



Exploring Milk Consumption Trends and Cow Milk Health Benefits Awareness: A Consumer Analysis in Anand and Vidyanagar Cities

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: <https://doi.org/10.9734/acri/2024/v24i6771>

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/119822>

Original Research Article

Received: 08/05/2024
Accepted: 10/07/2024
Published: 13/07/2024

ABSTRACT

This study investigates the consumption patterns and consumer awareness of cow milk in Anand and Vidyanagar cities. India, as the largest milk producer globally, relies heavily on cow milk, which plays a crucial role in the national economy and rural livelihoods. Unlike other milk options such as goat's milk, cow milk is predominantly consumed due to its widespread availability, affordability, and established preference among Indian households. This research also aims to debunk common

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myths surrounding cow milk and explore consumer perceptions of special cow milk variants. Through a survey of 200 respondents, the study reveals demographic characteristics, milk consumption habits, and awareness levels regarding cow milk's health benefits. The results show a high prevalence of milk consumption (99%) with a preference for packed milk (67%) and daily consumption (78.5%). However, consumer awareness about cow milk's nutritional content and health benefits was relatively low. The study employs descriptive statistics, Chi-square tests, and the Karl Pearson Correlation Coefficient to analyze the data, finding no significant association between income and cow milk consumption and education level and cow milk consumption, but a positive correlation between age and milk consumption. The findings underscore the need for increased consumer education on the nutritional benefits of cow milk to enhance informed consumption choices. These insights can guide policymakers and industry stakeholders in designing effective educational campaigns and interventions to promote cow milk, ultimately supporting healthier dietary practices and boosting the dairy sector's growth.

Keywords: Cow milk consumption; consumption pattern; consumer awareness; dairy industry; nutritional benefits; milk production.

1. INTRODUCTION

The Indian cow milk industry is a cornerstone of the country's agricultural sector, driving significant economic activity and supporting the livelihoods of millions. India stands as the largest producer of milk globally, contributing approximately 230.58 million tonnes in 2022-2023, [1] which represents about 24.62% of the world's milk production [2]. This achievement is underpinned by India's extensive bovine population of around 192.5 million cattle [1]. The industry benefits from a robust cooperative framework, with major players like Amul exemplifying successful models of farmer cooperation, marketing and distribution involving over 3.6 million milk producers [3]. Small-scale farmers contribute to 70% of the production highlighting the widespread engagement in dairy farming across rural areas [4].

Global milk production has been on a steady upward trajectory, 2023 indicating a total output of approximately 950 million tonnes. This represents a 1.3 per cent increase from the previous year, marking a notable acceleration compared to the 0.6 per cent growth observed in 2022 [5]. This uptick in global milk production is predominantly driven by significant volume growth in Asia particularly in India and China. In contrast, other regions are experiencing more moderate growth rates with Africa potentially seeing a decline in production [6].

The dairy industry in India stands as a monumental pillar of the country's agribusiness sector significantly contributing to the national economy. Recognized as the "Oyster" of the global dairy industry India's dairy sector is the

largest single agricultural commodity representing nearly 5 per cent of the nation's GDP and witnessing 6.4% (CAGR) in the past 5 years [7]. It plays a vital role in the livelihoods of approximately 70 million farmers who are directly involved in dairying. Unique among agricultural products, dairy ensures that 70-80 per cent of the final market value is shared with the farmers, accounting for about one-third of rural household income [3].

India holds the top position globally in milk production contributing 24.64% of the world's total milk production for the year 2021-22 [7]. Over the past nine years, from 2014-15 to 2022-23 India's milk production has surged by 58% reaching 230.58 million tonnes in 2022-23. This growth corresponds to a compound annual growth rate (CAGR) of 5.85%. The top five milk-producing states—Rajasthan (15.05%), Uttar Pradesh (14.93%), Madhya Pradesh (8.6%), Gujarat (7.56%) and Andhra Pradesh (6.97%)—together account for 53.11% of India's total milk production [7].

