



RESEARCH ARTICLE

# Analysis of consumption pattern of livestock products and its demand elasticities of Indian households: Evidence from NSSO data

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## Abstract

The present study aims to examine the consumption pattern and price elasticities of livestock products among rural and urban households in India, utilizing household consumption expenditure survey data for the year 2021-22. It provides insights into budget allocations and consumer responses to price fluctuations. The Almost Ideal Demand System (AIDS) model has been employed to estimate the elasticities. Milk, chicken and eggs dominate livestock-related expenditure, accounting for nearly 80 % of total spending. Milk alone represents 38.45 % of the budget, highlighting its status as a dietary staple, while chicken and eggs follow with shares of 20.09 % and 19.34 %, respectively. Other products such as fish, mutton, beef and pork hold smaller proportions, with fish contributing 13.12 %. The own-price elasticities indicate that the demand for milk, eggs and chicken is inelastic, meaning consumption remains relatively stable despite changes in price. In contrast, beef, mutton and pork though accounting for a smaller portion of total livestock spending, display demand patterns that are either positive or nearly inelastic in response to price changes, suggesting their consumption is concentrated among specific population segments. Cross-price elasticity estimates reveal limited substitutability among major livestock products. These findings underscore the essential role of milk, eggs and chicken in Indian diets and offer valuable insights for policymakers and market strategists aiming to address food security and nutrition in diverse demographic settings.

**Keywords:** AIDS model; consumption pattern; livestock products; price elasticities

**JEL Classification:** Q11, Q18

## Introduction

Human development is fundamentally dependent on global food security, which is closely aligned with 12 of the 17 Sustainable Development Goals (SDGs) (1). However, the growing global population and increasing dietary preferences for animal-based products and higher calorie intake pose significant challenges to food security (2). In this context, global demand for food is expected to rise steadily over the next four decades. By 2050, the world's population is expected to increase by two-thirds from its current level, accompanied by a comparable two-thirds rise in the consumption of animal protein (3).

India, the world's second-largest food producer after China, is undergoing a substantial transformation in household dietary patterns (4). There is a marked shift away from staple cereals towards high-value food items such as meat, milk and dairy products, fruits and vegetables. These transitions in consumption habits have been well documented in several studies (5-8). Contributing factors include rising income levels, urbanization, changes in lifestyle, growing

health awareness and enhanced access to both processed and fresh food through the expansion of supermarkets and better transportation and storage infrastructure (9, 10).

Livestock products now occupy a prominent role in Indian diets, second only to cereals. They are rich sources of calories, protein and fat, contributing to over 25 % of total household food expenditure (11). According to the National Sample Survey Office (NSSO) 68th round (2011-12), the per capita monthly consumption of milk was 4.3 L in rural areas and 5.4 L in urban areas. Egg consumption was reported at 2.7 eggs per person in rural areas and 4.4 eggs in urban areas, while meat consumption (including mutton, beef and chicken) stood at 0.32 kg in rural and 0.36 kg in urban households. Fish consumption was 0.27 kg and 0.32 kg in rural and urban households, respectively (12).

However, national averages mask significant regional disparities. For instance, fish consumption is much higher in coastal and eastern states like West Bengal (1.2 kg), Kerala (1.1 kg), Odisha (1.0 kg) and Assam. On the other hand, northern states such as Punjab and Haryana report high milk

consumption exceeding 9-11 L per capita per month, reflecting strong dairy traditions. These regional differences are influenced by cultural, geographical and economic factors. A comparative regional analysis can thus inform the design of region-specific livestock development policies and targeted nutritional interventions.

The importance of livestock extends beyond its role in dietary consumption. It serves as a critical source of nutrient-dense food, especially for low-income households. Livestock products provide essential amino acids and bioavailable micronutrients that are often deficient in malnourished populations, thereby playing a vital role in food and nutritional security (13).

Economically, the livestock sector is playing an increasingly significant role in India's agricultural growth. Between 2011-12 and 2021-22, India's overall Gross Value Added (GVA) rose from ₹81.07 lakh crore to ₹2.14 lakh crore. During this period, the Agriculture and Allied Sector maintained a consistent share of 18-20 %, rising from ₹15.02 lakh crore to ₹40.67 lakh crore. Notably, the contribution of the livestock sector to GVA surged substantially from ₹3.27 lakh crore (4 % of total GVA) in 2011-12 to ₹12.28 lakh crore (6 % of total GVA) in 2021-22, underlining its growing economic significance (14).

