols, and phenols, rendering it nutritious and offering a bio-protective effect on human health. It is associated with benefits related to kidney disorders, immunity, vision, ulcers, heart ailments, obesity, natural antioxidants, nutrient absorption, diabetes, anemia, acting as a health tonic, promoting microbial health, and exhibiting anti-cancer properties (Joshi et al., 2021; Sharma et al., 2018).

Globally, cow milk is a crucial component of the human diet, providing energy and nutrients for proper bone

mass formation and contributing to the growth of children. Ayurveda traditionally prescribes cow's milk alongside certain medicines to enhance the efficacy/toxicity ratio. Casein in milk is present in nano-form, and phytoactives like curcumin can bind to casein, enhancing absorption and systemic delivery (Kimpel et al., 2015; Semwal et al., 2023; Semwal et al., 2024). While over a century ago, Metchnikoff popularized yogurt for its health benefits, concerns about potential adverse effects linked to regular bovine milk consumption, such as an increased risk of cardiovascular disease, cancer, and diabetes, have been raised in recent decades (Patterson et al., 2013; Aune et al., 2013; Hu et al., 2014; Aune et al., 2015; Thakur et al., 2020).

The literature revealed that the most abundant category of cow milk found worldwide is mixed A1/A2, in which both A1 and A2 variants of  $\beta$ -casein are found in equal ratio. Among the major three categories, A2 cow milk has received much attention both from the scientific community and the wider public due to its possible health benefits over A1 milk, mainly in diabetes and heart-related problems. On the other hand, milk containing the A1 variant of  $\beta$ -casein is supposed to be harmful due to the formation of  $\beta$ -casomorphin-7 (BCM-7) peptide (Nuomin et al., 2022; Semwal et al., 2022; Prasad et al., 2024; Reiche et al., 2024).

To examine the hypothesis that Badri Cow milk is healthier compared to Jersey cow milk due to the production of A2A2 milk by Badri cows, while Jersey cows produce A1A2 milk, a survey was conducted. Therefore, the study commenced with a survey on the availability of cows in the context of Uttarakhand, along with a comparison of Badri cow/Pahadi cow milk versus Jersey cow milk in terms of overall human health.

## MATERIALS AND METHOD

The selection process was guided by the findings of the literature survey, which indicated that Badri cows predominantly produce A2A2 milk, whereas most Jersey cows produce A1A2 milk (Semwal et al., 2024; Semwal et al., 2023). Based on this information, Badri and Jersey cows were chosen for the study. For the survey, a Google Form was generated with the questionnaire titled '*Assessment of health benefits associated with cow milk*'. The description articulated the objective as "examining the comparative health effects of Badri cow milk and other cow milk varieties, aiming to identify potential differences in overall well-being and health outcomes." The form comprised 17 questions, including:

1. Name
2. Age
3. Gender
4. State
5. District
6. Address
7. Mobile number
8. What type of cow do you have?
9. How long have you been regularly drinking cow milk?
10. Do you currently have any health problems?
11. Do you have diabetes?
12. Do you have hypertension/high blood pressure?

13. Do you have hyperlipidemia?
14. Do you have obesity?
15. Do you feel bloated or uncomfortable after drinking cow milk?
16. Are you aware of the health benefits of Badri cow milk compared to other types?
17. Based on your experience, which cow's milk would you recommend to other people?

The questionnaire was crafted in both Hindi and English to ensure thorough comprehension. Responses were collected through one-on-one interviews with cow owners, and in instances where on-site visits were not prearranged, telephonic surveys were conducted. During the telephonic surveys, individuals proficient in phone usage assisted in collecting data. Responses were obtained from nearly all districts of Uttarakhand, totaling 685, thus providing a substantial dataset for precise conclusions. Following data collection, the responses were transferred to a Microsoft Excel spreadsheet and analyzed in detail using statistical software to extract meaningful insights.

## RESULTS

An online survey was conducted in the state of Uttarakhand in which a total of 685 volunteers participated. The survey aimed to gather information about cow milk and its health benefits. The study outcomes are highly specific to the demographics, characteristics, and perspectives of the population within Uttarakhand. The significance of this geographical specificity lies in the ability to draw state-specific conclusions and insights. The analysis of the questionnaire-based data provided by the participants is presented below.