The motivation for this research is multifaceted encompassing the need to understand and address consumer awareness surrounding cow milk health benefits. study is crucial for optimizing India's dairy sector by understanding consumption patterns [8,9] and dispelling myths about cow milk. It also aims to enhance consumer education on the nutritional benefits supporting healthier dietary choices and informed government policies. Government efforts in India include initiatives like the National Dairy Plan and Operation Flood aimed at modernizing dairy farming, promoting milk production and educating consumers about the nutritional

benefits of cow milk to support economic growth and rural livelihoods. The 'Gau Samridhi Yojana' focuses on enhancing cow welfare and productivity through subsidized veterinary care, improved breeding programs and support for organic feed production aiming to ensure sustainable growth in India's dairy industry [10].

A2 milk is a variety of cows' milk that mostly lacks a form of β -casein proteins called A1 and instead has mostly the A2 form. Cows' milk like this was brought to market by the A2 Milk Company and is sold mostly in Australia, New Zealand, China, and the United States. Non-cow milk including that of humans, sheep, goats, donkeys, yaks, camels, buffalo and others, contains mostly A2 β -casein, so the term "A2 milk" is also used in that context.

The A2 milk market is experiencing significant growth driven by rising consumer health consciousness and increasing consumer spending. The market is projected to grow at a compound annual growth rate (CAGR) of 9.5% from 2023 to 2033. In 2023, the market value was US\$ 2,036.6 million. One of the key growth factors is the heightened awareness and knowledge about A2 milk through advertising. Additionally, consumers' growing preference for sustainable beverages presents a substantial opportunity for the market. A notable trend within this market is the increasing use of A2 milk powder in infant formulas which has gained considerable popularity [11].

Mounika [12] notes a recent trend showing a significant shift in consumer behaviour towards A2 milk particularly among well-educated, middle-aged individuals with higher incomes. In Hyderabad, India, this demographic primarily buys A2 milk for their children, often opting for home delivery for convenience. The study indicates a high level of awareness regarding the health benefits of A2 milk, such as enhanced brain function and better diabetes management, with word of mouth and social media being the main sources of information. Key factors influencing their purchase decisions include the quality of the product, its health benefits [13], and ease of access. The study by Didore [14] found that milk consumption is highest among middle-aged individuals, primarily purchased via home delivery, with income and family size being key factors influencing consumption patterns.

Despite controversies over adult dairy consumption, epidemiologic studies confirm milk's nutritional importance and its role in preventing chronic conditions like CVDs, cancer, obesity, and diabetes [15,16]. Recognizing these health benefits and the pervasive myths surrounding cow milk consumption underscores the importance of this research. The study aims to provide insights that could inform regional and central government efforts to promote informed and healthy consumption choices among the public.

2. RESEARCH OBJECTIVES

- To examine the Consumption pattern of milk in Anand and Vidyanagar cities
- To analyse the level of consumer awareness regarding cow milk health benefits in Anand and Vidyanagar cities
- To analyse data of respondents who consume cow milk in Anand and Vidyanagar cities

3. RESEARCH METHODOLOGY

The relevant data for the research study was collected by using a primary survey done by a questionnaire. The questionnaire was filled out by respondents using Google Forms. In the present study, there were 200 number of respondents. 100 respondents were randomly selected from Anand and 100 from Vidyanagar Cites. The collected data was analysed using descriptive statistics [17], Chi-square test [18] and Karl Pearson Correlation Coefficient.

The Formula for Chi-Square is

$$\chi^2 = \sum ((O - E)^2 / E)$$

Karl Pearson Correlation Coefficient r =

$$\frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{(n\sum x^2 - (\sum x)^2)(n\sum y^2 - (\sum y)^2)}}$$

4. RESULTS AND DISCUSSION

4.1 Demographic Profile of Respondents

The demographic characteristics of respondents from Anand and Vidyanagar were surveyed, covering various aspects such as gender, age, educational qualification, occupation, type of family, and monthly family income. Below is a detailed description of the data collected:

Table 1. Demographic Profile of Respondents (n = 200)