The livestock sector also plays a vital socio-economic role in rural India, providing employing to about 8 % of the national labour force, including a large proportional of small and marginal farmers, women and landless agricultural workers (15). Moreover, it is recognised as a high-potential sector for generating export revenues (16).

Despite its importance, there is limited information available on the demand-side dynamics of livestock products. This data gap hinders the formulation of evidence-based policies and prevents producers from making informed, market-oriented decisions. Therefore, understanding consumption patterns and estimating demand elasticities for livestock products is crucial. This study, using unit-level data from the NSSO Household Consumer Expenditure Survey (2011-12), aims to fill that gap and provide a comprehensive analysis of livestock consumption in India.

## Materials and Methods

The present study is based on household-level data on dietary patterns and consumer expenditures, collected by the NSSO under the Household Consumption Expenditure Survey (HCES) for the period 2022-23. This dataset, hereafter referred to as NSSO HCES 2022-23, provides comprehensive, nationally representative estimates that capture both spatial (rural and urban) and commodity-level variations in the consumption of food and non-food items, including livestock-derived food products.

It is important to note that the preceding period of 2021-22 coincided with the COVID-19 pandemic, which likely influenced consumer behaviour and dietary patterns. The pandemic led to income shocks, mobility restrictions, supply chain disruptions and shifts in consumer preferences. These disruptions resulted in temporary closures of meat and fish

markets, heightened concerns over zoonotic disease transmission and a decline in household purchasing power. Consequently, some regions may have experienced a decrease in the consumption of perishable animal-source foods, while others possibly saw an increase in the consumption of locally available or home-sourced items such as milk and eggs.

The HCES 2022-23 survey covers a sample of approximately 261746 households across India, encompassing both rural and urban populations. The large sample size, standardized methodology and nationwide coverage make this dataset highly reliable for empirical research and policy analysis. The dataset provides information on average monthly per capita consumption and expenditure across a wide range of commodities, classified using a consistent and well-established coding structure. In this study, total per capita expenditure is used as a proxy for total per capita income and the two terms are used interchangeably throughout the analysis.

To examine spatial consumption patterns, the sample households were categorized based on their location of residence into rural and urban groups. The livestock products analyzed in this study include milk and milk products, eggs, fish, chicken, mutton, pork, beef and other livestock items such as birds, crab, oysters and similar products. These items were selected due to their nutritional significance and their growing role in Indian household diets.

Consumer demand behavior for these livestock products was estimated using the AIDS model, developed by Deaton and Muellbauer (1980). The AIDS model, which is grounded in utility-based framework, offers a second-order approximation to any arbitrary utility function, making it particularly suitable for empirical analysis. It allows the estimation of both price and expenditure elasticities and facilitates the understanding of how households allocate their food budgets among various commodities.

To implement the AIDS model, key variables include retail prices of different livestock products, household-level budget shares for each commodity and total household expenditure on livestock items. The integration of price, expenditure and quantity data enables robust estimation of demand elasticities. These estimates are essential for understanding consumer preferences and hold significant implications for policy development, marketing strategies and nutritional interventions within the livestock sector.

This analytical framework, which combines high-quality national data with a theoretically sound demand model, offers a solid foundation for evaluating consumption trends and estimating demand elasticities for livestock products across both rural and urban India.

The demand functions are derived in budget share form as:

$$p_i q_i \equiv w_i = a_i + \sum_{j=1}^{\infty} b_{ij} \ln p_j + c_i \ln \frac{y}{p}$$

Where  $w_i$  is the budget share,  $p$  is the price index

$$\ln P = a_0 + \sum_k a_k \ln p_k + \frac{1}{2} \sum_j \sum_k b_{jk} \ln p_k \ln p_j$$

And the parameters are subject to the following restrictions

$$\sum_i a_i = 1, \sum_i b_{ij} = 0, \sum_i c_i = 0, \sum_j b_{ij} = 0, b_{ij} = b_{ji}$$

$$E_{it} = -1 + \frac{b_{ij}}{w_i} - c_i, E_{ij} = \frac{b_{ij}}{w_i} - \frac{c_i}{w_i} w_j, \eta_i = 1 + \frac{c_i}{w_i}$$

## Results and Discussion

### Per capita expenditure on food groups

Table 1 provides a comparative analysis of per capita expenditure on various food groups for rural and urban households in India across two time periods: 2011-2012 and 2021-2022. The data, expressed in rupees per annum at constant prices, reveals a general increase in expenditure across all food groups over the decade. Notably, spending on has declined as a proportion of total food expenditure, particularly in rural areas, indicating a shift in dietary preferences. In contrast, livestock products such as milk, eggs and meat have experienced a substantial increase in expenditure in both rural and urban settings, emerging as the largest share of food spending by 2021-2022.