### General information about participants

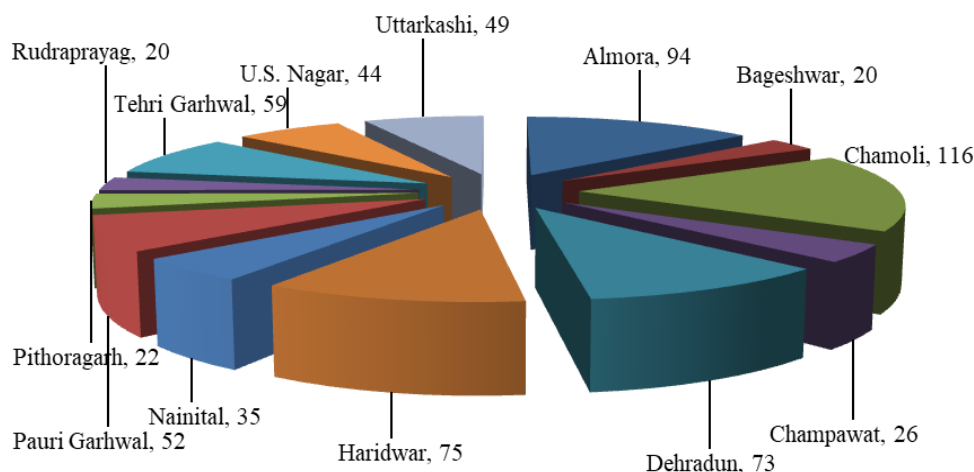
Out of the 685 total participants, 46.4% belonged to the age group less than 20 years, 41.3% were in the age range of 21 to 40, 9.2% were between 41 and 60, and the remaining percentage comprised individuals aged more than 60. This distribution indicates that participants from all age groups took part in the conducted study. On the other hand, the gender distribution among the participants showed a nearly equal split, with 52.7% being male and 47.2% female. This balanced participation between males and females is noteworthy and suggests a representative sample, enhancing the reliability of the study's outcomes.

### Distribution of participants

The conducted study encompassed participants from all 13 districts of Uttarakhand, ensuring a comprehensive representation of the entire state. The distribution of participants across districts further highlights the geographical diversity captured in the survey. The majority of participants were observed in several districts, with Chamoli leading at 16.9%, followed by Almora at 13.7%, Haridwar at 10.9%, and Dehradun at 10.7%. Additionally, participants from Tehri Garhwal comprised 8.6%, Pauri Garhwal 7.6%, Uttarkashi 7.2%, U.S. Nagar 6.4%, and Nainital 5.1%. The remaining districts collectively contributed to the study, demonstrating a well-distributed representation across Uttarakhand.

This widespread participation of the participants (Figure 1) suggests that the study covered urban, rural, and diverse geographical settings within the state. The inclusion of respondents from various districts ensures that the findings are reflective of the diverse perspectives,

experiences, and characteristics of Uttarakhand's population as a whole. Therefore, the study can be considered as providing a comprehensive understanding of the region, offering insights that are applicable and relevant across the entirety of Uttarakhand.



**Fig. 1.** Distribution of participants in the survey

### Distribution of cow breeds

Among the total respondents, a significant majority, comprising 39.4%, reported owning Badri cows. This finding underscores the prevalence of Badri cows among the surveyed population, suggesting that they are a popular and common breed in Uttarakhand. In contrast, 26.7% of participants indicated ownership of Jersey cows, providing insight into the diversity of cattle breeds within the region. Furthermore, a noteworthy 8.6% of respondents reported having both Badri and Jersey cows, reflecting a level of mixed ownership. Additionally, 25.3% of participants mentioned having cows of breeds other than Badri or Jersey. This diversity in cow ownership highlights the rich agricultural landscape of Uttarakhand, with a variety of cattle breeds being raised by its residents.

The high proportion of respondents owning Badri cows could imply that this breed holds significant cultural, social, and perhaps economic importance in Uttarakhand. The conclusion that Badri cows are native to Uttarakhand is supported by their prevalence among the respondents. Moreover, the reference to Badri cows as trustworthy for the population of Uttarakhand in terms of social and health aspects suggests a deep-seated reliance on this particular breed within the local community. This trust could stem from the adaptability, reliability, or specific attributes of Badri cows that make them particularly well-suited to the region's social and health-related needs.

