# TRADE DIRECTIONS OF INDIAN BUFFALO MEAT EXPORTS
# AND ITS PROFITABILITY IN PUNJAB

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## ABSTRACT

India is the habitat of about 55% of the world's buffalo populace. However, the current production and marketing structure of buffalo meat for the indigenous and international market is endowed with multitudinous challenges. At present, there is an elevation in demand for Indian buffalo meat in the global market, especially when processing units in Brazil and Argentina continued to be closed due to the outbreak of the Covid 19. Keeping this in mind, knowledge regarding the performance of Indian buffalo meat export and identification of its profitability is required. The study examined the cost-return pattern in Punjab state. Further, it examined the pattern of trade, fluctuating directions of the buffalo meat trade in India by Markov Chain Analysis, and projected exports of Indian Buffalo meat till 2023 to 2024. The Transitional Probability Matrix found that Indonesia, Malaysia, and Vietnam were the most consistent and trustworthy markets for Indian Buffalo meat, with probability retention of 81.06, 79.58, and 74.75%, respectively. Saudi Arab would be considered an unstable importer. The projections of Buffalo meat export up to 2023 to 2024 showed an increase in Vietnam's export share. There is a need to popularise and commercialise the buffalo male calf rearing business in rural areas, especially in Punjab. Further, linking these farms to meat processing plants is also crucial. Pertinent inspection of the quality of buffalo meat to meet international market standards is a pressing priority to grab additional share in the global market.

## INTRODUCTION

India at present is home to about more than half of the world's buffalo population. India, along with Pakistan, constitutes about 3/4th of the world's buffalo population. It grew from 89.91 million in 1997 to 109.85 million in 2019. But still, Indian dairy products had a lack of export competitiveness

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in the world market (Rakotoarisoa and Gulati, 2006). Buffalo milk constitutes about 49% of the total milk production in India. Besides the major contribution to the national milk pool by buffaloes, its meat provides plenty of opportunities for income and employment generation, particularly in rural areas.

In 1991 the launch of a new economic policy triggered liberalization and integration with the world economy for widening marketing opportunities for the Indian agriculture sector. To expand the exports of the nation's agricultural products, multiple trade discussions, the rising demand for animal products on the global market, and national reforms were all undertaken. The meat of buffalo, whose local demand is low, emerged as a significant livestock commodity in the export basket of national agricultural products. Due to less domestic consumption, the export of buffalo meat by India is about 81.6% of its buffalo meat production to the world (Kandanuri, 2019).

The meat of buffalo is a prospective source of revenue for dairy farmers. About 1152.5 thousand tons of buffalo meat worth Rs 22668.5 crore were exported from 2019 to 2020 from India. There is a lot of demand for bovine meat in other countries. It not only increased the volume and value but also increased the unit price of recognition of an exported product, which indicates its rising acceptability in the importing nations (Kumar *et al*., 2012). India exports 3.05% of bovine meat by value and ranks 12th in the world bovine meat export in 2018. Major importers of buffalo meat are USA, Japan , and China. Presently, India does not import bovine meat.

In the dairy farming system, buffalo are suited to the local climatic conditions and are resistant to a number of parasites and illnesses. Buffalo is the future diary animal of India. It is also known as black gold on account of its importance from a milk and meat point of view. There is no difficulty for stray animals in the case of buffaloes as their slaughtering is permitted in India. Old and unproductive animals are sold for slaughter, giving dairy farmers a substantial income. In India, nearly 37.8 million numbers of farmers rear buffalo only for milk purposes. The male calves are not reared for particular meat purposes. If they reared, it could become a profitable standalone business for farmers. A farmer might begin the business of raising male calves by buying male calves that are between two and three months old from other farmers in the region. Increasing the production of buffalo meat in this way leads to earning more foreign exchange for the country.

There is a dire need of chalking out the buffalo meat trade directions and its future potential so that the government can frame suitable policies for streamlining and accelerating the buffalo meat export, particularly now when there is an elevation in demand for Indian buffalo meat in the global market, especially when several processing units in Brazil and Argentina continued to be closed due the outbreak of the Covid 19. The present paper attempts to study the buffalo meat profitability, trade directions, and future prospects so that suitable remedial measures can be adopted well in advance to raise the Indian export share in the global market.