Expenditure on fruits and vegetables has also increased, suggesting improvements in dietary diversity. A notable trend is the significant rise in spending under the “Other food commodities” category-likely encompassing processed foods-especially in urban areas, where it has surpassed many traditional food groups. This trend may reflect increasing urbanization and the influence of modern dietary habits.

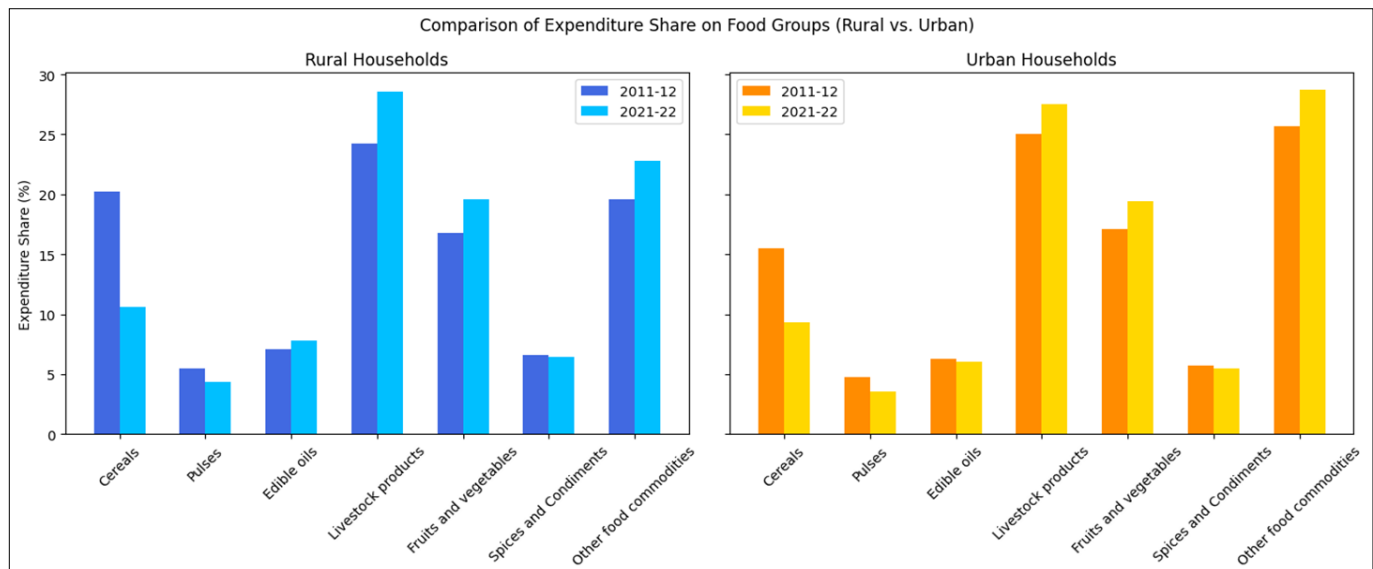
However, the shift in livestock product consumption poses concerns for nutritional security, especially for undernourished populations and low-income households. Animal-source foods like milk, eggs and meat are crucial providers of high-quality proteins, essential vitamins and bioavailable minerals. Reduced access to these foods can worsen nutrient deficiencies, particularly in vulnerable groups like children and women (17). Additionally, the growing shift towards plant-based diets may inadvertently lead to higher consumption of calorie-dense but nutrient-poor foods, thereby contributing to “hidden hunger” (18).