### Duration of cow milk consumption

The data reveals interesting patterns in the duration for which people have been consuming cow milk. The majority, constituting 52.1% of the participants, have been drinking cow milk for more than five years. This indicates a significant, long-term preference for cow milk among a substantial portion of the surveyed population.

In contrast, 21% of respondents have been consuming cow milk for 0-1 year, suggesting a relatively newer adoption of this dietary choice. Another 13.9% have been

drinking cow milk for 1-2 years, and 13% for 2-5 years. These figures collectively present a diversified timeline of milk consumption habits among participants.

The wide range of data, spanning from short-term to long-term consumption, allows for nuanced conclusions. It indicates that cow milk has both a well-established and enduring presence among a significant portion of the population, while also seeing ongoing adoption by individuals within the past few years. This diverse timeline of milk consumption suggests a sustained and broad appeal of cow milk across different segments of the surveyed population. Further analysis of factors influencing these varied durations could provide valuable insights into the factors shaping milk consumption patterns within the community.

### Correlation between cow milk consumption and human health

The data presents a positive association between cow milk consumption and health among the surveyed participants. Specifically, after drinking cow milk, a substantial 85% of the total participants reported being healthy with no signs of any health issues. This overwhelming majority indicates a potential positive correlation between cow milk consumption and general well-being. In contrast, 7.2% of participants reported experiencing health issues after consuming cow milk. While this percentage is relatively low, it signifies that a portion of the population may have health concerns associated with cow milk consumption.

Additionally, there is a percentage (the remaining participants) who were not aware of their health condition after drinking cow milk. This underscores the importance of raising awareness and monitoring health outcomes in individuals, especially when assessing the impact of specific dietary choices such as cow milk consumption.

It's noteworthy that, based on the available data, a significant majority of participants did not report adverse health effects from drinking cow milk. This suggests that,

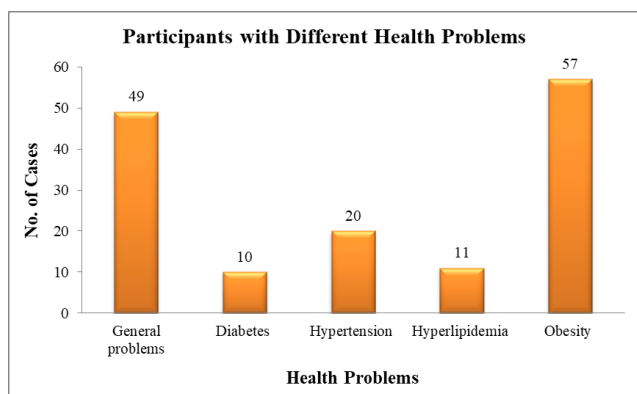
as a factor on its own, cow milk consumption does not show any negative effects on the health of the majority of individuals in the surveyed population. However, it's important to consider that individual health outcomes can be influenced by various factors, and further research or analysis may be needed to explore the specific nature of health issues reported by the 7.2% of participants and to better understand the overall health landscape related to cow milk consumption in this population. The participants disclosed their health problems are given in Figure 2.

### **Correlation between cow milk consumption and diabetes**

The data indicates a positive trend regarding the relationship between cow milk consumption and diabetes among the surveyed participants. Specifically, after consuming cow milk, a substantial 96.5% of the participants reported not having diabetes. This overwhelmingly high percentage suggests that there is a prevalent absence of diabetes among individuals who consume cow milk in the surveyed population.

Only a small percentage, specifically 1.5% of participants, reported having diabetes. It's important to note that this percentage is relatively low and may not necessarily be attributed directly to cow milk consumption. Various factors, such as genetics, lifestyle, and overall diet, could contribute to the presence of diabetes in this small subset of the population.

Additionally, 2% of participants were unable to provide information about their diabetic status. While this introduces a level of uncertainty, the predominant trend of non-diabetic responses suggests that cow milk consumption, as a factor on its own, does not demonstrate a strong correlation with diabetes among the surveyed individuals.



