



Camel Milk Consumption Trends and Drivers in Rajasthan, India: A Consumer Behaviour Study

Harsh Saharan^a, Amita Sharma^a and Anubhav Beniwal^{a*}

^a Institute of Agri Business Management, SKRAU, Bikaner-(334006), India.

Authors' contributions

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

Article Information

DOI: 10.9734/AJAEES/2023/v41i61921

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/98557>

Original Research Article

Received: 25/02/2023

Accepted: 27/04/2023

Published: 03/05/2023

ABSTRACT

The conservation status of Indian camels and their declining population is a growing concern, with the IUCN listing them as a threatened species. The decline in their population is attributed to a decrease in their use for agriculture and transportation, as well as a decrease in demand for camel milk and milk products. However, camel milk has been shown to have various health benefits and has been approved for sale in India by the Food Safety and Standards Authority. The study has explored brand preferences and factors influencing consumers' selection of a brand, concluding that quality and price were the most important factors for consumers. The study highlights the potential of the camel milk industry for economic development and conservation efforts.

Keywords: Camel milk; consumer behaviour; consumer preference; brands; health; factor analysis.

*Corresponding author: E-mail: anubhav.iabm@gmail.com;

1. INTRODUCTION

Indian camels, *Camelus dromedaries*, are listed in the IUCN (The International Union for Conservation of Nature) Red List of threatened species [1]. The Indian camel may be labelled as a globally endangered species in the IUCN list, according to a Times of India news excerpt written on December 19, 2016, which is not a positive sign. It further claims that, according to the census, the population of camels in the state declined from 421,836 in 2007 to 325,713 in 2012, a decrease of 22.79% [2]. The IUCN was established in 1984 with the goal of creating databases of animals and plants and their status. The primary rationale for the inclusion of Indian camels in the IUCN red list is the significant decline in their population.

Camels have a global population of 26.99 million. According to the 19th Livestock Census-2012, camels are primarily found in Rajasthan (81.4%), Gujarat (7.6%), Haryana (4.7 %), Bihar (2.2%), Uttar Pradesh (2.0%), and Other States (2.13%) in India [3]. The global camel population is scattered throughout 47 nations. Somalia is a country located on the African continent with a population of 7.10 million. It is the most populous country in the world. With 0.38 million camels, India is ranked 10th in the world [4]. The global camel population is expanding due to a threefold growth in the African region, whereas the Asian region, which includes India, is falling. The decline in Asia and India is due to a decline in the use of camels for agriculture and transportation, as well as a decrease in demand for camel milk and camel milk products. Camel milk is now in high demand and meat, on the contrary, is a major factor in the increasing trend of camel population in the African region.

Milk of camel is referred as "white gold." For decades, camel milk has been used as a natural diabetes treatment in Middle Eastern, Asian, and North African societies. It is also beneficial for children who have a cow milk allergy, and preliminary research data support its use in relation to treatment of autism in children, diarrhoea, allergies, and respiratory illnesses, camel milk which has been fermented is useful as a probiotic. It has a total solids content of 8 to 11%, a total protein content of 1 to 1.25%, and a fat content of less than 3% [5]. Camels' milk is highly perishable by nature, however by using a refrigerated supply system, its shelf life can be extended. It contains minerals like iron, copper, and zinc, as well as vitamins like B1, B6, B12,

and C. Due to the high concentration of lysozyme, lactoferrin, immunoglobulins, and lactoperoxidase, it also serves as an immunomodulator [6].

The Food Safety and Standards Authority of India (FSSAI) approved milk of camel for sale on November 29th, 2016. Camel milk has been used to treat cancer, insulin-dependent diabetic mellitus (IDDM), baby diarrhoea, autism, and alcohol-induced liver damage, among other disorders [7]. It has unusually high levels of an insulin-like molecule. Camel milk has also been said to be beneficial for a variety of conditions, including dropsy, jaundice, spleen problems, tuberculosis, asthma, anaemia, piles, and food allergies. Camel milk has been demonstrated to be beneficial to chronic liver patients, chronic tiredness patients, and as a complement to mother's milk. People in urban areas indicated that they were taking camel milk for various health benefits [8]. Indian camels can have a lactation period of 14 to 16 months, depending on when the calf is weaned. The average milk yield during the weaning phase is 3 to 4 litres per day, with a peak yield of 5 to 6 litres per day in the fifth and sixth months of lactation [9].

2. METHODOLOGY

The research was descriptive in nature, and primary data were collected to know consumer behaviour, preference towards different brands for camel milk in study area. To study the set objectives, National Research Centre on Camel (NRCC) and their associated customers were selected. Additionally, customers purchasing camel milk from other brands were also selected. For the study, multistage sampling was used.

In first stage to judgmental sampling was used to select Rajasthan because the highest population of camel is founded in Rajasthan according to the Department of Animal Husbandry Rajasthan. In 2nd stage again judgment sampling was used to select Bikaner because NRCC is located in Bikaner and various researches were conducted for milk production, potential in camel, and also technology validation to improve the socio-economic profile of camel ranchers. And, in 3rd stage again Bikaner tehsil is selected because of highest population in Bikaner district. Furthermore, the most important unit of this research, the costumers were selected based on convenience as per their availability.

The analytical method used in the study were %age analysis, Pareto analysis, and factor analysis. Descriptive statistical analysis using principal axis factoring, and Varimax rotation was used for the study.