## MATERIALS AND METHODS

The study is based on secondary data regarding the population of buffalo animals, meat production, spices-wise meat production and its export from India. Data pertaining to these heads was obtained for a different time period collected

from secondary sources such as the online portal of export data (APEDA) and others heads from Indian.stat.com. Yearly export statistics for the period of 2010-2011 to 2018-2019 are used to analyze the changing pattern of Indian buffalo meat export using gauss Markov chain analysis.

**Markov chain analysis**

To estimate the trade direction i.e, the direction which is followed for export practices of Indian buffalo meat, the Gauss Makrov Chain analysis with first order has been used (Bansal *et al*., 2020). The transitional probability matrix 'P$_{ij}$' has been used, which indicates the probability that the export share of a country will switch from i$^{th}$ country to j$^{th}$ country over a period of time. The matrix explains the retention of export contributions to different countries. In which diagonal element indicates the loyalality and stability of an importing country to specific country's export and off-diagonal element depicted the probability of shift of export share of a specific country to other countries over the time. In the present study, six major importing countries of Indian buffalo meat for the period of 2010-2011 to 2018-2019 has been taken. The algebraical expression is as follows

$$E_{jt} = \sum_{i=1}^{s} E_{it-1} * P_{ij} + \mu_{jt}$$

Where; $E_{jt}$ = export from India to j$^{th}$ country for year 't'

$E_{it-1}$ = export from India to i$^{th}$ country for year 't-1'

$P_{ij}$ = probability of shift of export from i$^{th}$ country to j$^{th}$ country

$\mu_{jt}$ = random error term

t = number of year considered for study

s = number of importing countries.

The transitional probabilities ($P_{ij}$) can be arranged in (c*r) matrix which depicted the export data got multiplied with the previous period 't-1' data to get expected export share of each country for period 't'.

$$\sum_{j=1}^{r} P_{ij} = 1$$

**Computation of $P_{ij}$**

The minimization of Mean Absolute Deviation method are used for calculating the transitional probability which has minimized the total absolute deviation. (Gohain *et al*., 2022). The conventional linear programming technique are used to satisfy the properties of transitional probabilities of non-negativity restrictions and row sum constraints in the calculation. The linear programming equation are as follow:

Min OP* + Ie

Subject to,

XP* + V = Y

GP* = 1

P*e ≥ 0

Where; O is the vector of zero,

I as an appropriate dimensioned vector of area,

e is the vector of absolute error,

Y is the proportion of export to each country,

X is a block diagonal matrix of the lagged value of Y,

V is the vector of random term,

G is the grouping matrix to add row elements of P as arranged in P* to unity.

**Forecasting of export scenario**

For forecasting the future value of Indian

buffalo meat's export share with other countries, transitional probability matrix are used. (Chavan *et al*., 2023)

$$Y_{jt} = \sum_{i=1}^{r} Y_{it-1} * P_{ij}$$

Where $Y_{it}$ is the forecast proportions of jth country's share during 't' year. is the experimental proportion of ith country share during 't-1' year and is the estimated value of probability matrix.

## RESULTS AND DISCUSSIONS

### Trend of buffalo population in India

The trend of the buffalo population in India is presented in Table 1. The results brought out that the buffalo population is increasing with the passage of time. It increased from 89.91 million during 1997 to 109.85 million in 2019. The number of female buffaloes increased by 25.67% during 1997 to 2019 whereas that of males has declined by 48.13% during the same period. The probable reason for the decline in a number of males is that farmers do not prefer to rear male calves, which otherwise can be a good source of income if reared scientifically for meat purposes exclusively.

### Meat production

India has a competitive advantage in the production of several livestock products (Kumar *et al*., 2001; 2007; Birthal and Taneja, 2006). As shown in Figure 1, meat production had increased from 1.9 million tonnes during 1998 to 1999 to 8.1 million tonnes during 2018 to 2019. There was a remarkable increase in meat production after 2005 to 2006. Species-wise, next to poultry meat (50.06%), buffalo meat ranks second, contributing

19.05% to Indian total meat production (Table 2). The consumption of buffalo meat is meager in India and major proportion of the buffalo meat is exported to other countries. There is plenty of room to increase buffalo meat production and take advantage of its export potential.