In rural communities, where livestock farming serves both as a source of nutrition and a means of livelihood, reduced demand for animal-source foods can further increase economic vulnerability and food insecurity (19). This situation may worsen health outcomes, including anaemia and childhood stunting, underscoring the urgent need to ensure the availability and affordability of animal-source foods to combat malnutrition (20). Overall, total per capita food expenditure remains significantly higher in urban areas, as illustrated in Fig. 1, highlighting the persistent disparity in consumption levels between rural and urban households.

**Table 1.** Per capita expenditure on food groups in rural and urban households in India

Food group	Expenditure (Rs. /Annum) at Constant Prices					
	2011-2012			2021-2022		
	Rural	Urban	India	Rural	Urban	India
<b>Cereals</b>	1835(20.21)	2086(15.51)	1960(17.40)	1267.89 (10.58)	1589.41 (9.29)	1450.43 (9.94)
<b>Pulses</b>	499(5.50)	644(4.79)	571(5.07)	520.22 (4.34)	608.64 (3.56)	576.56 (3.95)
<b>Edible oils</b>	641(7.06)	840(6.25)	741(6.58)	928.35 (7.75)	1035.14 (6.05)	1007.14 (6.90)
<b>Livestock products</b>	2201(24.24)	3364(25.01)	2782(24.70)	3419.14 (28.54)	4711.88 (27.54)	4093.02 (28.04)
<b>Fruits and vegetables</b>	1521(16.76)	2295(17.06)	1908(16.94)	2348.58 (19.60)	3321.52 (19.41)	2847.71 (19.51)
<b>Spices and Condiments</b>	601(6.62)	765(5.68)	683(6.06)	770.81 (6.43)	932.34 (5.45)	867.31 (5.94)
<b>Other food commodities*</b>	1780(19.61)	3458(25.70)	2619(23.25)	2726.18 (22.75)	4910.32 (28.70)	3755.53 (25.73)
<b>Total</b>	<b>9079(100)</b>	<b>13451(100)</b>	<b>11264(100)</b>	<b>11981.17 (100)</b>	<b>17109.24 (100)</b>	<b>14597.71 (100)</b>

Figures in the parentheses are percentages to total; \*Salt and sugar, beverages, served and packaged processed foods



**Fig. 1.** Decadal changes in per capita consumption expenditure on food groups in rural and urban households in India.

### Rural households

The analysis of livestock product consumption among rural households provides insights into their dietary preferences and sensitivity to price changes. As shown in Table 2, milk constitutes the largest share of livestock expenditure at 35.4 %, followed by chicken (21.1 %) and eggs (20.1 %). Fish also plays a notable role, accounting for 14.2 % of the livestock budget, whereas mutton, beef and pork represent smaller shares at 2.6 %, 2.4 % and 3.4 %, respectively.

Budget elasticities estimates suggest that these products are viewed necessities, with expenditures remaining relatively stable in response to income changes. The price elasticities for milk (-0.76), eggs (-0.87) and chicken (-0.79) indicate inelastic demand, meaning consumption decreases less than proportionately when price increases. Fish also demonstrates inelasticity, with a slightly lower elasticity of -0.69. In contrast to the finding that the demand for milk, chicken and eggs was more elastic in rural areas (16).

Interestingly, mutton, beef and pork exhibit positive price elasticities, indicating a lower preference for these products in rural diets. Several factors may contribute to this trend. Cultural and religious segmentation plays a significant role, with consumption patterns varying widely across communities. In some groups, these meats are considered luxury or status-enhancing foods and higher prices may be interpreted as indicators of better quality, thereby increasing demand-particularly among wealthier or urban consumers.

Furthermore, limitations in the dataset-such as the inability to capture regional, seasonal, or cultural nuances-may lead to apparent increases in demand despite rising prices (21, 22). The availability of substitutes may also influence these patterns; as the prices of one category of meat rise, consumers may shift to alternatives, complicating the interpretation of demand behaviour.

Cross-price elasticity estimates weak substitution effects among livestock products. Most of these items are treated as distinct categories within Indian diets, rather than interchangeable goods. This limited substitutability is largely rooted in longstanding cultural, religious and regional dietary preferences. For instance, beef and pork are consumed by specific population segments and may not substitute well with products like chicken or fish due to religious restrictions. Similarly, dairy products occupy a unique nutritional and cultural role, especially among vegetarians and are not widely substituted by meat products.

These insights are valuable for policymakers and market participants aiming to understand consumer behaviour in response to price changes and for designing targeted food security or subsidy programs.