2.1 Analytical Tools Used in Research

2.1.1 Factor Analysis using Principal Component Analysis (PCA)

The data from the excel spreadsheet was cleaned and fed in IBM SPSS Statistics performing Factor analysis using PCA. The various factors influencing the consumers to purchase camel milk were subjected to factor analysis. To get the factor loadings, the principal component analysis method was used. The primary purpose of adopting PCA was to know the most important factors that influence consumers' choice to purchase camel milk. The component model is expressed as follows.

$$X_i = A_{i1} F_1 + A_{i2} F_2 + A_{i3} F_3 + \dots + A_{im} F_m + V_i U_i$$

Where

- X_i = ith standardised variable
- A_{ij} = standardised multiple regression coefficient of variable i on common factor j
- F = common factor
- V_i = standardised regression coefficient of variable i on unique factor i
- U_i = the unique factor for variable i
- m = number of common factor

The unique factors are correlated with each other and with the common factors. The common factors themselves can be expressed as linear combinations of the observed variables.

$$F_i = W_{i1} X_1 + W_{i2} X_2 + W_{i3} X_3 + \dots + W_{ik} X_k$$

Where

- F_i = estimate of ith factor
- W_i = weight or factor score coefficient
- k = number of variables

The principal components having Eigenvalues greater than or equal to one would be retained to determine the number of components in the present study. While selecting the variables from the various extracted dimensions, more significant and positive values from the rotated component matrix (Varimax rotation method)

were selected from the respective dimensions (Zakir, 2008), Kaiser varimax rotation, as well as Bartlett test, were also used.

3. RESULTS AND DISCUSSION

3.1 Consumer Buying Behaviour for Camel Milk

In this objective studied about the consumers consumption pattern, decision of buying milk, preference, and point of purchased.

3.1.1 Duration of consuming camel milk

Fig. 1 shows the duration of camel milk consumption by buyers. This was divided into four categories.

Fig. 1 depicts that the sample size was dominated by the making the decision to buy camel milk. Respondents who had been drinking camel milk for more than a year reported that it had a positive impact on their health.

3.1.2 Decision of buying camel milk

Making the decision to buy camel milk. Decisions made by individuals and families were divided into two categories.

Fig. 2 illustrated that the group of individual decision-makers was dominated by family decision-makers in the sample size because without any reason nobody prefers to consume camel milk.

3.1.3 Kind of milk preferred by consumers

Fig. 3 shows the type of milk that consumers prefer. The groups were divided into three categories.

Fig. 3 depicts the three groups: packed milk, unpacked milk, and powdered milk. The next numbers were 49, 35, and 16 respectively. In the sample size, most respondents favoured packed milk first, followed by unpacked milk and powdered milk in that order.

3.1.4 Time prefer to buy camel milk

Data shows that the time prefer to buy camel milk. It was classified into four groups, early in the morning, afternoon, evening and anytime.

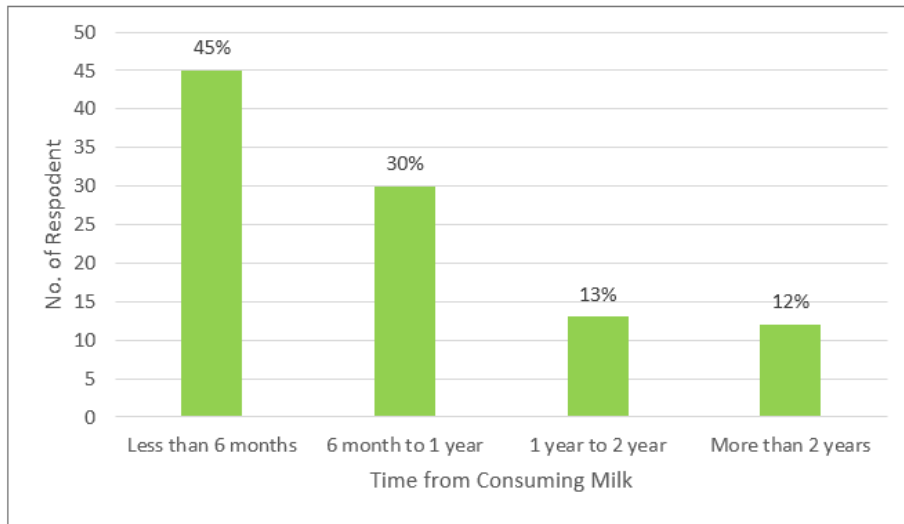


Fig. 1. Duration of consuming camel milk
 Source: Researcher's own computation from primary data

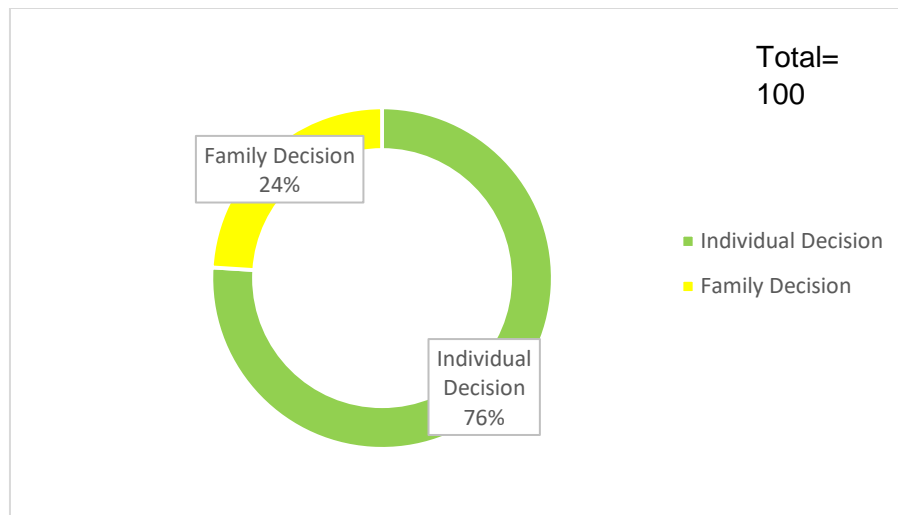


Fig. 2. Decision of buying camel milk
 Source: Researcher's own computation from primary data