### Punjab model for the rearing a male buffalo calf

In Punjab, there are about 28 lakh breedable buffaloes, of which 18.67 lakh calves have 67% of breeding efficiency. After a 10% mortality rate, 8.40 lakh male calves were predicted to survive, assuming a 50:50 male: female ratio. According to Singh and Kaur (2018) study, about 8400 units in Punjab with 100 male calves each are offered a supplementary 2.31 lakh tonne meat in a year with a value of Rs. 2310 crore. Apart from that it also helps to generate self-employment opportunities for 8400 people and employment to 16800 labour. Also, it was observed that these male calves can grow nearly 300 kg as average live body weight at the age of 15 m. The male calf rearing unit of calf-size 100 with the initial investment of Rs 1.25 lakh are depicted in Table 3. The variable cost for one year rearing 100 male calves was relatively higher with a value of Rs 16.49 lakh compared to the fixed cost, i.e., Rs 1.78 lakh. For one year, it will cost Rs. 18.27 lakh to raise 100 male calves. The return structure showed that the share of returns from sales for meat purposes was relatively higher than the share of return in terms of use as farm manure. The benefit-cost ratio, i.e., 1.29, annual net return after deducting all costs and monthly income, i.e., Rs 13,750, is pretty high, indicating that rearing male calves is secure and economically viable business opportunity. The discussion concluded that rearing male buffalo calves exclusively for meat purposes is a remunerative business. Enhancing the country's buffalo meat production by adopting
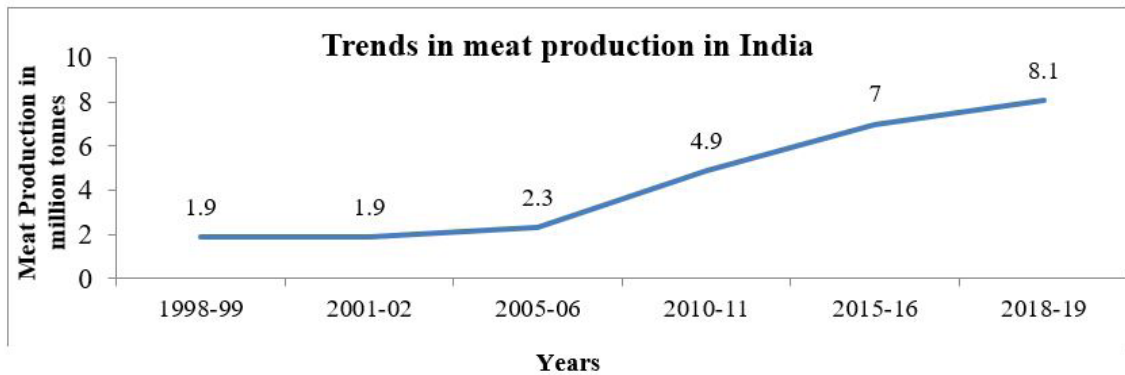
Figure 1. Trends in meat production in India during 1998-1999 to 2018-2019. Source: Govt of India (2019).

Table 1. Trends of buffalo population in India, 1997-2019 (In million).

| Year | 1997 | 2007 | 2012 | 2019 | Percent change 1997-2019 |
|------|------|------|------|------|--------------------------|
| Total buffalo | 89.91 | 105.34 | 108.70 | 109.85 | 22.18 |
| Males | 17.89 (18.28) | 19.60 (18.61) | 16.10 (14.82) | 9.28 (8.50) | -48.13 |
| Female | 80.03 (81.72) | 85.74 (81.39) | 92.60 (85.18) | 100.57(91.5) | 25.67 |

Source: Govt of India (2019).

Table 2. Species-wise meat production in India, 2018-19 (000 tonnes).

| Sr. No. | Category | Meat Production | Proportion |
|---------|----------|-----------------|------------|
| 1 | Buffalo | 1545.83 | 19.05 |
| 2 | Cattle | 326.48 | 4.02 |
| 3 | Goat | 1097.91 | 13.53 |
| 4 | Sheep | 677.99 | 8.36 |
| 5 | Pig | 404.46 | 4.98 |
| 6 | Poultry | 4061.79 | 50.06 |
| Total | | 8114.46 | 100.00 |

Source: Govt of India (2019).

Table 3. Punjabi male buffalo calf-rearing model.

| Sr. No. | Bifferication of cost and return | Value (Rs lakh) |
|---|---|---|
| I | Capital investment | 12.50 |
| II | Fixed cost | 1.78 |
| III | Operating cost | 16.49 |
|  | Total Cost (B+C) | 18.27 |
| IV | Returns |  |
| 1 | Via sale of calves | 22.50 |
| 2 | Via FYM | 1.02 |
| 3 | Gross returns | 23.52 |
| 4 | Net returns | 5.24 |
| 5 | Net returns (per month) | 0.43 |
| 6 | Benefit-Cost Ratio | 1.29 |

Source: Kaur and Singh (2019).