		Gender					
Sr No.	Particular	No. of respondents					
		Anand	%	Vidyanagar	%	Total	%
1	Male	61	61	58	58	119	59.5
2	Female	39	39	42	42	81	40.5
	Total	100	100	100	100	200	100
		Age					
1	Upto 30 years	32	32	42	42	74	37
2	31 to 40 years	32	32	40	40	72	36
3	41 to 50 years	25	25	13	13	38	19
4	Above 50 years	11	11	5	5	16	8
	Total	100	100	100	100	200	100
		Educational Qualification					
1	Primary	20	20	4	4	24	12
2	Secondary	26	26	15	15	41	20.5
3	Graduate	38	38	65	65	103	51.5
4	Post Graduate	16	16	9	9	25	12.5
5	Doctoral	0	0	7	7	7	3.5
	Total	100	100	100	100	200	100
		Occupation					
1	Employed	43	43	40	40	83	41.5
2	Not yet working	14	14	23	23	37	18.5
3	Retired	8	8	5	5	13	6.5
4	Self-employed	26	26	13	13	39	19.5
5	Student	9	9	19	19	28	14
	Total	100	100	100	100	200	100
		Type of family					
1	Nuclear	29	29	46	46	75	37.5
2	Joint	71	71	54	54	125	62.5
	Total	100	100	100	100	200	100
		Monthly income of the family					
1	<10000	3	3	4	4	7	3.5
2	10001 - 20000	19	19	4	4	23	11.5
3	20001 - 30000	27	27	12	12	39	19.5
4	30001 - 40000	23	23	38	38	61	30.5
5	More than 40000	28	28	42	42	70	35
	Total	100	100	100	100	200	100

Source: Primary source

Gender distribution: The gender distribution of the respondents indicates a slightly higher number of males compared to females. In Anand, 61% of respondents were male and 39% were female. Similarly, in Vidyanagar, 58% were male and 42% were female. Overall, the total percentage of male respondents was 59.5%, while females constituted 40.5% of the total sample.

Age distribution: The age distribution shows a diverse range of ages among respondents. The largest age group was those up to 30 years, making up 37% of the total respondents. This was followed by those aged 31 to 40 years (36%), 41 to 50 years (19%) and those above 50 years (8%). In Anand, the age distribution was evenly spread between the first two age groups (32% each), while in Vidyanagar, the largest group was up to 30 years (42%).

Educational qualification: Respondents' educational qualifications varied significantly. The majority of respondents were graduates, comprising 51.5% of the total. In Anand, 38% were graduates, whereas in Vidyanagar, a significant 65% had graduated. Secondary education was the second most common qualification (20.5%), followed by postgraduates (12.5%), primary education (12%) and doctoral degrees (3.5%).

Occupational status: The occupational status of the respondents reveals that 41.5% were employed. Notably, a higher percentage of respondents in Anand were self-employed (26%) compared to Vidyanagar (13%). Students made up 14% of the total respondents, with a higher concentration in Vidyanagar (19%). Additionally, 18.5% were not yet working, 19.5% were self-employed and 6.5% were retired.

Type of family: The survey also captured the type of family structure. Joint families were more common, accounting for 62.5% of the total respondents. This trend was particularly pronounced in Anand (71%), while in Vidyanagar, the proportion of joint families was 54%. Nuclear families represented 37.5% of the respondents with a higher occurrence in Vidyanagar (46%).

Monthly family income: Monthly family income was categorized into five brackets. The most common income bracket was more than 40,000 INR representing 35% of the respondents.

Vidyanagar had a higher proportion in this category (42%) compared to Anand (28%). The second most common income range was 30,001 to 40,000 INR comprising 30.5% of respondents. The income ranges of 20,001 to 30,000 INR (19.5%), 10,001 to 20,000 INR (11.5%) and less than 10,000 INR (3.5%) followed.

4.2 Consumption Pattern of Milk

This Table 2 provides a breakdown of respondents' consumption patterns of milk in Anand and Vidyanagar, along with their respective percentages and totals.

The Table 2 presents a comprehensive analysis of milk consumption and purchasing habits among respondents from Anand and Vidyanagar. It reveals that an overwhelming majority (99%) of respondents in both cities consume milk, with only 1% not consuming it. Among those who consume milk, 67% prefer packed milk, with a higher preference in Vidyanagar (69%) compared to Anand (65%), while 32% consume loose milk.

The frequency of milk consumption shows that 78.5% of respondents consume milk once a day, with Anand slightly higher at 83% compared to 74% in Vidyanagar. A smaller proportion, 8.5%, consume milk multiple times a day, more so in Anand (13%) than in Vidyanagar (4%). Additionally, 8% of respondents consume milk a few times a week, with Vidyanagar significantly higher (15%) compared to Anand (1%), and 5% rarely or never consume milk.