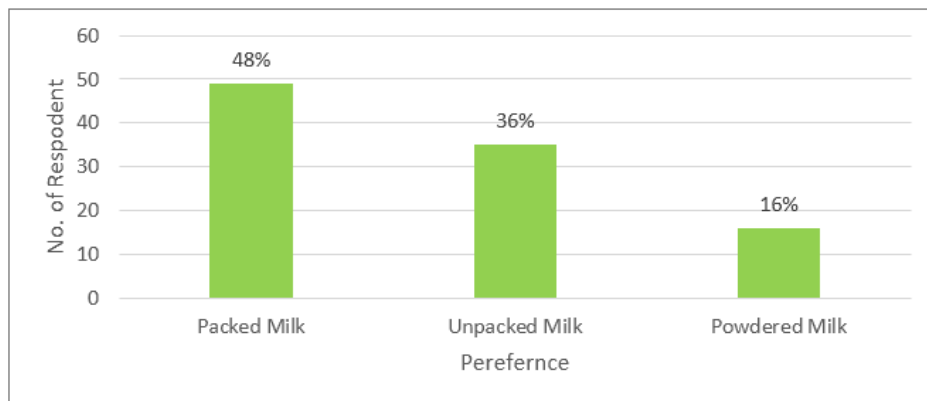


Fig. 3. Kind of milk preferred
 Source: Researcher's own computation from primary data

Fig. 4 illustrates that 44% of respondents prefer to buy camel milk in the morning, 26 % prefer to buy camel milk in the evening, 23% prefer to buy camel milk at any time, and 7 % prefer to buy camel milk in the afternoon. The sample size was dominated by early morning customers.

3.1.5 Point of purchasing camel milk

Following figure shows the point for purchasing camel milk. Camel milk was only accessible on specific counters constructed by camel milk producers because it was not readily available in supermarkets, shops, or dairy. It was divided into two categories.

Fig. 5 shows that the point of purchase was divided into two categories: first, retailers, and second, direct from the source of manufacturing, with 65% and 35% respectively. The sample size was dominated by the group of purchases from retailers.

3.1.6 Willing to get delivery at doorstep

Data depicts the willingness to accept delivery at one's doorstep. Camel milk was only available in accessible stores due to scarcity.

Fig. 6 shows that 66 % of respondents want deliveries delivered to their doorstep, whereas 34% do not. Most of the population in the sample size was willing to have milk delivered to their door.

3.1.7 Average consumption of camel milk per day

Fig. 7 shows study of consumer consumption patterns of camel milk. It was divided into five categories.

Fig. 7 depicts the consumption pattern, which was divided into five categories: 250 ml, 250 to 500 ml, 501 to 750 ml, 751 to 1000 ml, and >1 Litre. The %ages of those who followed were 37 %, 33 %, 14 %, 10%, and 6%, respectively. With 37% of the sample size, the group of 250 ml was dominated.

3.1.8 Frequency of purchasing camel milk

Table 2 shows the frequency with which camel milk is purchased. Analyse the pattern of camel milk purchases. This purchasing pattern was divided into five categories: daily, once every 1 to 3 days, once every 4-7 days, once every 8-15 days, and any other.

Table 1. Frequency of purchasing camel milk

Frequency of purchasing % of Respondent	
Daily	45%
Once in 1-3 days	42%
Once in 4-7 days	11%
Once in 8-15 days	2%
Any other	0%

Source: Researcher's own computation from primary data

Table 1 categorises shopping patterns into five categories: daily, once every 1 to 3 days, once every 4-7 days, once every 8-15 days, and any other. The % ages of those who followed were 45%, 42%, 11%, 2%, and 0%. With 45% of the sample size, the first group of everyday purchases was dominated. Those who did not buy regularly were not regular customers (more than 3 days).

3.1.9 Value for money paid to buy camel milk

In Fig. 8, the value for money given by consumers for camel milk was studied.

Fig. 8 shows that 89% of respondents felt they were getting good value for their money, while 11% did not. With 89% of the sample size, the group that gets value for money was dominated.

3.1.10 Reason for consuming camel milk

In Fig. 9, Studied about the reasons for consuming camel milk. In this Pareto analysis was used for graphical representation.

As shown in Fig. 9, diabetes was a key reason for consuming camel milk, as revealed by Pareto analysis. After that, joint pain and health consciousness were the main reasons for consuming camel milk in the sample size, with the % age of 40%, 20%, and 15% respectively. The rest of the groups had less dominance in sample size.

3.1.11 Attributes responsible for camel milk purchase

Table 2 illustrated about the different attributes who were responsible for purchasing camel milk in this calculate the descriptive statistics, KMO and Bartlett's Test, Communalities, Total Variance Explained and Rotated Component Matrix.