Table 4. Transitional probability matrix of buffalo meat in India (2010-2011 to 2018-2019).

| Country | Vietnam | Malaysia | Egypt | Indonesia | Iraq | Saudi Arab | Others |
|---|---|---|---|---|---|---|---|
| Vietnam | 0.8106 | 0.0599 | 0.0604 | 0.0027 | 0.0416 | 0.0126 | 0.0122 |
| Malaysia | 0.0000 | 0.7475 | 0.1479 | 0.0000 | 0.1046 | 0.0000 | 0.0000 |
| Egypt | 0.9532 | 0.0000 | 0.0468 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Indonesia | 0.0000 | 0.0000 | 0.0000 | 0.7958 | 0.1694 | 0.0000 | 0.0348 |
| Iraq | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0583 | 0.0000 | 0.9417 |
| Saudi Arab | 0.7344 | 0.0000 | 0.2656 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Others | 0.0000 | 0.0000 | 0.0606 | 0.0000 | 0.0000 | 0.1340 | 0.8053 |

Source: Authors' calculations.

this enterprise can go a long way in tapping the export potential of buffalo meat.

**Trade direction of buffalo meat exports**

The direction of Indian buffalo meat export's trade to various destinations was studied by calculating using Gauss Markov chain analysis. The transitional probability matrix is presented in Table 4. The major importing countries namely Indonesia, Saudi Arab, Vietnam, Egypt, Iraq, Malaysia, with rest of importers being categorized as others.

Results depicted a retention level of 81.06% in the current period of Vietnam market. India's previous buffalo meat to Vietnam market was retained at the level of 81.06% during the current period. Rest 19% was diverted to other countries. Among the major importers of Indian buffalo meat, Vietnam is considered as the most stable and loyal partner. Others countries also showed

higher probability of 80.53% over the study period. Indonesia and Malaysia retained their export share to the tune of 79.58 and 74.75%, respectively. Iraq and Eqypt had retained only 5.83 and 4.68% of its original share. Thus Vietnam, Malaysia, and Indonesia were the most reliable and loyal markets for Indian buffalo meat.

Vietnam lost 6.04% to Egypt and 5.99% to Malaysia whereas it gained 95.32% of Egypt 's share and 73.44 of Saudi Arab's share. Others gained 94.17 from Iraq and 3.48 from Indonesia and they lost 13.40 to Saudi Arab and 6.06 to Egypt. Malaysia lost to the tune of 14.79 to Egypt, 10.46 to Iraq, whereas it gained 5.99 from Vietnam. Indonesia lost 16.94% share to Iraq and 3.48% to rest of the countries, whereas it gained from 0.27% from Vietnam. With regard to other countries, it lost 6.06% to Egypt and 13.40% to Saudi Arab, whereas it gained from 94.17% of Iraq' s share, 3.48% of Indonesia's share and 1.22% of Vietnam. Hence, the results show that Vietnam, Indonesia and Malaysia were the most stable importer of Indian buffalo meat with probability retention of 81.06, 79.58 and 74.75%, respectively. Saudi Arab would be considered as unstable importer as they could not retain their original share.

**Projection of buffalo meat from India**

The share of export of Indian buffalo meat to different nations is calculated by a transitional probability matrix. The forthcoming shares of Indian buffalo meat in the world's market to the major importing nations are projected till 2022 to 2023. Scrutiny at the actual and predicted stake of buffalo meat exported to diverse nations throughout the study period discloses that the perceived proportions of export proportions were inconsistent with the expected share of exports derivative from the Markov Chain process.