In terms of the type of milk by species, mixed milk was the most popular, consumed by 57% of respondents, with Vidyanagar at 60% and Anand at 54%. Buffalo milk was more favoured in Anand (26%) than in Vidyanagar (19%), while cow milk consumption was almost equal, with 19% in Anand and 20% in Vidyanagar.

Regarding the point of purchase, 31.5% of respondents buy milk from company outlets, with a higher percentage in Vidyanagar (34%) compared to Anand (29%). Home delivery was preferred by 30%, with Anand slightly higher at 32% compared to Vidyanagar's 28%. Local vendors and malls were less common sources, with only 4% buying from local vendors and 3% from malls. Retail shops were equally popular in both cities, each at 31.5%.

Table 2. Consumption Pattern of Milk (n = 200)

Sr No.	Particular	Consumption of Milk					
		Anand		Vidyanagar		Total	%
		No. of respondents	%	No. of respondents	%		
1	Consume milk	99	99	99	99	198	99
2	Do not consume milk	1	1	1	1	2	1
	Total	100	100	100	100	200	100
Type of Milk Consumed							
1	Packed	65	65	69	69	134	67
2	Loose	34	34	30	30	64	32
3	Not consume	1	1	1	1	2	1
	Total	100	100	100	100	200	100
Frequency of Milk Consumption in Anand and Vidyanagar City							
1	A few times a week	1	1	15	15	16	8
2	Multiple times a day	13	13	4	4	17	8.5
3	Once a day	83	83	74	74	157	78.5
4	Rarely or never	3	3	7	7	10	5
	Total	100	100	100	100	200	100
Type of Species Wise Milk Consume by Respondents							
1	Buffalo milk	26	26	19	19	45	22.5
2	Cow milk	19	19	20	20	39	19.2
3	Mix milk	54	54	60	60	114	57
4	Not consume	1	1	1	1	2	1
	Total	100	100	100	100	200	100
Point of Purchase for Milk (n = 198)							
1	Company outlet	28	29	33	34	63	31.5
2	Home Delivery	32	32	28	28	60	30
3	local vendor	4	4	4	4	8	4
4	Mall	2	2	4	4	6	3
5	Retail shop	33	33	30	30	63	31.5
	Total	99	100	99	100	198	100
Purchase Decision of Buying Milk							
1	Female	91	91	88	88	179	89.5
2	Male	9	9	12	12	21	10.5
	Total	100	100	100	100	200	100

Source: Primary source

Finally, the purchase decision for buying milk was predominantly made by females, accounting for 89.5% of the decisions, with males making up 10.5%. This trend is consistent in both cities, with 91% of females in Anand and 88% in Vidyanagar being the primary decision-makers.

4.3 Awareness Level of Various Aspects of About Cow Milk among Respondents

This Table 3 provides a detailed breakdown of respondents' awareness of various aspects of cow milk in Anand and Vidyanagar, along with their respective percentages and totals.

The Table 3 reveals various aspects of consumer awareness regarding cow milk in Anand and Vidyanagar. It shows that only 33.5% of respondents were aware of the FAT and SNF content of cow milk, while 66.5% were not. Awareness of cow milk's health benefits, such as diabetes management, was at 44%, with 56% unaware. Regarding weight loss benefits, 63% were informed, while 37% were not. A significant 74% recognise cow milk as an excellent source of vitamins and minerals, with 26% unaware. Additionally, 84% understand that cow milk fat and protein were more easily digestible than buffalo milk, while 16% did not. Finally, 39.5% know the difference between A1 and A2 cow

Table 3. Awareness level of cow milk (n = 200)