### Urban households

Table 3 explains that Urban households devote 43 % of their livestock budget to milk, followed by 18.3 % for eggs and 18.7 % for chicken. Fish takes up 11.4 %, while mutton, beef and pork combined make up around 7.3 % of their spending.

**Table 2.** Price elasticity, cross price elasticity, expenditure elasticity and expenditure share of livestock products in rural households in India

Livestock Products	Eggs	Milk	Fish	Mutton	Beef	Pork	Chicken	Others	Expenditure Elasticity	Expenditure Shares
<b>Eggs</b>	<b>-0.870***</b> (0.001)	-0.177*** (0.001)	-0.006*** (0)	0.034*** (0.001)	0.029*** (0.001)	0.038*** (0.001)	-0.027*** (0)	-0.046*** (0.001)	1.003*** (0.000)	20.1
<b>Milk</b>	-0.053*** (0)	<b>-0.763***</b> (0.001)	-0.096*** (0)	-0.142*** (0.001)	-0.109*** (0.001)	-0.120*** (0.001)	-0.083*** (0)	0.002* (0.001)	0.998*** (0.000)	35.4
<b>Fish</b>	-0.013*** (0.001)	-0.126*** (0.001)	<b>-0.696***</b> (0.002)	-0.015*** (0.001)	-0.039*** (0.001)	-0.046*** (0.001)	-0.045*** (0)	-0.041*** (0.002)	1.001*** (0.000)	14.2
<b>Mutton</b>	-0.008*** (0.001)	-0.025*** (0.002)	-0.024*** (0.001)	<b>0.871***</b> (0.023)	-0.022*** (0.002)	-0.022*** (0.003)	-0.030*** (0.001)	-0.003 (0.003)	1.000*** (0.000)	2.6
<b>Beef</b>	-0.004** (0.001)	-0.105*** (0.002)	-0.016*** (0.001)	0.001 (0.002)	<b>0.868***</b> (0.025)	-0.044*** (0.003)	-0.034*** (0.001)	-0.016*** (0.004)	1.001*** (0.000)	2.4
<b>Pork</b>	-0.007*** (0.001)	-0.121*** (0.001)	-0.020*** (0.001)	0.025*** (0.002)	-0.022*** (0.002)	<b>0.458***</b> (0.015)	-0.032*** (0.001)	-0.055*** (0.003)	1.001*** (0.000)	3.4
<b>Chicken</b>	-0.023*** (0)	-0.102*** (0.001)	-0.031*** (0)	-0.026*** (0.001)	-0.024*** (0.001)	-0.030*** (0.001)	<b>-0.792***</b> (0.001)	-0.019*** (0.001)	1.000*** (0.000)	21.1
<b>Others</b>	0.000*** (0)	0.002*** (0)	-0.000*** (0)	-0.001*** (0)	-0.000*** (0)	0.000 (0)	0.000*** (0)	<b>-1.021***</b> (0)	1.000*** (0.000)	0.8

Figures in the parentheses indicate standard errors; \*\*\* and \*\* indicated significance at 1 and 5 % levels, respectively

**Table 3.** Price elasticity, cross price elasticity, expenditure elasticity and expenditure share of livestock products in urban households in India