It is discerned from Table 5 that the actual share of Vietnam buffalo meat's exports had shown fluctuation over the period (2010-2011 to 2018-2019) but it has increased from 14.76 to 33.44%. A similar scenario was noticed in predicted export share, where export share increase from 29.25 to 43.79%. The projected exports of buffalo meat crops to importing countries upto 2022 to 2023 are shown in Table 6, suggesting an increase from 43.79 to 47.79%. Indonesia's actual and projected export share exhibited an increasing trend from 0 to 7.30% and 0.04 to 7.30%, respectively. But the estimation for 2022 to 2023 also suggested a decreasing trend from 7.30 to 3.29%. Further, the actual share of Malaysia had shown more or less the same trend over the period. While the estimation from 2022 to 2023 suggested a negligible increase from 10.51 to 10.66% Both Egypt's actual and anticipated export share showed a tendency towards decline. i.e. from 12.21 to 10.48%, while the expected proportion similarly showed a tendency of decline from 8.41 to 6.711%. But the estimation for 2022 to 2023 proposed an increase from 6.71 to 7.17%. The actual and predicted export of Iraq showed an increasing trend. The actual percentage rose from 2.49 to 5.33%, and the projected share of Indian exports to Iraq increased from 2.07 to 4.85%. The estimation of 2022 to 2023 suggested a decreasing trend from 4.85 to 3.94%. With regard to the other nations, Both the actual and predicted exports declined during the course of the study period. The predicted percentage of India's export share to other countries suggested an increase from 23.26 to 240.7%, whereas the actual share declined from 50.32 to 27.77%. India has the ability to enhance its exports of buffalo meat by gaining access to markets of more developed nations and adopting rigorous adherence to sanitary regulations during the production stage. (Kaur *et al.*, 2021).

Table 5. Actual and estimated values of Buffalo meat export from India for the period from 2010-2011 to 2018-2019 (in 000' US $).

| Countries Years | Vietnam | | Malaysia | | Egypt | | Indonesia | | Iraq | | Saudi Arab | | others | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | E | A | E | A | E | A | E | A | E | A | E | A | E |
| 2010-2011 | 280 (14.76) | | 237 (12.53) | | 231 (12.21) | | 0 (0.00) | | 47 (2.49) | | 146 (7.69) | | 954 (50.32) | |
| 2011-2012 | 831 (29.25) | 554 (29.25) | 291 (10.25) | 194 (10.25) | 239 (8.41) | 159 (8.41) | 0 (0.00) | 1 (0.04) | 60 (2.12) | 39 (2.07) | 197 (6.93) | 131 (6.93) | 1224 (43.05) | 816 |
| 2012-2013 | 944 (29.48) | 1046 (36.81) | 357 (11.17) | 268 (9.41) | 231 (7.20) | 231 (8.13) | 2 (0.08) | 2 (0.08) | 65 (2.03) | 69 (2.41) | 216 (6.73) | 174 (6.14) | 1387 (43.32) | 1052 (37.02) |
| 2013-2014 | 1796 (41.27) | 1143 (35.71) | 389 (8.93) | 324 (10.11) | 338 (7.77) | 262 (8.18) | 0 (0.00) | 4 (0.14) | 87 (2.00) | 81 (2.53) | 247 (5.68) | 198 (6.18) | 1494 (34.34) | 1189 (37.16) |
| 2014-2015 | 2153 (45.03) | 1959 (45.04) | 423 (8.85) | 398 (9.15) | 422 (8.83) | 338 (7.77) | 0 (0.00) | 5 (0.11) | 66 (1.39) | 120 (2.77) | 259 (5.42) | 223 (5.12) | 1458 (30.48) | 1307 (30.04) |
| 2015-2016 | 1993 (48.98) | 2338 (48.90) | 410 (10.08) | 445 (9.31) | 358 (8.79) | 370 (7.73) | 2 (0.06) | 6 (0.13) | 117 (2.88) | 138 (2.88) | 216 (5.31) | 222 (4.65) | 972 (23.90) | 1263 (26.41) |
| 2016-2017 | 2040 (51.98) | 2115 (51.98) | 356 (9.07) | 426 (10.47) | 303 (7.72) | 314 (7.72) | 230 (5.86) | 7 (0.18) | 128 (3.27) | 133 (3.27) | 150 (3.82) | 155 (3.82) | 717 (18.28) | 918 (22.56) |
| 2017-2018 | 2283 (56.66) | 2053 (52.30) | 371 (9.20) | 388 (9.89) | 256 (6.34) | 273 (6.97) | 96 (2.37) | 188 (4.80) | 156 (3.87) | 169 (4.29) | 118 (2.92) | 122 (3.10) | 751 (18.64) | 732 (18.64) |
| 2018-2019 | 1698 (47.33) | 2181 (54.12) | 369 (10.27) | 414 (10.27) | 117 (3.27) | 281 (6.99) | 323 (9.01) | 82 (2.04) | 170 (4.75) | 159 (3.95) | 112 (3.14) | 129 (3.21) | 797 (22.22) | 783 (19.43) |
| 2019-2020 | 1070 (33.44) | 1571 (43.79) | 379 (11.83) | 377 (10.51) | 335 (10.48) | 241 (6.71) | 234 (7.30) | 262 (7.30) | 170 (5.33) | 174 (4.85) | 123 (3.85) | 128 (3.57) | 889 (27.77) | 834 (23.26) |

Figure in parentheses indicate the percentage to total export from India. Source: Authors' calculations.