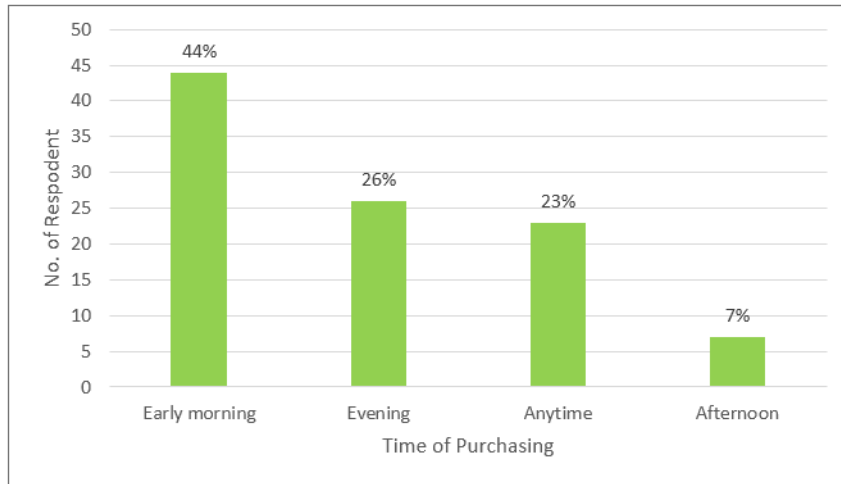


Fig. 4. Time preference to buy camel milk
Source: Researcher's own computation from primary data

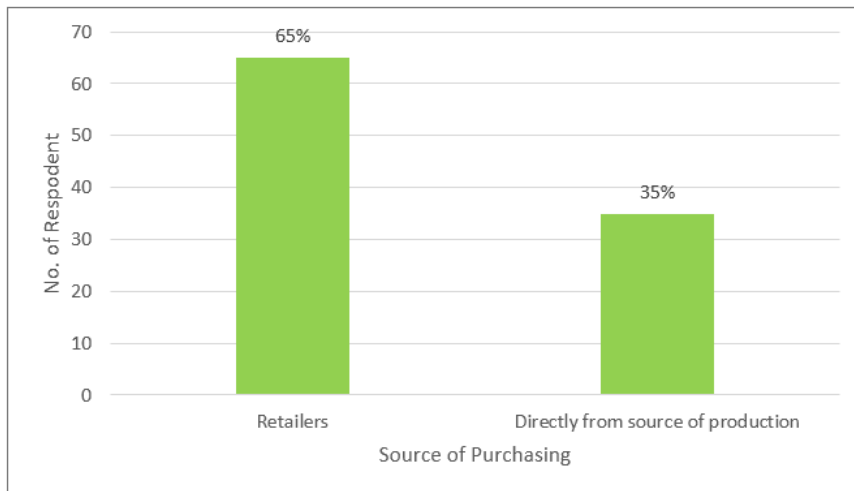


Fig. 5. Point of purchasing camel milk
Source: Researcher's own computation from primary data

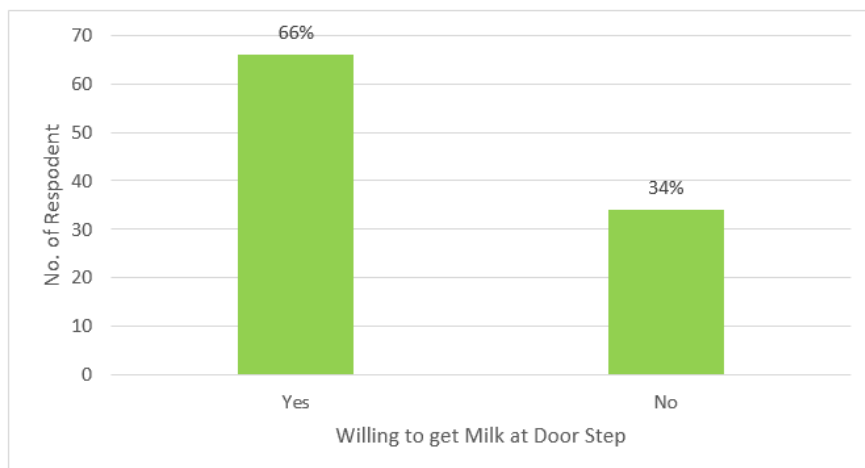


Fig. 6. Willing to get delivery at doorstep
Source: Researcher's own computation from primary data

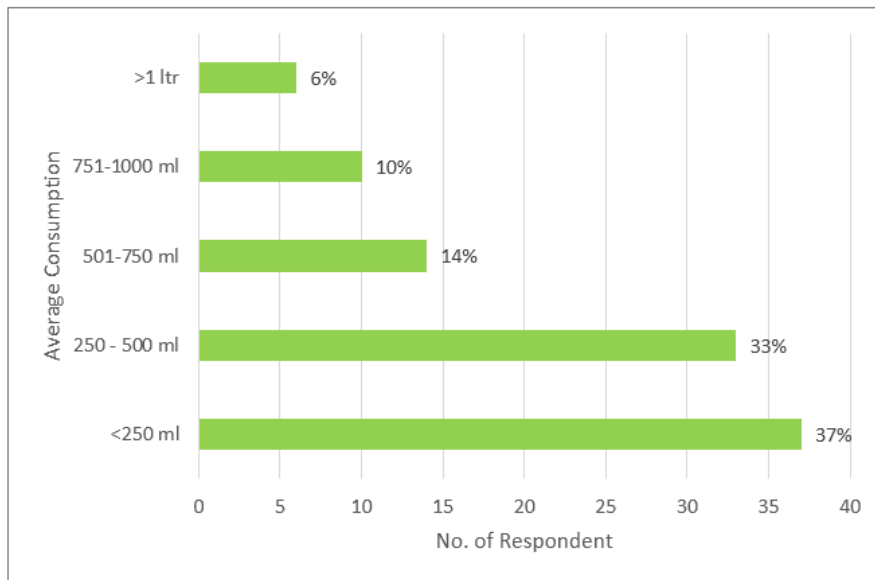


Fig. 7. Average consumption of camel milk per day
 Source: Researcher's own computation from primary data

