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POLICY ARTICLE

Meat Processing in India: Science, Technology, Policy and Skill Development Issues

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Abstract

In 2015, India retained its top position as the world's largest exporter of buffalo meat. Indian buffalo meat is witnessing a strong demand internationally due to its organic nature and lean character. Also, India has a cost advantage as Indian buffalo meat is one of the most competitively priced red meat in the world. Some of the challenges faced by the meat industry are lack of scientific approach to rearing of meat animals, lack of good and nutritious fodder resulting in low quality meat and unorganized nature of meat production and marketing. Therefore, the next phase of active reforms in the buffalo meat industry for the domestic market should consider modernization of existing abattoirs, strengthening of the livestock market, utilization of byproducts, an efficient disease diagnostic and monitoring system, amendments to the Meat Export Policy and developing a state-wise market intelligence system for the livestock sector, which can assist in realistic planning at all levels. Robust Science and Technology policy and skilled manpower for the sector would also provide a boost to the sector.

Keywords: Meat processing, Science and technology issues, Skill development, Policy issues.

1. Introduction

India has one of the largest livestock population in the world. It accounts for around 58% of the world buffalo population and 14.7% of the cattle population. Frozen bovine meat constitutes the single largest meat item exported from India (Suresh *et al.*, 2012). An important role is played by India's large resource of livestock and poultry in improving the socio-economic conditions of the rural people. Livestock sector reduces the seasonality in livelihood patterns especially for the rural poor and generates a continuous stream of employment and income (Birthal and Ali, 2005). Indian buffalo meat binds easily with ingredients and retains more moisture and is thus ideal for processing. Many of the major Islamic countries import Indian meat as it is genuinely halal, nutritious, lean and healthier than beef. There is a strong demand for Indian buffalo meat in international markets due to its organic nature and lean character. Indian meat also has a cost advantage since it's very competitively priced and is hence gaining popularity in global markets (Kondaiah, 2015). Thus, India's meat sector shows a vast scope for development and with the introduction of better technology can remain as the top exporter of carabeef for many years to come.

Most of India's buffalo meat exports goes to Asian countries (around 80%) as shown by data from Centre for Monitoring Indian Economy (CMIE). India is the fifth largest meat producer in the world at around 6.3 million tonnes which accounts for 3% of world meat production (220 million tonnes). Vietnam is the largest importer within Asia, comprising 45% of India's meat export. Fig 1 shows graph of the quantity of buffalo meat exported from India to top 10 countries.

Domestic beef consumption has fallen by 44.5% in 2014 from the level it was in 2000. Irrespective of the political party in power this fall in consumption has been taking place. Per capita meat consumption in India is around 5 kg, compared to the global average of 47 kg. A large part of the Indian population is vegetarian whether by choice or due to religious reasons. The monthly per capita consumption of buffalo meat in rural and urban areas state wise in 2011-12 is given in Fig 2.

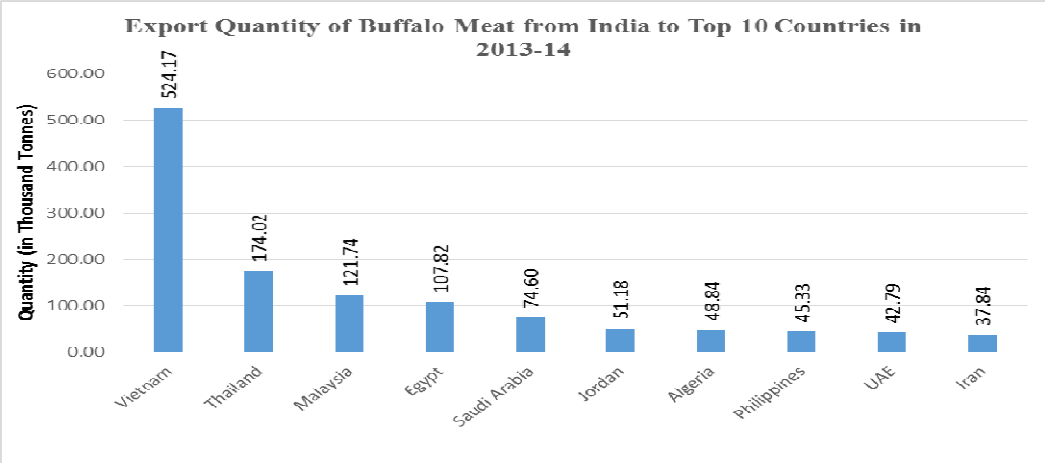

Fig 1: Export Quantity of Buffalo Meat from India to Top 10 countries in 2013-14
(*Source: GOI, APEDA, Accessed on 7 March, 2016 from http://agriexchange.apeda.gov.in)*