Livestock Products	Eggs	Milk	Fish	Mutton	Beef	Pork	Chicken	Others	Expenditure Elasticity	Expenditure Shares
<b>Eggs</b>	<b>-0.883***</b> (0.001)	-0.212*** (0.001)	0.004*** (0)	0.038*** (0.001)	0.038*** (0.001)	0.062*** (0.001)	-0.021*** (0)	-0.057*** (0.001)	1.003*** (0.000)	18.3
<b>Milk</b>	-0.042*** (0)	<b>-0.807***</b> (0)	-0.079*** (0)	-0.103*** (0.001)	-0.083*** (0.001)	-0.112*** (0.001)	-0.063*** (0)	-0.002 (0.001)	0.998*** (0.000)	43
<b>Fish</b>	-0.003** (0.001)	-0.144*** (0.001)	<b>-0.646***</b> (0.003)	-0.029*** (0.001)	-0.042*** (0.002)	-0.050*** (0.002)	-0.047*** (0.001)	-0.023*** (0.002)	1.000*** (0.000)	11.4
<b>Mutton</b>	-0.001 (0.002)	-0.002 (0.004)	-0.029*** (0.002)	<b>0.428***</b> (0.019)	-0.033*** (0.003)	-0.037*** (0.004)	-0.034*** (0.001)	-0.002 (0.004)	0.999*** (0.000)	3.1
<b>Beef</b>	0.006** (0.002)	-0.091*** (0.004)	-0.015*** (0.002)	-0.011*** (0.003)	<b>1.171***</b> (0.043)	-0.058*** (0.005)	-0.038*** (0.002)	-0.016** (0.005)	1.000*** (0.000)	1.8
<b>Pork</b>	0.008*** (0.002)	-0.117*** (0.003)	-0.015*** (0.002)	0.021*** (0.002)	-0.037*** (0.003)	<b>1.030***</b> (0.030)	-0.033*** (0.001)	-0.057*** (0.004)	1.001*** (0.000)	2.4
<b>Chicken</b>	-0.017*** (0.001)	-0.109*** (0.001)	-0.032*** (0.001)	-0.030*** (0.001)	-0.025*** (0.001)	-0.023*** (0.001)	<b>-0.791***</b> (0.001)	-0.015*** (0.002)	1.000*** (0.000)	18.7
<b>Others</b>	0.000*** (0)	0.003*** (0)	-0.000*** (0)	-0.001*** (0)	-0.001*** (0)	-0.001*** (0)	0.000*** (0)	<b>-1.019***</b> (0)	1.000*** (0.000)	1.3

Figures in the parentheses indicate standard errors; \*\*\* and \*\* indicated significance at 1 and 5 % levels, respectively



The analysis of price elasticity shows that milk, eggs and chicken exhibit relatively inelastic demand, indicating that their demand decreases only slightly when prices rise. For example, the own-price elasticity of milk is -0.807, implying that a 1 % rise in price leads to a 0.81 % decrease in consumption. Similarly, eggs show an elasticity of -0.883. However, prior studies have noted that the demand for meats such as mutton and goat, as well as eggs, tends to be more elastic among urban consumers (23).

Cross-price elasticity estimates suggest that certain products, particularly eggs, pork and beef, serve as substitutes within the livestock consumption basket, adjusting more flexibly in response to price variations. Nevertheless, most livestock products-especially milk, chicken and fish-occupy distinct roles in urban diets and are not easily substitutable. These consumption patterns are deeply shaped by cultural norms, religious beliefs and regional dietary practices.

Overall, the findings highlight the strong preference of urban households for milk and eggs, where price changes are likely to exert the most influence on consumption behaviour. In contrast, beef and pork display unique demand characteristics, reflecting more specialized market segments. This may be attributed in part to the rapid growth of online meat delivery start-ups in India, particularly in Tier-I and Tier-II cities, which offer curated product selections tailored to consumer preferences and convenience.

Animal-source foods such as milk, meat and eggs provide vital nutrients-such as zinc, iron, calcium, vitamin A and vitamin B12- that are often deficient or less bioavailable in plant-based diets. These nutrients are essential for optimal growth and development, immune and cognitive function, memory and learning, thyroid health and overall well-being (24, 25).

Comparison between rural and urban households: The comparison between rural and urban households in livestock product consumption and price elasticities reveals distinct spending patterns and price sensitivities can be seen from Fig. 2. Rural households allocate a greater proportion of their livestock budget to chicken (21 %) and eggs (20.1 %), while urban households demonstrate a stronger preference for milk, which comprises 43 % of their expenditure. Additionally, rural households spend a higher share on fish (14.2 %) compared to their urban counterparts (11.4 %).