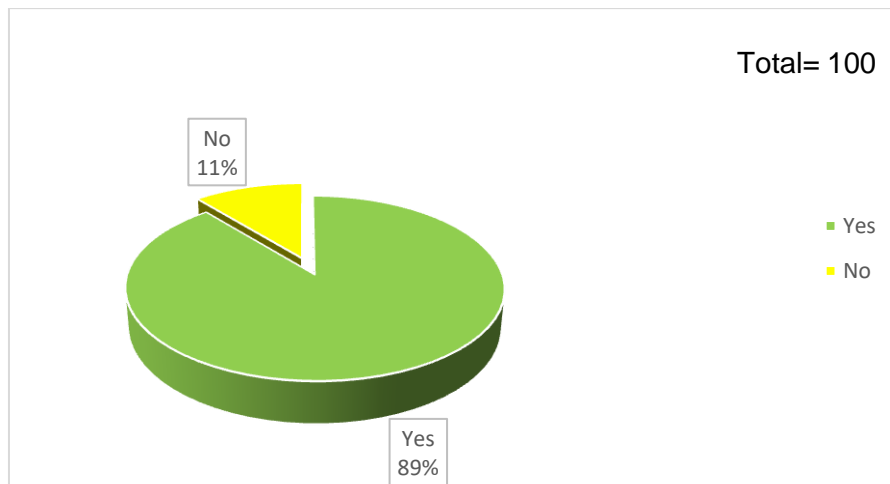


Fig. 8. Value for money paid for buying camel milk
 Source: Researcher's own computation from primary data

Table 2. Descriptive statistics

	Mean	Std. deviation	Analysis N
Camel milk is more fresh than other available milk	4.640	.5777	100
Comparatively Its taste is better	2.580	.8667	100
Price of camel milk is in my budget	3.680	1.0336	100
It is free of additives	3.510	.6741	100
Nutrient values are higher comparative to other available milk options	4.680	.7090	100
Recommendation is one of the major reasons for buying	4.000	.9428	100
Certification is very important	3.510	.8819	100
It is very useful to maintain good health	4.560	.7292	100
Doctors' recommendation is also one of the main reason	4.070	1.0565	100

Source: Researcher's own computation from primary data

Table 2 shows how to calculate Descriptive Statistics using the SPSS software, as well as the mean and standard deviation for all variables.

As shown in Table 3, KMO and Bartlett's test was represented test value shows 0.693 is acceptable (mediocre level) as a value above 0.6 is acceptable in the case of the KMO test. Bartlett's test of sphericity has a significant value of 0.000, which is acceptable as a value below 0.001 is acceptable. The value is statistically significant for Bartlett's test of sphericity.

Table 4 shows that the extraction value tells us the proportion of each variable that can be explained by the factors. The external value for recommendation, maintain health,

nutrition value, doctors' recommendation, certification, freshness, price, taste, and free of additives, which thus can be explained well by these factors.

Table 3. KMO and Bartlett's test

Kaiser-Meyer-Olkin measure of sampling adequacy		
.693		
Bartlett's Test of Approx. Chi-Square		127.192
sphericity	Df	36
	Sig.	.000

Source: Researcher's own computation from primary data

As shown in Table 8, SPSS extracted three components, which can be used to explain 27.995, 15.257, and 12.915 % of the variance of the various components under consideration.