Meat imports in India are meager and only highly processed meat products are imported in the country. These trends are not because of any restrictive policy but because a large portion of meat consumers are very particular about the process followed for meat production i.e. halal (Ali, 2007). According to the US Department of Agriculture, in 2015, India retained its top position as the world's largest exporter of buffalo meat. The largest meat producing state is Uttar Pradesh (11.37 lakh tonnes), followed by Andhra Pradesh (9.06 lakh tonnes) and West Bengal (6.48 lakh tonnes). Fig 3 shows the average buffalo meat production in different states during the period 2011-12 to 2013-14. There has been a boost in the meat industry due to the governmental support. The government has started a scheme to establish new abattoirs or modernize existing ones with a grant of up to Rs.15 crore. Indian meat is cheaper than Brazilian meat and is hence gaining popularity in global markets. Thus, the future of buffalo meat and meat products in India is promising both in the domestic and international markets (Murty and Devadason, 2003).

There are around 4000 slaughter houses and 33 modern abattoirs. All 33 abattoirs are 100% export oriented units and are registered with the Agricultural and Processed Food Export Development Authority (APEDA). The safety specifications given by the Meat and Meat Product Order of 1973 which is issued by the Directorate of Marketing and Inspection, Government of India, are followed by almost all the export oriented plants. Along with this, the measures which are recommended in Codex Alimentarius are also implemented (Guleria *et al.*, 2015).

New markets have been opening up for India even in developed western countries. The main importers of Indian meat until a few years back were Southeast Asia, Africa and Middle East. In 2013, India and China signed a MoU (Memorandum of Understanding), over China providing market access to Indian meat. Recently, 4 meat processing plants in India have been approved to export carabeef to Russia, according to Russia's Federal Service for Veterinary and Phytosanitary Surveillance website.

2. Methodology

We reviewed the relevant literature and analyzed the secondary data available on meat processing sector. The data sources are from National Sample Survey Organisation (NSSO) report on Household Consumption of Various Goods and Services in India, 2011-12 (68th round), Agriexchange portal of Agricultural and Processed Food Products Export Development Authority (APEDA) and Ministry of Agriculture report- Basic Animal Husbandry and Fishery Statistics 2014. The other reports which were consulted are Federation of Indian Chamber of Commerce and Industry (FICCI), Agriculture Division report- Overview of Indian buffalo meat value chain and National Skill Development Corporation (NSDC) report Human Resource and Skill Requirements in the Food Processing Sector (2022) - A report.

3. Science and Technology Issues in Meat Processing

India has around 4000 slaughter houses and 33 modern abattoirs. Many of them lack necessary facilities such as water, drainage, light, holding pens etc. Many of these slaughter houses are quite old and have out-lived their utility. As a result, it became essential for the government to modernize and improve

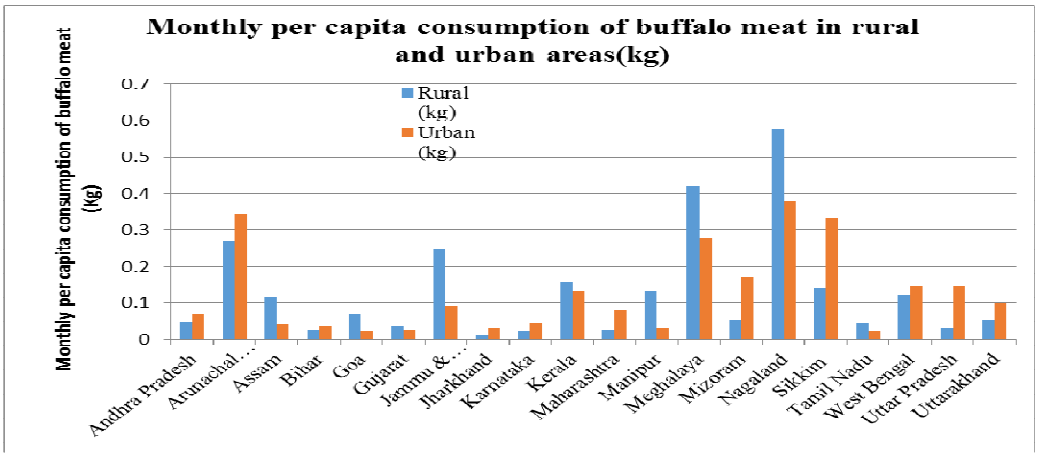

Fig 2: Monthly Per Capita Consumption of Buffalo Meat in Rural and Urban Areas State Wise, 2011-12
(Source: NSS Report No. 558: Household Consumption of Various Goods and Services in India, 2011-12, Accessed on 17 March, 2016)