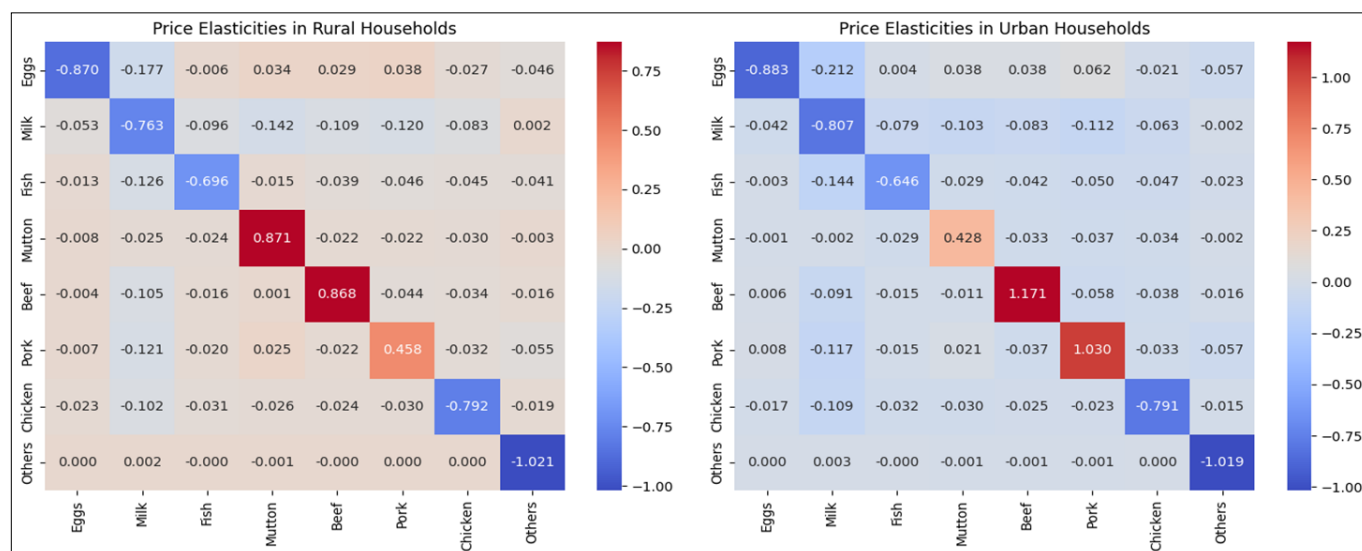
In terms of price elasticity, both rural and urban households exhibit relatively inelastic demand for milk and eggs, indicating that consumption declines only marginally with price increases. Urban households appear slightly more inelastic in their milk consumption (-0.807) than rural households (-0.763), reflecting a higher dependency on this staple product.

Cross-price elasticity estimates suggest minimal substitution among milk, eggs and chicken, reinforcing their roles as dietary staples. These findings illustrate a greater reliance on milk in urban areas, while rural households maintain a more diversified intake of livestock products, particularly chicken and eggs. Recognizing these distinctions is vital for policymakers and market stakeholders aiming to design effective strategies to ensure food security and maintain price stability.

### All India

An examination of livestock consumption patterns and price elasticities across Indian households reveals clear trends in expenditure and responsiveness to price changes. As presented in Table 4, milk is the most consumed livestock product nationwide, accounting for 38.45 % of total household livestock expenditure. This is followed by chicken (20.09 %) and eggs (19.34 %), underscoring their central role in Indian diets. Fish accounts for 13.12 % of spending, while mutton, beef and pork together represent a combined share of approximately 8 %. Fish remains particularly significant in coastal regions.

Price elasticity estimates show that milk (-0.782), eggs (-0.874) and chicken (-0.791) are relatively inelastic, indicating that price increases result in only minor reductions in consumption. This reflects the essential role these products play in meeting household protein needs. In contrast, fish demonstrates greater price sensitivity with an elasticity of -0.679. Interestingly, beef (0.957) and pork (0.631) display positive price elasticities, suggesting they function as less commonly consumed or niche goods, where higher prices may signal perceived quality or status, leading to increased demand.



**Fig. 2.** Comparative visualization of price elasticities of livestock products in rural and urban households in India.

**Table 4.** Price elasticity, cross price elasticity, expenditure elasticity and expenditure share of livestock products in rural and urban households in India