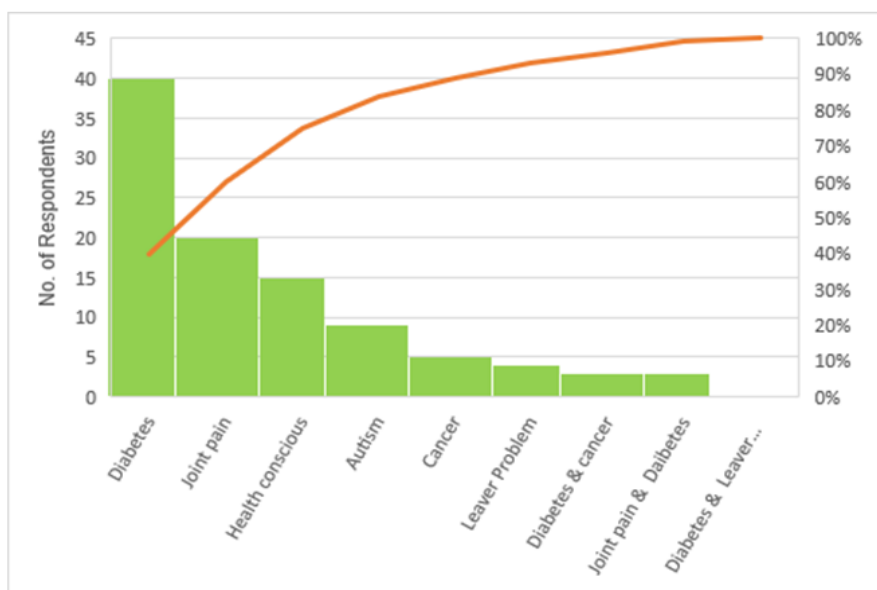


Fig. 9. Reason of camel milk consumption

Source: Researcher's own computation from primary data

Table 4. Communalities

	Initial	Extraction
Camel milk is more fresh than other available milk.	1.000	.503
Comparatively Its taste is better.	1.000	.447
Price of camel milk is in my budget.	1.000	.469
It is free of additives	1.000	.449
Nutrient values are higher comparative to other available milk options.	1.000	.666
Recommendation is one of the major reasons for buying	1.000	.712
Certification is very important.	1.000	.513
It is very useful to maintain good health.	1.000	.707
Doctors' recommendation is also one of the main reasons	1.000	.588

Extraction Method: Principal Component Analysis

Source: Researcher's own computation from primary data

Table 5. Total variance explained

Component	Initial Eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	2.520	27.995	27.995	2.520	27.995	27.995	1.977	21.970	21.970
2	1.373	15.257	43.252	1.373	15.257	43.252	1.668	18.535	40.505
3	1.162	12.915	56.167	1.162	12.915	56.167	1.410	15.662	56.167
4	.881	9.789	65.956						
5	.786	8.730	74.685						
6	.697	7.745	82.431						
7	.691	7.682	90.112						
8	.491	5.453	95.565						
9	.399	4.435	100.000						

Extraction Method: Principal Component Analysis

Source: Researcher's own computation from primary data

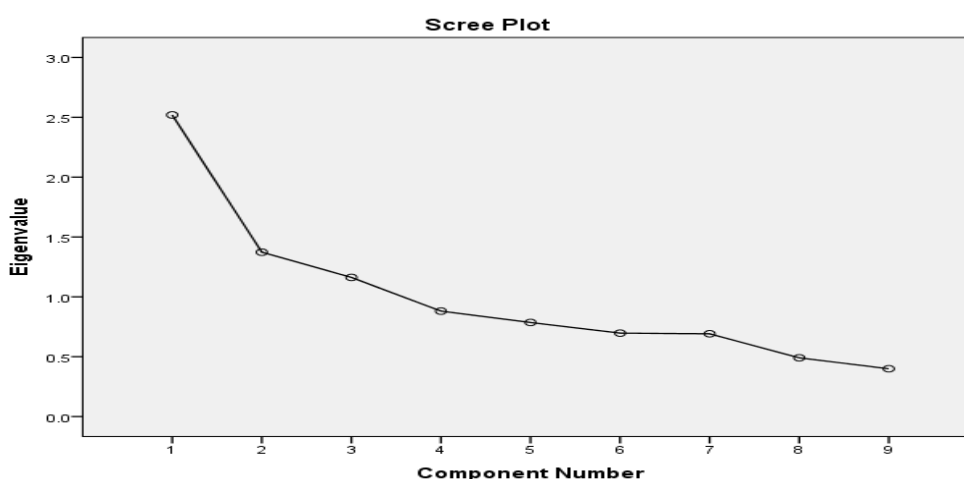


Fig. 10. Scree plot

Source: Researcher's own computation from primary data

As shown in Table 6, Component matrix explaining the strength of the relationship between the various items and the components being extracted in the solution. All the variables are grouped into following three factors:

As per the Table 7, component 1 strongly correlates with freshness, health consciousness, and recommendation and all these are related to health consciousness. Therefore component 1 seems to reflect the health consciousness. Component 2 strongly correlates with taste, price, and certification and these are attributes of a product. Therefore component 2 seems to reflect the importance of product attributes. Component 3 strongly related to additives, nutrition value and recommendation and all these are related to word of mouth. Therefore component 3 seems to reflect the importance of word of mouth for a product consideration.

3.2 Preference of Consumers towards Major Brands of Camel Milk

In this objective, studied about the preference of the consumers towards major brands of camel milk, brand loyalty, attributes that can influence to buy camel milk and factor influencing to buy major brands.

3.2.1 Brand preferred by consumers

Fig. 11 shows the consumers' brand preferences and the key brands they use.

Fig. 11 depicts the consumer preferred NRCC milk most. NRCC milk was dominated in the sample size with 36%, followed by Pearl milk, Adavik Foods milk, Amul milk, and Urmul milk, with % ages of 23%, 16%, 14%, and 11%, respectively.

Table 6. Rotated component matrix

	Component		
	1	2	3
Camel milk is more fresh than other available milk	.696		
Comparatively Its taste is better		.667	
Price of camel milk is in my budget		.574	
It is free of additives			.495
Nutrient values are higher comparative to other available milk options			.610
Recommendation is one of the major reason for buying			.823
Certification is very important		.688	
It is very useful to maintain good health	.767		
Doctor's recommendation is also one of the main reason	.695		

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.^a

a. Rotation converged in 5 iterations.