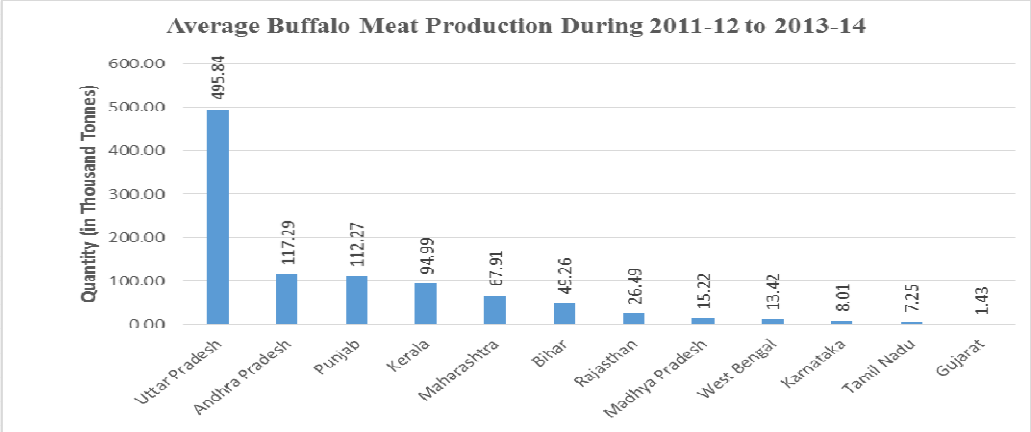

Fig 3: Average Buffalo Meat Production in Different States from 2011-12 to 2013-14
Source: GOI, 2014, Accessed on 7 March, 2016 from http://dahd.nic.in)

the conditions of the slaughter houses. Keeping this in view, the APEDA, Ministry of Agriculture, Department of Animal Husbandry and Dairying and Ministry of Food Processing Industries formulated some schemes. Under these schemes, financial assistance is being provided for the upgrading of the meat processing plants and abattoirs. At present, there are only about 60 abattoirs cum buffalo meat processing plants approved by APEDA in India with Uttar Pradesh having the most abattoirs at 37 followed by Maharashtra. Majority of the slaughterhouses and meat processing plants are unapproved and have outdated facilities. Though the State Directorates of Animal Husbandry, End Implementing Agencies (EIAs) and Directorate of Marketing and Inspection (DMI) are responsible for inspection of meat prior to export, usually it's the State Animal Husbandry Departments that carry out the inspection of meat. Unfortunately, the state government laboratories are not sufficiently equipped and there is a lack of skilled staff for conducting the various examinations of meat. It has become necessary that these laboratories be further fortified in terms of skilled manpower and modern testing facilities.

Buffaloes are mainly reared in India for milk production and usually slaughtered when they became uneconomical for draught purpose or milk production (Naveena *et al.*, 2011; Kandeepan *et al.*, 2013; Mane and Chatli, 2015). There is a lack of scientific breeding and vaccination of the animals. Male Buffalo Calves fatten more quickly when they are reared using a scientific approach (Mendiratta and Kondaiah, 2015). It's also important that nutritious and good quality fodder be provided to obtain the best quality meat (Abdolghafour and Saghir, 2014). Inadequate infrastructure is one of the major obstacles hindering -