Sr No.	Awareness	No. of respondents					
		Anand	%	Vidyanagar	%	Total	%
Awareness of the FAT and SNF content of cow milk							
1	Aware	36	36	31	31	67	33.5
2	Unaware	64	64	69	69	133	66.5
	Total	100	100	100	100	200	100
Awareness about cow milk's health benefits like it helps in diabetes management							
1	Aware	49	49	39	39	88	44
2	Unaware	51	51	61	61	112	56
	Total	100	100	100	100	200	100
Aware that cow milk helps in weight loss							
1	Aware	59	59	67	67	126	63
2	Unaware	41	41	33	33	74	37
	Total	100	100	100	100	200	100
Aware that cow milk is an excellent source of vitamins and minerals							
1	Aware	67	67	81	81	148	74
2	Unaware	33	33	19	19	52	26
	Total	100	100	100	100	200	100
Aware that cow milk fat and protein are more easily digestible than buffalo milk							
1	Aware	79	79	89	89	168	84
2	Unaware	21	21	11	11	32	16
	Total	100	100	100	100	200	100
Awareness about the difference between A1 and A2 cow milk							
1	Aware	32	32	47	47	79	39.5
2	Unaware	68	68	53	53	121	60.5
	Total	100	100	100	100	200	100

Source: Primary source

milk, while 60.5% did not. This data underscores the need for increased consumer education on the nutritional benefits of cow milk.

4.4 Analyse Data of Respondents Who Consume Cow Milk in Anand and Vidyanagar Cities

4.4.1 Age wise distribution of respondents who consume cow milk (n = 39)

The bar chart (Fig. 1) illustrates the age-wise distribution of respondents who consume cow milk, categorized into four age groups. The data shows that 23% of respondents were up to 30 years old, indicating a significant portion of young adults consuming cow milk. The largest group, comprising 59% of the respondents, was aged 31 to 40 years, suggesting that middle-aged adults were the predominant consumers. Those aged 41 to 50 years make up 10% of the respondents, showing a moderate level of consumption. Finally, respondents above 50 years constitute

8% of the total, indicating a lower but still notable level of cow milk consumption among older adults.

4.4.2 Monthly income-wise distribution of the respondents who consume cow milk (n = 39)

The Fig. 2 shows the monthly income-wise distribution of the families of respondents who consume cow milk, segmented into five income groups. It indicates that 5% of the respondents' families earn less than INR 10,000 per month. Families earning between INR 10,001 and 20,000 per month make up 10% of the respondents. Those with a monthly income between INR 20,001 and 30,000 constitute 13% of the respondents. A notable 26% of the respondents' families fall within the INR 30,001 to 40,000 income range. The largest group comprising 46% of the respondents had a monthly income of more than INR 40,000 indicating that high-income families were the predominant consumers of cow milk among the surveyed population.