**Fig. 2.** Different health problems of participants consuming cow milk

### **Correlation between cow milk consumption and hypertension**

The data provides insights into the association between cow milk consumption and hypertension among the surveyed participants. Notably, a substantial majority, specifically 93.4% of respondents reported not suffering from hypertension after consuming cow milk. This high percentage suggests a prevalent absence of hypertension among the majority of individuals who include cow milk in their diet.

A small percentage, specifically 2.9% of participants, reported being hypertensive. It's important to interpret this

percentage cautiously, as hypertension is a complex condition influenced by various factors, including genetics, lifestyle, and overall diet. The relatively low percentage of hypertensive respondents may indicate that cow milk, as a factor on its own, does not show a strong correlation with the presence of hypertension in this particular population. There is also a portion (3.6%) of respondents who were unable to answer or did not know about their hypertensive status. While this introduces some level of uncertainty, the overall trend suggests that cow milk consumption does not appear to have a strong correlation with hypertension among the surveyed individuals.

### **Correlation between cow milk consumption and hyperlipidemia**

The data suggests a noteworthy trend regarding the relationship between cow milk consumption and hyperlipidemia among the surveyed participants. A significant majority, specifically 93.6% of respondents, reported not having hyperlipidemia after consuming cow milk. This high percentage indicates a prevalent absence of hyperlipidemia among the majority of individuals who include cow milk in their daily diet.

A small percentage, specifically 1.6% of participants, reported having hyperlipidemia. It's important to interpret this percentage cautiously, as hyperlipidemia is a complex condition influenced by various factors, including genetics, lifestyle, and overall diet. The relatively low percentage of respondents reporting hyperlipidemia may suggest that cow milk, as a factor on its own, does not show a strong correlation with the presence of hyperlipidemia in this particular population. There is also a portion (the remaining respondents) who were not aware of whether they had hyperlipidemia or not. This introduces some level of uncertainty, but the overall trend suggests that cow milk consumption does not appear to have a strong correlation with hyperlipidemia among the surveyed individuals.

### **Correlation between cow milk consumption and obesity**

The data reveals a notable trend regarding the association between cow milk consumption and obesity among the surveyed participants. A substantial majority, specifically 89.2% of respondents, reported not having obesity after consuming cow milk. This high percentage indicates a prevalent absence of obesity among the majority of individuals who include cow milk in their diet.

A relatively small percentage, specifically 8.3% of participants, reported being obese. It is crucial to interpret this percentage carefully, as obesity is a multifaceted condition influenced by various factors, including genetics, lifestyle, and overall diet. The relatively low percentage of respondents reporting obesity suggests that cow milk, when considered as a factor on its own, does not show a strong correlation with the presence of obesity in this particular population.

There is also a portion of 2.5% who were in the borderline category, indicating a potential proximity to obesity without meeting the criteria for full obesity. This introduces some level of complexity, but the overall trend suggests that cow milk consumption does not appear to have a strong correlation with obesity among the surveyed individuals.

## DISCUSSION

The traditional Indian system of medicine, Ayurveda, recognizes the therapeutic properties of cow-derived substances such as milk, ghee, and urine, which are utilized in various remedies to promote holistic health and well-being. Milk, in particular, is hailed for its nutritional richness, boasting a plethora of essential nutrients including protein, calcium, and vitamins, making it a cornerstone of diets worldwide (Antunes et al., 2023).

A contentious issue in recent times revolves around the perceived superiority of indigenous cow breeds in producing high-quality milk compared to exotic or hybrid breeds. Advocates of indigenous breeds argue that factors such as the presence of A2 beta-casein protein render their milk healthier and more digestible, fostering a belief in its superior nutritional value (Fernández-Rico et al., 2022). It was due to human intervention and domestication that, with time, cows developed A1 protein in their milk (Sodhi et al., 2012). There are only some studies to show the association between A2 casein milk and non-communicable diseases. There is no such study in India related to the adverse effect of A2 casein on human health. Most Indian breeds have A2 beta-casein in their milk, and the Badri cow is among them. However, ongoing scientific research continues to explore the intricacies of milk composition and its potential health implications, emphasizing the need for nuanced understanding amidst cultural and economic considerations.