Livestock Products	Eggs	Milk	Fish	Mutton	Beef	Pork	Chicken	Others	Expenditure Elasticity	Expenditure Shares
<b>Eggs</b>	<b>-0.874***</b> (0.001)	-0.190*** (0)	-0.002*** (0)	0.035*** (0)	0.032*** (0.001)	0.046*** (0.001)	-0.025*** (0)	-0.051*** (0.001)	1.003*** (0.000)	19.3
<b>Milk</b>	-0.047*** (0)	<b>-0.782***</b> (0.001)	-0.088*** (0)	-0.123*** (0.001)	-0.098*** (0.001)	-0.116*** (0.001)	-0.074*** (0)	0.001 (0.001)	0.998*** (0.000)	38.5
<b>Fish</b>	-0.009*** (0.001)	-0.133*** (0.001)	<b>-0.679***</b> (0.001)	-0.019*** (0.001)	-0.039*** (0.001)	-0.047*** (0.001)	-0.045*** (0)	-0.037*** (0.001)	1.001*** (0.000)	13.1
<b>Mutton</b>	-0.007*** (0.001)	-0.017*** (0.002)	-0.026*** (0.001)	<b>0.661***</b> (0.015)	-0.027*** (0.002)	-0.028*** (0.002)	-0.033*** (0.001)	-0.002 (0.002)	0.999*** (0.000)	2.8
<b>Beef</b>	-0.001 (0.001)	-0.105*** (0.002)	-0.015*** (0.001)	-0.002 (0.002)	<b>0.957***</b> (0.022)	-0.048*** (0.003)	-0.035*** (0.001)	-0.016*** (0.003)	1.001*** (0.000)	2.2
<b>Pork</b>	-0.002* (0.001)	-0.123*** (0.001)	-0.017*** (0.001)	0.025*** (0.001)	-0.026*** (0.002)	<b>0.631***</b> (0.014)	-0.032*** (0.001)	-0.057*** (0.002)	1.002*** (0.000)	2.9
<b>Chicken</b>	-0.023*** (0)	-0.107*** (0.001)	-0.032*** (0)	-0.028*** (0.001)	-0.025*** (0.001)	-0.028*** (0.001)	<b>-0.791***</b> (0.001)	-0.018*** (0.001)	1.000*** (0.000)	20.1
<b>Others</b>	0.000*** (0)	0.002*** (0)	-0.000*** (0)	-0.001*** (0)	-0.001*** (0)	-0.000*** (0)	0.000*** (0)	<b>-1.020***</b> (0)	1.000*** (0.000)	1.1

Figures in the parentheses indicate standard errors; \*\*\* and \*\* indicated significance at 1 and 5 % levels, respectively

Cross-price elasticity results further reveal that eggs may act as substitutes for mutton, beef and pork, as indicated by their positive substitution effects. Similarly, pork and mutton show mild substitutability. However, the majority of livestock products-particularly milk, chicken and fish-exhibit strong negative cross-price elasticities with other products, indicating limited substitutability. This reflects the distinct and culturally embedded dietary preferences across Indian households.

## Conclusion

The analysis of consumption patterns and price elasticities for livestock products across India offers valuable insights into the dietary preferences and economic behaviours of households. In both rural and urban settings, milk, eggs and chicken dominate the household expenditures on livestock products, highlighting their staple role in the Indian diets. These products exhibit inelastic demand, indicating that their consumption remains relatively stable despite changes in price. This highlights their essential nature and reflects India's evolving dietary trends, which increasingly emphasize nutrition and protein intake. Additionally, the declining need for draught animals-attributable to the growing mechanization of the agricultural sector-has further shifted the focus toward livestock primarily for food rather than labour purposes.

While fish holds a smaller share of household budgets and shows more price sensitivity, especially in rural areas, it remains an important source of protein, particularly in coastal regions. Beef, mutton and pork account for a smaller portion of total livestock spending and their demand patterns showing positive or near-inelastic responses to price changes indicate these goods are consumed by specific segments of the population.

Moreover, the low cross-price elasticities among major livestock products suggest limited substitutability. This suggests that households view items such as milk, chicken and eggs as fulfilling distinct nutritional functions, thereby reducing the likelihood of substitution even when relative prices fluctuate.

Overall, this study provides a comprehensive understanding of the consumption behaviour of livestock product in India. It highlights the central role of certain protein-rich staples and identifies varying levels of price sensitivity across different products. These findings serve as a crucial foundation for policymakers and market stakeholders in designing targeted interventions and strategies aimed at stabilizing food prices, improving protein accessibility and addressing regional disparities in consumption. As demand for livestock products continues to rise-driven by increasing incomes and changing lifestyles-such insights will be pivotal in shaping future food security and nutrition policies.

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## Authors' contributions

GSR was responsible for designing the study, collection of articles, developing the protocol and drafting the initial manuscript. RM contributed and revised the manuscript. MA read and approved the final manuscript.

## Compliance with ethical standards

**Conflict of interest:** There is no conflict of interest between the authors.

**Ethical issues:** None

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