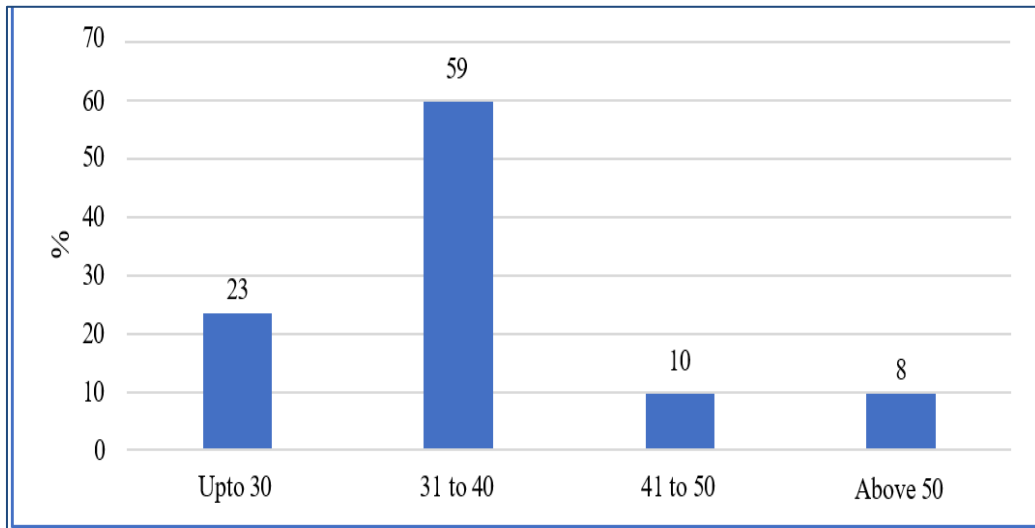


Fig. 1. Age wise distribution of respondents

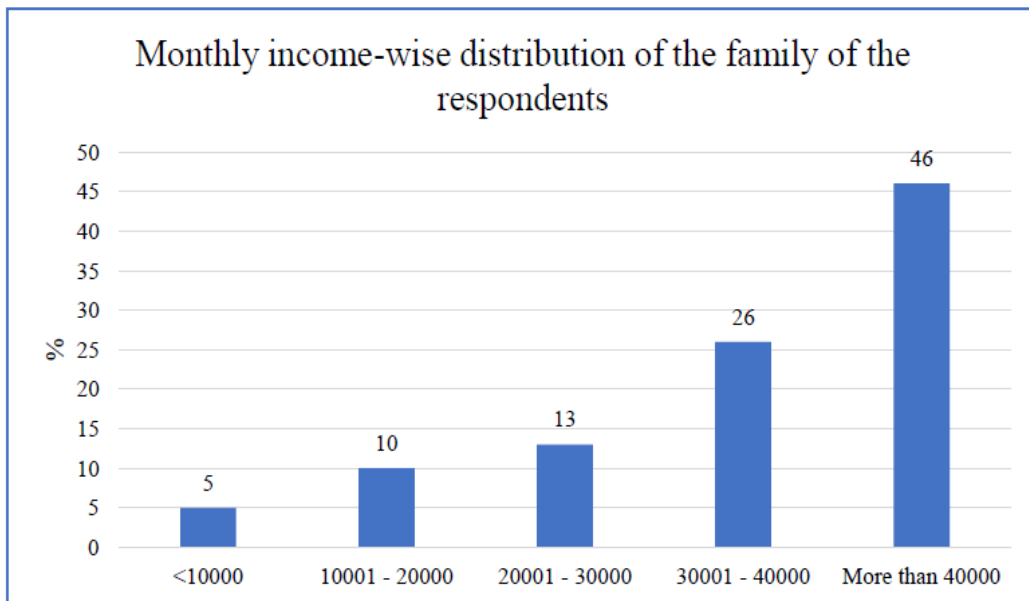


Fig. 2. Monthly income-wise distribution of the respondents who consume cow milk

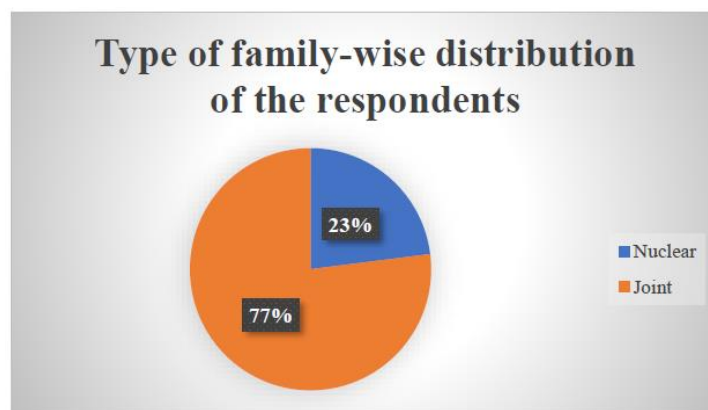


Fig. 3. Type of Family-Wise Distribution of The Respondents Who Consume Cow Milk

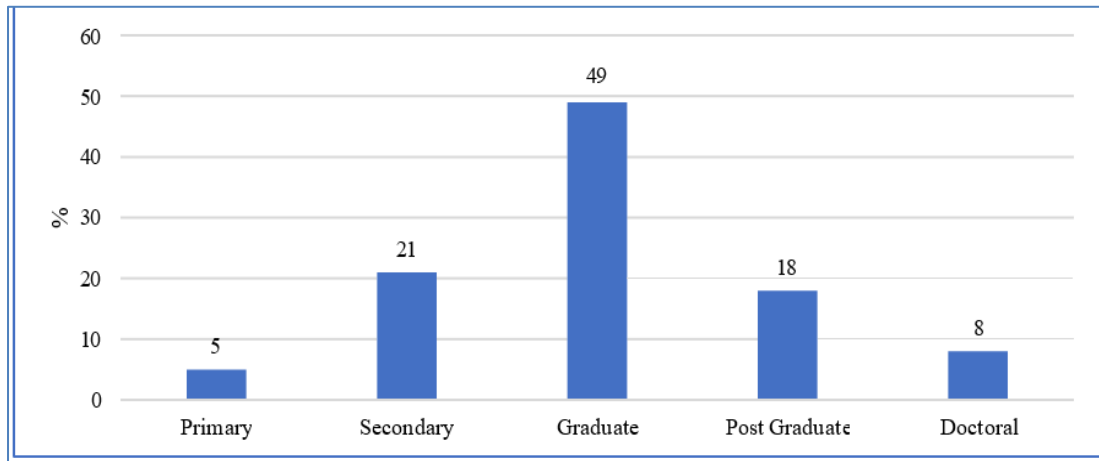


Fig. 4. Educational qualification-wise distribution of the respondents who consume cow milk

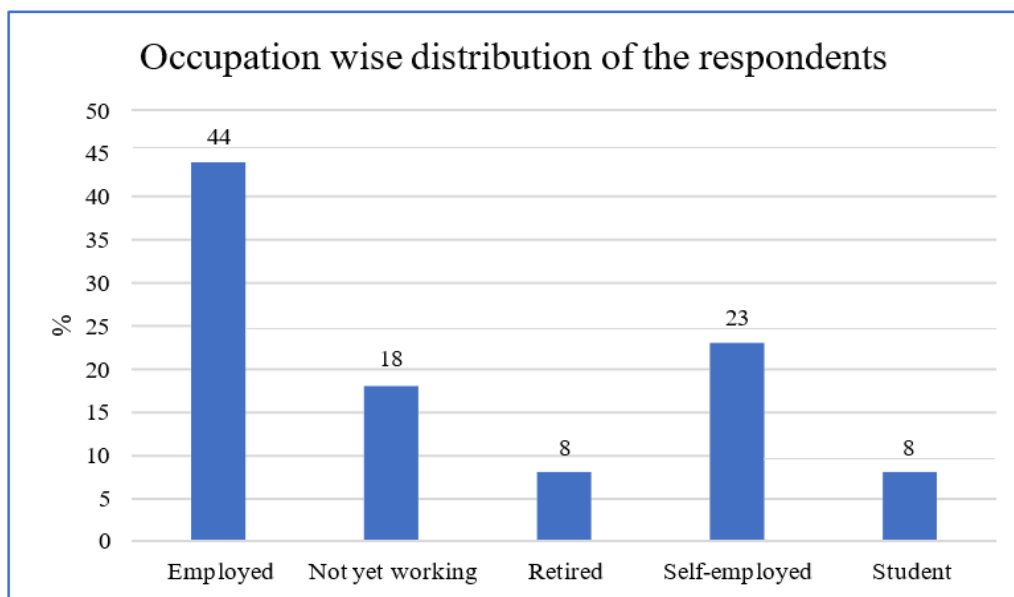


Fig. 5. Occupation wise distribution of the respondents who consume cow milk

4.4.3 Type of family-wise distribution of the respondents who consume cow milk (n= 39)

The pie chart (Fig. 3) data shows that 23% of the respondents belong to nuclear families, indicating a smaller proportion of cow milk consumption within this family type. In contrast, a significant 77% of the respondents live in joint families suggesting that the majority of cow milk consumers come from joint family.

4.4.4 Educational qualification-wise distribution of the respondents who consume cow milk (n = 39)

The Above Fig. 4 shows that, the largest group, comprising 49% of the respondents were

graduates. This was followed by those with secondary education at 21%. Respondents with post-graduate qualifications make up 18%, while those with doctoral degrees account for 8%. The smallest group at 5% consists of individuals with only a primary education. This distribution highlights that nearly half of the respondents had attained graduate-level education indicating a high level of educational attainment among the survey participants.

4.4.5 Occupation wise distribution of the respondents who consume cow milk (n = 39)

The above Fig. 5 shows that, the majority of respondents 44% were employed making this the

largest group. Following this, 23% of respondents were self-employed. The next significant category was those who were not yet working which constitutes 18% of the respondents. Both the retired and student categories each account for 8% of the respondents. This distribution provides a clear overview of the occupational demographics of the survey participants highlighting a predominance of employed individuals.