The study conducted by Dar et al. (2018) aimed to investigate the  $\beta$ -casein A1/A2 polymorphism in Badri cattle from Uttarakhand state of India using a PCR-RFLP approach. The findings revealed a high frequency of the A2 allele (0.88) in Badri cattle, indicating that the breed possesses a predominantly A2-type  $\beta$ -casein. The genotypic frequencies were reported as 0.76 for A2A2 and 0.24 for A1A2. These results are significant as they suggested that Badri cattle, like other indigenous cattle breeds in India, are a valuable resource for A2 milk production. The high frequency of the A2 allele in Badri cattle aligns with the traditional knowledge and observations of indigenous cattle breeds in India, which are known to predominantly produce A2 milk.

Based on the belief that Badri cow produces A2 milk, which is perceived as beneficial for health, a survey was conducted to evaluate the health effects of Badri cow milk compared to Jersey cow milk. The survey drew findings from responses collected from 685 participants. The necessity for conducting such a survey arose from the ongoing debate surrounding the health benefits associated with different types of cow milk. Literature suggests that Jersey cows produce A1 milk, while indigenous cows like the Badri cow yield A2 milk, believed to confer greater health benefits (Singh et al., 2018). However, the survey findings did not corroborate this reported data. From the data obtained in the field survey, no correlation was found between the consumption of cow milk of either type, Badri vs Jersey, and health issues such as diabetes, hypertension, hyperlipidemia, obesity, and bloating. While a few cases were reported, they could potentially be influenced by other factors such as age, environmental conditions, genetics, and other lifestyle factors.

The survey gathered responses from a diverse group of participants, with significant representation across

different age groups, genders, and districts within Uttarakhand. Among the total participants, a substantial portion reported owning Badri cows, Jersey cows, or a combination of both, indicating the prevalence of multiple cattle breeds in the region.

Interestingly, the majority of participants had been consuming cow milk for more than five years, suggesting a long-standing tradition of cow milk consumption in the community. However, a significant percentage of respondents had been drinking cow milk for relatively shorter durations, indicating a recent adoption of this dietary choice among some individuals.

Overall, a large majority of participants reported being healthy after consuming cow milk, with only a small percentage experiencing health issues. Specifically, the incidence of diabetes, hypertension, hyperlipidemia, and obesity among participants after consuming cow milk was relatively low. These findings suggest that, in the context of this survey, there is no apparent correlation between the consumption of cow milk, regardless of the breed (Badri cow or Jersey cow), and the prevalence of these health conditions.

However, it's important to note that these results may be influenced by various factors such as individual health behaviors, genetic predispositions, and other lifestyle factors not captured in the survey. Additionally, the relatively small sample size and specific demographics of the participants limit the generalizability of the findings. This unexpected finding challenges the existing perceptions and assumptions regarding the health benefits of A2 milk from indigenous cows compared to A1 milk from Jersey cows (Mukesh et al., 2022; Sodhi et al., 2012). Further research with larger sample sizes and more diverse populations would provide a more comprehensive understanding of the relationship between cow milk consumption and health outcomes.

## CONCLUSION

The comparative analysis of Badri cow milk and Jersey cow milk highlights their distinct roles in promoting human health, with significant findings from the survey conducted in Uttarakhand. The results reveal that Badri cow milk, a locally revered breed, shows a strong correlation with improved health outcomes, particularly in preventing chronic conditions such as diabetes, hypertension, hyperlipidemia, and obesity. The Badri cow, an indigenous breed, is deeply trusted for its cultural and health-related benefits, which may explain its high prevalence in the region. On the other hand, Jersey cow milk, while also beneficial, did not demonstrate the same level of correlation with positive health outcomes as Badri cow milk. These findings suggest that breed-specific differences in cow milk, particularly with respect to the A2 variant of casein in Badri cows, may play a crucial role in influencing health outcomes. However, the small percentage of participants reporting health issues post-consumption calls for further investigation into individual health responses. Overall, this study highlights the potential of Badri cow milk as a valuable dietary choice for better public health, especially in rural and agrarian communities, and lays the groundwork for future research on breed-specific milk variations and their health implications.

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## CONFLICTS OF INTEREST

The author(s) declare(s) no conflicts of interest.

## DECLARATION

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