Source: Researcher's own computation from primary data

Table 7. Different factor with high loading

Health Consciousness	Product Attributes	Marketing Communication
Camel milk is more fresh than other available milk	Comparatively Its taste is better	It is free of additives
It is very useful to maintain good health	Price of camel milk is in my budget	Nutrient values are higher comparative to other available milk options
Doctor's recommendation is also one of the main reasons	Certification is very important	Recommendation is one of the major reasons for buying

Source: Researcher's own computation from primary data

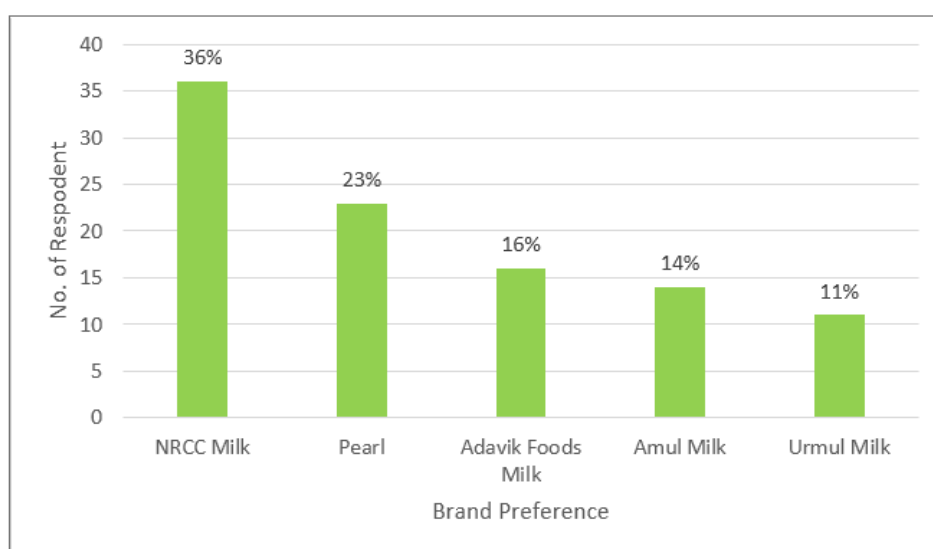


Fig. 11. Brand preferred by consumer

Source: Researcher's own computation from primary data

3.2.2 Factor influencing for selection of brand

Table 8 shows the characteristics that can influence consumers to buy a particular brand. It can be demonstrated using the wattage average

approach. On a scale of 1 to 5, 1 represents Not at all important, 2 represents Somewhat not important, 3 represents Neutral, 4 represents Somewhat important, and 5 represents Extremely important.

Table 8 depicts the highest weighted average was for nutritional factor were 4.83, so dominated factor for influencing for selection of brand was nutritional factor after this ease of availability with 4.69 and brand image with 4.43 weighted average, less dominated factors were advertisement, word of mouth and local product with weighted average of 3.9, 3.52 and 2.44 in sample size.

3.2.3 Comparative analysis of different camel milk brands

Fig. 12 shows a radar chart that was used to research several brand attributes for comparative analysis.

Fig. 12 shows that NRCC milk had the best quality, availability, price, and thickness, whereas Pearl milk had the best taste. Amul milk was ranked second in thickness, while Adavik Food Milk was the least competitive among the camel milk brands available in the study area, as seen

in the radar chart. The most competitive is NRCC, followed by Pearl Milk.

3.2.4 Unavailability of brand used by consumer

In Fig. 13, the brand loyalty of customers towards the brand that they used when the brand was unavailable was explored.

As indicated in Fig. 13, most respondents were brand loyal and did not filter when their preferred brand was unavailable. There were two groups: one that did not sift and another that did sift in the event of unavailability. Following rates were 66 % and 34 %, respectively. The non-sifting was dominated in the sample size.

3.2.5 Preference towards various camel milk product

In Fig. 14, studied about the preference towards various camel milk products.

Table 8. Factor influencing for selection of brand

Factors/Scale	1	2	3	4	5	Weighted average
Advertisement	06	04	13	48	29	3.9
Brand image	01	04	08	25	62	4.43
Local product	32	21	25	15	07	2.44
Word of mouth	02	05	41	43	09	3.52
Ease of availability	01	00	01	25	73	4.69
Nutritional factors	00	00	02	13	85	4.83