**Conclusion and policy implications**

Buffalo meat is known for its nutritional value and is in high demand in many countries worldwide. It is a rich source of protein, minerals, and vitamins, making it a popular choice among health-conscious consumers. The rising disposable income, growing population, and changing food habits of consumers have also contributed to the increasing demand for buffalo meat in the global market.

The results of the present study show that the prospects of buffalo meat exports in Punjab, India, are promising. With the net annual return from the buffalo male calf rearing of about Rs 5.25 lakh, i.e. about Rs 43,750 per month and the benefit-cost ratio calculated was 1.29 which is pretty highly recommends that the trading of the male calf is economically viable and profitable business opportunity in near future for trading with other countries. The state has the necessary infrastructure, transportation facilities, and government support to promote the meat industry.

Consequently, buffalo meat exports can be one fine tool in doubling farmers' income if promoted by concerned authorities with a long-term view. However, given that the quantity has significantly impacted the value of buffalo meat exports, there is a need to boost buffalo meat production and guarantee a steady supply of raw materials to the meat processing industry. So besides UP and AP , Punjab can be another promising market to export meat.

A stable market destination is a necessary condition for steady exports; therefore, the present study scrutinized the prospects in detail. This study beheld Indian buffalo meat exports for eight years, from 2010-2011 to 2018-2019, to determine its probabilistic trade direction and export pattern.

The result of the transitional probability matrix showed that Vietnam, Indonesia, and Malaysia were the most reliable and loyal markets for Indian buffalo meat with probability retention of 81.06, 79.58, and 74.75%, respectively. Saudi Arab would be considered as unstable importers as they could not retain their original share. The future market shares of Indian buffalo meat to major importing countries projected up to 2023 to 2024 showed an increase in export share in Vietnam and a negligible increase in Malaysia and other countries. India is a profitable market for exporting

Table 6. Forecasting value of Indian buffalo meat (Rs. Crore).

| Year | Vietnam | Malaysia | Egypt | Indonesia | Iraq | Saudi Arab | others |
|---|---|---|---|---|---|---|---|
| 2020-2021 | 1597 (44.53) | 376 (10.48) | 247 (6.87) | 213 (5.93) | 159 (4.44) | 132 (3.67) | 864 (24.09) |
| 2021-2022 | 1626 (45.33) | 377 (10.50) | 251 (7.00) | 174 (4.84) | 151 (4.21) | 136 (3.79) | 873 (24.33) |
| 2022-2023 | 1657 (46.19) | 379 (10.56) | 255 (7.10) | 143 (3.98) | 145 (4.05) | 137 (3.83) | 871 (24.28) |
| 2023-2024 | 1687 (47.03) | 382 (10.66) | 257 (7.17) | 118 (3.29) | 141 (3.94) | 138 (3.84) | 864 (24.07) |

Source: Authors' calculations.

buffalo meat, and its long-term sustainability of it seemed feasible.

Hence, rearing male buffalo calves exclusively for meat is a remunerative business, especially in Punjab where we urgently need a mixed farming approach. The country's buffalo meat production can be enhanced by adopting this enterprise which can go a long way in tapping the export potential of buffalo meat. The need to popularize and commercialize the buffalo male calf rearing business in rural areas, especially in Punjab, is suggested. Further, linking these farms to meat processing plants is also crucial which can be easily done with the support of government export promotion policies.

In 2020 there is a boost in demand for Indian buffalo meat in the global market, especially when a number of processing units in Brazil and Argentina continued to be closed due to the outbreak of the Covid 19. This allowed India to sell male calves' meat to these nations, which are experiencing a shortage of buffalo meat production and wanted to import it to meet their own demand. However, India lacks access to the high-paying markets in advanced nations like USA, EU, Japan, etc. due to their rigorous food safety and quality standards (Non-Tarif Barriers). Thus, a pertinent inspection of the quality of buffalo meat to meet international market standards is a pressing priority to grab additional share in the global market. India should make a comprehensive effort to tap the potential of this sector to grasp a bigger chunk of the global market.

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