4.4.6 Relational analysis with different variable

- (a) Relation between Family Income and respondents who consumed Cow milk using Chi- square analysis

Inference:

$$\chi^2 = \sum((O - E)^2/E) = 3.637663$$

At 5% level of significance and 4 degrees of freedom, χ^2 critical = 9.488

χ^2 calculated < χ^2 critical

Null hypothesis is accepted.

Hence, it is inferred that there is no association between income and consumption of cow milk.

- (b) Relation between Education qualification and respondents who consumed Cow milk using Chi-square analysis

Inference:

$$\chi^2 = \sum((O - E)^2/E) = 6.229829$$

At 5% level of significance and 4 degrees of freedom, χ^2 critical = 9.488

χ^2 calculated < χ^2 critical

Null hypothesis is accepted.

Hence, it is inferred that there is no association between Education qualification and consumption of cow milk.

- (c) Relation between Age of respondents and respondents who consumed Cow milk using Chi-square analysis

Inference:

$$\chi^2 = \sum((O - E)^2/E) = 11.59656$$

At 5% level of significance and 3 degrees of freedom, χ^2 critical = 7.815

χ^2 calculated > χ^2 critical

Null hypothesis is rejected.

Hence, it is inferred that there is an association between income and consumption of cow milk.

- (d) Degree of Linear Relation between Age and number of respondents who consume cow milk using Correlation Co-efficient

Inference:

$$r = 0.5183$$

Hence, it is inferred that there exists a significant positive correlation between Age and consumption of cow milk.

5. CONCLUSION

This study provides a detailed profile of respondents in Anand and Vidyanagar. The gender distribution shows slightly more males (59.5%) than females (40.5%). The age distribution was predominantly young, with 73% of respondents under 40 years. Educational attainment was high with 51.5% being graduates, especially in Vidyanagar (65%). Employment status reveals 41.5% were employed with higher self-employment in Anand (26%) compared to Vidyanagar (13%). Joint families were more common (62.5%), particularly in Anand (71%). The most common income bracket was above 40,000 INR (35%) with Vidyanagar having a higher proportion (42%) than Anand (28%). These insights highlight the demographic and socioeconomic characteristics of the respondents.

This study reveals that 99% of respondents in Anand and Vidyanagar consume milk with 67% preferring packed milk. Daily consumption was high with 78.5% drinking milk once a day. Mixed milk was the most popular type (57%) and company outlets and home delivery were common purchase points. Females predominantly make milk purchase decisions (89.5%). These findings highlight strong milk consumption habits and the significant role of women in purchasing decisions.

This study reveals low consumer awareness regarding cow milk in Anand and Vidyanagar. Awareness of its FAT and SNF content was limited to 33.5%, health benefits to 44%, and weight loss benefits to 63%. However, 74% recognize it as a good source of vitamins and minerals and 84% understand its digestibility compared to buffalo milk. Knowledge about A1 and A2 cow milk was low at 39.5%. These

findings emphasize the necessity for enhanced consumer education on cow milk's nutritional advantages.

The analysis of cow milk consumption among respondents from Anand and Vidyanagar highlights key demographic trends. Most consumers were middle-aged (59% aged 31-40 years) with notable representation from young adults (23% up to 30 years). High-income families (46% earning above INR 40,000/month) were predominant consumers. Joint families (77%) show higher milk consumption compared to nuclear families (23%). Educationally, a majority were graduates (49%) reflecting a high level of education. In terms of occupation, 44% were employed with significant numbers in self-employment (23%) and among students/retirees (each 8%). Statistical analysis reveals a significant positive correlation between age and milk consumption ($r = 0.5183$), while no association was found between family income and milk consumption and education level and cow milk consumption. These findings provide insights into the demographic factors influencing cow milk consumption patterns in the surveyed areas.

6. RECOMMENDATIONS

Based on the study findings, it is recommended to implement targeted educational campaigns in Anand and Vidyanagar to increase awareness about the nutritional benefits of cow milk, including FAT, SNF content and the differences between A1 and A2 milk. These campaigns should focus on schools, colleges and community centers and highlight health benefits such as weight management and vitamin and mineral content. Given the key role of women in purchasing decisions, these initiatives should particularly target female consumers. Marketing strategies should also focus on high-income and joint-family households to reinforce and expand existing milk consumption habits.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

CONSENT

As per international standards or university standards, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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