Source: Researcher's own computation from primary data

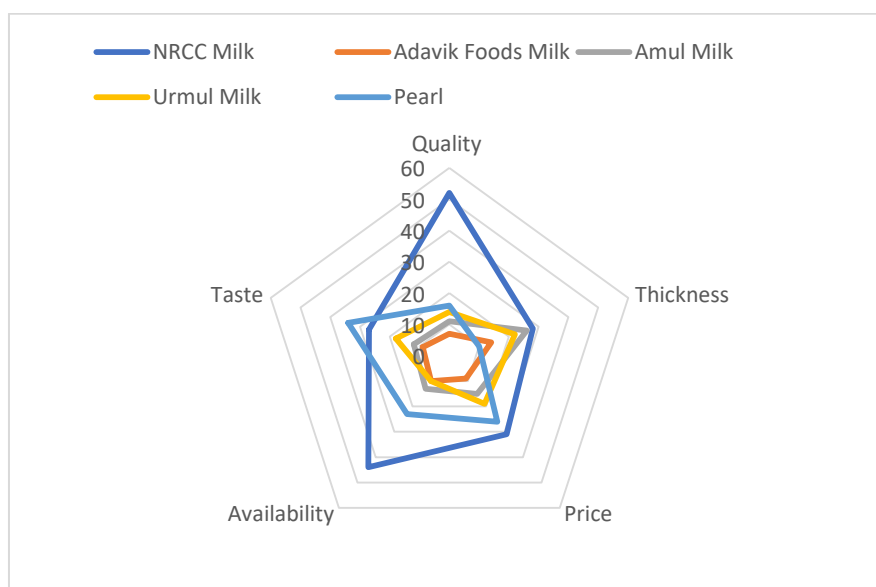


Fig. 12. Comparative analysis of different camel milk brands

Source: Researcher's own computation from primary data

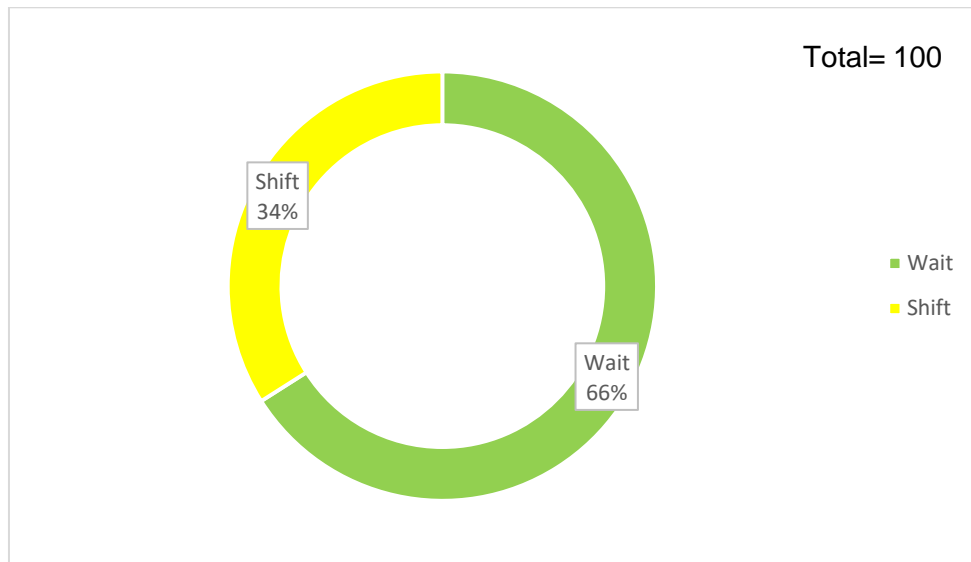


Fig. 13. Brand loyalty
 Source: Researcher's own computation from primary data

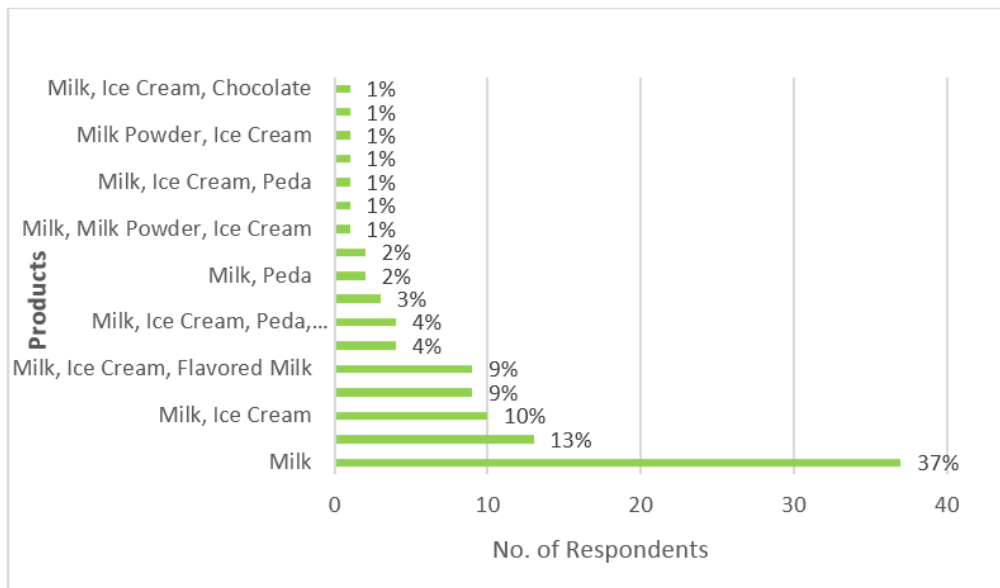


Fig. 14. Preference towards camel milk products
 Source: Researcher's own computation from primary data

Fig. 14 depicts consumer preferences for various camel milk products. Milk was ranked first, followed by ice cream and flavoured milk, which were ranked second and third respectively. The sample size was dominated by ice cream and flavoured milk. Because respondents were unfamiliar of camel milk products and because they were not readily available in the market, ICAR-National Research Centre on Camel (NRCC) encouraged the use of camel milk products through research and provided free product trials in training.

4. CONCLUSION

This study explores the socio-economic profile, buying behaviour, and preferences of consumers towards camel milk brands. The study found that there was a significant participation of female customers, and the age group of 26-35 was dominant in purchasing camel milk. Consumers from the upper-middle-class group were the most prominent in the sample size. The study showed that the consumers mainly preferred packed milk but many respondents preferred unpacked milk

due to quality concerns. The majority of respondents purchased camel milk from retailers and preferred delivery at doorstep. Diabetes, joint pain, and health consciousness were the main reasons for consuming camel milk. Recommendation, health benefits, and nutrition value were the main attributes that influenced consumers to buy camel milk. NRCC milk was the most preferred brand, followed by Pearl Milk, and Adavik Food Milk was the least competitive among the available camel milk brands in the study area. The majority of respondents were brand loyal and did not shift to other brands in case of unavailability. The study also found that ice cream and flavoured milk were the most preferred products other than milk.

COMPETING INTERESTS

Authors have declared that they have no known competing financial interests or non-financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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