Table 1: Science and Technology aspects in meat processing in India

Item	Status
Feed management	Nutrient minerals like sodium, calcium, potassium, iron, copper etc. are very important for the nourishment of buffaloes. They help to improve the quality of buffalo and prevent diseases. These should be present in hay, silage and fodder in correct proportion for maximum productivity. At least 15 kg of fodder needs to be given for optimal yield.
Health issues	Buffalo meat has high demand due to it being lean in nature and having low fat content (below 2 %) and its free from Mad Cow Disease since the animals are only fed grass and farm by-products.
Disease management	Systematic and efficient planning to control and ultimately eradicate livestock diseases like Foot and Mouth Disease (FMD). The control programme started in 2003 with only 54 districts under it and has now expanded to 221 districts. Cold storage space needs to be made available for the storage of FMD vaccines. The meat industry has taken some timely initiatives by providing space for the cold storage of FMD vaccines for vaccination programmes. Transport is being provided for the state veterinarians to vaccinate.
Halal meat	The market for halal meat is growing rapidly throughout the world. Some of the halal meat by-products in India include crushed bone grist, casings, sausages, leather, gelatin and other products. Pre- and post-slaughtering procedures to ensure quality, livestock management, strategies to increase share of halal meat in global market and slaughterhouse automation are some of the focus areas for promotion of halal meat trade and production.
Processing technology	Better packaging solutions and tools, use of modern machinery as well as training need to be encouraged. The consumption of processed meat products and number of players in the frozen meat products segment has increased in recent times due to changing lifestyles. Frozen meat, ready-to-eat meat products and value added products are now widely available in the market.
Transportation technology for processed meat	Some transportation subsidies (Rs.3-15 per kg) are provided by the government for its export. Buffalo meat has been included under APEDA's Transport Assistance Scheme for new markets in Africa/Commonwealth of Independent States (CIS) where freight cost for refrigerated containers from India is much higher than from competing countries. Service Tax on transportation of meat products processed for exports has been exempted.

Source: Various Reports and Research Papers cited in the reference section.

the growth of the industry. Cold storage facilities like refrigerators or deep freezers are generally not present in most retail outlets.

However the future of the meat processing industry seems bright. The government has realised the need to set up and modernize abattoirs. Importance is being given to quality control and implementation of clean technologies. As of 2015-16, 16 abattoirs projects have been approved during the period 2008 to 2015. The range of grant approval for these projects is around 32.58 to 1500 lakhs. West Bengal has the most number of approved projects followed by Sikkim and Andhra Pradesh.

There is also a need to concentrate on the utilization of by-products by the municipal slaughter houses. There is no reliable data available on the economic losses that are caused to the nation, however its estimated to be around Rs.1,000 crore per annum from slaughter houses and Rs.600 crore from dead and fallen animals (Thota, 1999). Converting waste products of slaughterhouses like blood, rumen, fat, etc. into products like fertilizer, tallow, animal feed etc. will increase their income and decrease the wastage. The percent yield of boneless meat from a buffalo is around 30-35% while the percent yield of by-products is around 65-70%. The cost of a buffalo weighing around 300 Kg is Rs.18, 000 at Rs.60/Kg live weight, cost of deboned meat in India is around Rs. 200/Kg, the cost of carcass is around Rs. 150/Kg, the value of hide and skin from a buffalo is around Rs. 400/Kg and the -

Table 2: Policy issues in the meat sector

Issue	Policies/ Schemes/ Programmes	Details
Export of tallow, fat and/or oils of any animal origin excluding fish oil is prohibited	Export Policy Schedule-2	Tallow, fat and/or oils of any animal origin excluding fish oil (Code no.1503) are not permitted to be exported, according to the Export Policy Schedule-2. Permission for export of at least buffalo fat in integrated, export oriented abattoirs needs to be considered.
Certification procedures need to be strengthened	Foreign Trade Policy	Shipment certificates should be issued by APEDA to control the quantity that each unit is producing to efficiently implement the revised Foreign Trade Policy.
Lack of organized slaughter houses with proper facilities	Setting up of new abattoirs and modernization of existing abattoirs	Identification and acquisition of land remains the major challenge. Difficulties in modernizing and relocating existing abattoirs in urban areas due to there being not enough land for expansion or modernization.
Archaic regulations	Meat Food Products Order (MFPO)/ Licensing requirements	It's not comprehensive. MFPO covers frozen meat but doesn't apply to chilled products. MFPO has not been reviewed after discussing it with stakeholders. An overhaul of the existing procedure for inspection and monitoring is also needed.
Lack of hygiene and food standards	Implementation of HACCP/ISO 22000, ISO 14000/GHP/GMP Quality/ Safety Management System	Small and medium units find it difficult to comply with the requirements of HACCP since it would require greater capacity building.
Insufficient number of laboratories	Setting Up/Up-gradation of Quality Control/Food Testing Laboratory	The amount of grant assistance provided was not sufficient for setting up food labs. It also does not provide any support for related civil works and miscellaneous fixed assets.
Lack of backward and forward linkages	Scheme for Research and Development in Processed Food Sector	Backward and forward linkages in R&D units are still weak. Only those R&D units have established linkages which have an established commercial activity. Co-ordination between the different institutes as well as institutes and industry is less because they lie under the purview of different ministries resulting in limited focus on R&D.
Non-existent cold chain network	Scheme for Integrated Cold Chain, Value Addition and Preservation Infrastructure	There is overlapping of some of the project components being assisted by National Horticulture Board (NHB) and National Horticulture Mission (NHM). Some of the states were unable to get any cold chain projects due to national level selection.

Skilled human capital is in short supply	Scheme for Human Resource Development	There is insufficient skilled human capital (eg. food analysts in testing labs, veterinarians, meat inspectors etc.) leading to many posts being vacant.
Unsatisfactory disease diagnostic and monitoring system	National Animal Disease Reporting System	The disease reporting is neither timely nor complete. The veterinary services available in the country are wholly inadequate. There are also issues related to communication, internet connectivity and hardware maintenance.
Presence of multiple authorities for the sector	Department of Animal Husbandry, Ministry of Agriculture and APEDA	The Department of Animal Husbandry, Ministry of Agriculture and APEDA all have their own schemes leading to little coordination in efforts and low response to the schemes.
Absence of an apex agency	National Meat Board	It hasn't progressed beyond the proposal stage. The multiplicity of authorities in this sector has resulted in its slow and unregulated growth.
Lack of scientific approach to breeding	National Programme for Bovine Breeding and Dairy Development	This scheme charges fees from the farmers for the performance of Artificial Insemination (AI). As AI is just getting popular among the farmers this discourages them from coming forward for AI.

Source: Various Reports and Research Papers Cited in the reference section.

value of other by-products is around Rs. 150/Kg. Some of the uses of these by-products are in soaps, cosmetics, leather products, detergents, fertilizers, lubricant, edible surgical sutures, musical strings, burn dressing, upholstery, carpets, pharmaceuticals etc. and even for direct consumption (Irshad and Sharma, 2015).

The growth of this sector has been significantly affected by the large-scale prevalence of diseases such as Foot and Mouth Disease (FMD), Black Quarter (BQ) etc. in cattle. In order to combat this a new centrally sponsored scheme, the National Animal Disease Reporting System (NADRS) was proposed for implementation during last 3 years of the 11th Five Year Plan with full central government assistance. A computerized system of animal disease reporting has been introduced, linking each Block/ Taluka, District and State headquarters to the Central Disease Reporting and Monitoring Unit at the Department of Animal Husbandry, Dairying and Fisheries in New Delhi. The technology used for processing in India, is not upto international standards and this is a significant risk factor for the industry. Disease management, processing and transportation technology, livestock health issues and feed management are some of the key Science and Technology challenges being faced by the meat processing industry in India. Table 1 shows the aspects of Science and Technology in Indian meat processing industry.

4. Policy Issues in the Meat Sector

The share of Indian meat exports in the world market is less than 2%. Adequate meat production potential exists in the country to meet the domestic demand and to substantially increase the export (Wanapat and Chanthakhoun, 2015). It is important that policy makers formulate frameworks and policies, which would ensure sustained growth in this sector while keeping the limitations in mind. Table 2 presents some of the major policy issues of concern in the meat sector of India.

5. Skill Development Issues in the Meat Processing Industry

Demand for processed meat and poultry is expected to be driven by increasing consumption levels. Demand for high-value frozen foods and preference for fresh meat in the domestic market will drive growth in the export markets. Global dietary habits are rapidly changing and India with one of the world's largest livestock population is also gearing up for the increase in demand. Also, with the advent of big players, their state of art processing infrastructure and increased capacity will help to fulfill the demand. With a compounded annual growth rate (CAGR) of 16.3%, the meat processing sector is estimated to grow from 369 billion in 2008 to 3000 billion in 2022.

Government institutions need to conduct regular training for meat workers, managers and supervisors on the importance of scientific slaughtering and dressing –

Table 3: Skill gaps and skill requirements across various levels in the meat processing sector

Level/Description	Skill Requirements	Skill gaps
Worker at Breeder Farm	Basic reading/writing knowledge so that they are able to understand the standard operating procedures that the contracting company has specified. Ability to maintain hygienic conditions. Ability to comprehend and execute the hygiene requirements like cleaning of cell.	Inability to understand standard operating procedures including knowledge of what to do and what not to do. Inadequate uniformity in operations due to insufficient understanding of the immediate or long term impacts.
Supervisory staff (Experienced personnel)	Ability to ensure assessment of sanitation of water samples at proper intervals. Ability to make sure that performance is upto the quality parameters.	Communication skills while interacting with the workers is inadequate. Understanding of the importance of maintenance of hygiene is inadequate.
Veterinary Services	Capable of taking care of the nutrition and medicinal needs of the animals. Communication skills for interacting with the workers on issues like maintenance of environment in the cells.	Inadequate verbal communication skills for executing effective training. Very little initiative to execute preventive care methods for improved performance.
Manager Level	Ability to supervise the overall operations of a business unit and control the top line / bottom line. Ability to oversee and maintain the overall quality aspect of operations in all business units. Able to coordinate with client for operational activities. Capable of undertaking corrective actions in the case of crisis such as the outbreak of disease in farm, sudden increase in mortality rate etc.	Inability to efficiently handle crisis situations such as sudden decrease in quantity or quality of output, sudden increase in mortality rate.

Source: National Skill Development Corporation. *Human Resource and Skill Requirements in Food Processing Sector – A Report*. Accessed on March 20, 2016, from http://www.nsdcindia.org/sites/default/files/files/food-processings-2009.pdf

(Kondaiah, 2015). In addition, the technology used for processing in India, is not abreast with international trends in all sectors and this is a significant risk factor for the industry. The key success factors in the meat processing industry in India are ability to tap into export growth in the value-added segment and ensuring sustained branding and quality. The key risk factors are low hygiene and quality in street-side wet markets, imperfect slaughtering, high supply chain costs, relatively unregulated slaughter facilities to the extent of 50% and primitive rearing techniques. Table 3 presents the skill requirements and skill gaps across various levels in meat processing sector in India.

6. Conclusion

India's livestock sector has helped in improving the socio-economic conditions of the rural people, next only to crop raising. Buffalo meat export has been increasing steadily and lower domestic demand has fuelled its export (Kumar, 2010). It is important that policy makers should, keeping in mind the importance of this sector to the rural population, formulate frameworks and policies that would ensure sustained growth in this sector. Some of the reforms that need to be carried out in the buffalo meat sector in order to tap its full potential are the modernization of existing abattoirs, utilization of byproducts, adopting a scientific approach to breeding, setting up of food testing labs with skilled personnel, strengthening of livestock markets, setting up a national meat board as

an apex agency for the meat sector and an efficient disease diagnostic and monitoring system.

Some of the major problems which traditional slaughter houses face are those related to prevalence of manual slaughtering of animals, sanitation and hygiene and low quality control. Modernization of existing abattoirs is essential to ensure hygienic slaughtering of the animals and supply of quality meat and meat products to domestic market.

The by-products of the meat industry are utilized by a number of ancillary industries such as leather, fish feed, poultry feed, handicraft, gelatin etc. Thus, optimum utilization of animal by-products is vital from economic point of view. A study on the production and utilization of edible by-products needs to be undertaken.

There is a high mortality of buffalo calves in India. Wastage can be avoided by salvaging these calves for meat production and recovery of hides, thus increasing the amount of quality meat for export and domestic consumption. Government schemes on salvaging and rearing of male buffalo calves along with the participation of the private sector is expected to increase the availability of livestock in coming years. Thus, sustainable livestock development can only be brought about through combined efforts of the farmers, favorable country policies and fair trade.

There is a disparity between the market and slaughtering fees in various states. Basic facilities for trouble-free marketing should be provided to livestock farmers and traders, keeping in view the enormous benefits of such weekly markets. A study on the technologies used internationally for preparing value added meat products needs to be carried out and we need to test the potential marketability of packed meat in the country.

Most of the export-oriented meat processing plants in India are certified with ISO-9002, HACCP (Hazard Analysis Critical Control Points) and SGS (Société Générale de Surveillance); meeting the OIE (Office International des Epizooties) norms (Guleria *et al.,* 2015). HACCP is being enforced by APEDA (Agricultural and Processed Food Products Export Development Authority). The plants with HACCP accreditation are approved by APEDA through an interdepartmental panel. The government has, in recent years, propagated regulations requiring the exporter to declare the source of meat. However, certification procedures need to be strengthened to ensure only meat that has been prepared from healthy, disease-free livestock and conforming to the notified standards and specifications will be exported.

The potential of Indian buffalo meat in the international market is immense but it has not been able to export to some major international markets like Russia due to some occurrence of FMD over the years, though at much reduced levels. The government should run vaccination programmes to control livestock diseases like Foot and Mouth Disease (FMD), Haemorrhagic Septicaemia (HS), Black Quarter (BQ) etc.

Robust Science and Technology policy and skilled manpower for the sector would also provide a boost to the sector. In addition, further amendments to the Meat Export Policy will help the buffalo meat sector to gain its rightful position in target export markets.

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