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Meat Hygiene and Associated Health Hazards Awareness among Butchers and Meat Retailers in Jammu District of Jammu and Kashmir

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Authors' contributions

This work was carried out in collaboration between all authors. Author RAB designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author SAK guided the author RAB during whole research period and edited the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Meat is a perishable commodity and therefore from production till consumption it needs to be innocuous. Many pathogenic micro-organisms grow in the meat if hygienic procedures are not followed. Meat acts as a vehicle for disease transmission mainly bacterial, protozoan and helminthic. Lack of appropriate hygienic slaughtering and meat handling techniques are causing unnecessary losses of meat as well as valuable by-products from animal carcasses Thus the awareness of good hygienic, sanitary practices and health hazards by personnel engaged in unorganized meat production will improve safety and suitability of meat which will lead to increased marketability and consumption, finally resulting into better socio-economic and health status of all personnel engaged either in animal rearing, trade or processing of meat. The present study was

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conducted in Jammu district of Jammu and Kashmir State to evaluate the meat hygiene and associated health hazard awareness among butchers and meat retailers in Jammu district of Jammu and Kashmir. Three Major slaughter houses of Jammu district situated at Nagrota, Old Rehari and Gujjar Nagar were selected for the study. A list of butchers in the selected slaughter houses was prepared. Ten butchers from each slaughter house were selected randomly. After preparing the comprehensive list of meat markets operating in Jammu district, three meat markets were selected, and from each selected meat market ten retail meat shops were randomly chosen. From each randomly selected retail meat shop, one person was selected purposively who was actively involved in animal slaughter and sale of meat at retail meat shop. Thus, a total of thirty butchers and thirty retailers were selected in all. Data was collected through interview schedule as well as through observations. The data was coded, classified, tabulated and analyzed using the software; Statistical Package for the Social Science (SPSS 16.0). The presentation of data was done to give pertinent, valid and reliable answer to the specific objectives. Frequencies, percentage, mean and standard deviation were worked out for meaningful interpretation. It was observed that contact with infected person and improper meat handling was considered as a major risk for transmission of diseases by most of meat handlers. Majority of meat handlers were aware of the public health significance of their business. Few had limited knowledge about cross contamination and presence of microorganisms in meat. Poor awareness was found regarding different zoonotic diseases (except bird flu), which can be transmitted through meat handling. Meat handlers avoided the meat handling work only when suffered major diseases. They were frequently wrong in judging the condition/diseases in which animals should not be slaughtered. The finding indicates that lapses exist between meat handlers' decision and the scientifically correct decision and thus final decision about the fitness of carcass and offal's must rest only with the veterinarian.

Keywords: Awareness; butchers; health hazards; meat retailers; zoonotic diseases.

1. INTRODUCTION

Meat is a perishable commodity and therefore from production till consumption it needs to be innocuous. Many pathogenic micro-organisms grow in the meat if hygienic procedures are not followed. Meat acts as a vehicle for disease transmission mainly bacterial, protozoan and helminthic. It is observed that along with meat, water used for meat processing also transmit some diseases (c*ampylobacteriosis*, *amoebiasis*, and *ascariasis*) to human beings during unhygienic handling of meat and its products, particularly in unorganized sectors in developing countries like India. Globally, food borne illness is a growing public health problem because of increasing global trade in food, changes in the way food is produced and changes in the consumer's requirements. These changing pattern cause new challenges in the way of food safety management. About 75 percent of the new communicable diseases that have affected humans over the past 10 years have been caused by pathogens originating from animals or from products of animal origin. Many of these new human diseases are called zoonotic diseases, which are associated with handling of diseased domestic and wild animals, slaughtering, meat cutting, retailing and processing. Although developing countries face increasingly strict sanitary and phytosanitary standards in their export markets, they can maintain and improve market access and improve domestic food safety and agricultural productivity by adopting a strategic approach to food safety, public health and trade [18]. International organizations like Food and Agriculture Organization (FAO) [6] and World Health Organization (WHO) of United Nations are concerned with the prevention and transmission of human diseases through contaminated food, and with improvement of hygienic production, processing and distribution. An important development is the establishment of joint FAO/WHO [7] food standards programme whose main responsibility is to prepare the "Codex Alimentarius", a collection of internationally adopted standards for food and food products. The Codex Alimentarius Code of Hygienic Practice for Meat (CHPM) constitutes the primary international standard for meat hygiene and incorporates a risk-based approach to application of sanitary measure throughout meat production chain.

Consumer preference for freshly cut slaughtered birds/animals along with poor refrigeration facilities are probable factors for existence of retail meat shops in India. The shops are managed by meat sellers/butchers, who form an

integral part of meat selling activity in India. In fact, butchers act as system nodes in meat selling as entire meat trade passes through butchers till Point of sale [12]. Rapid increase in the household income, urbanization and changing lifestyle have combined to shift consumption towards non-traditional cereals and value added products, including many derived from livestock. Access to good quality, safe and nutritious food is considered as basic right of the people, and illness resulting from the consumption of food has been a basic problem for consumers. Even more recently, despite a continuous increase in demand, the image of animal products has been tarnished by the risk of meat borne diseases. Now days, economic lifestyle and consumer's attitudes to food regarding quality are tending to be more and more consistent in the world. As income rise in relation to the cost of living, consumers generally tend to spend more on protein products of animal origin than before, thus quality of food of animal origin especially meat and meat products is now a days a predominant source of food for everyone in society [1]. The demand is for nutritious, tasteful, safe, healthy and affordable food, either fresh or processed. Therefore the quality of animal products is usually assessed by specialist in animal production according to its nutritional, technological, sensory, hygienic and sanitary aspects.

The entire chain of meat production including processing and marketing is neglected one in India. The major constraints for the meat industry are lack of scientific approach to rearing of meat animals, unorganized nature of meat production and marketing, socio-economic taboos associated with meat eating, inadequate infrastructural facilities and poor post-harvest management. Rapid increase in the household income, urbanization and changing lifestyle have combined to shift consumption towards non-traditional cereals and value added products, including many derived from livestock. This study was undertaken to evaluate the meat hygiene and associated health hazard awareness among butchers and meat retailers.

2. MATERIALS AND METHODS

The present study was conducted in Jammu district of Jammu and Kashmir State. Jammu and Kashmir consist of three division's viz. Jammu, Kashmir and Ladakh. The state comprises of 22 district of which Jammu is an important one and most populated with a population of 15, 29,958 (Census, 2011). It is located at 23.73 degree north and 74.87 degree east. District Jammu falls in sub-mountainous region, at the foothills of the Himalayas and is approximately 600 kilometers away from the national capital, New Delhi. Three major slaughter houses of Jammu district situated at Nagrota, Old Rehari and Gujjar Nagar were selected for the study. A list of butchers in the selected slaughter houses was prepared. Ten butchers from each slaughter house were selected randomly. After preparing the comprehensive list of meat markets operating in Jammu district, three meat markets were selected, and from each selected meat market ten retail meat shops were randomly chosen. From each randomly selected retail meat shop, one person was selected purposively who was actively involved in animal slaughter and sale of meat at retail meat shop. Thus, a total of thirty butchers and thirty retailers were selected in all. Data was collected through well structured interview schedule as well as through observations after proper testing of schedule and using appropriate scales. The interview schedule was developed using the package of practices of neighboring universities as "universe of content" after proper consultation with the members of Faculty of Veterinary Science and Animal Husbandry, SKUAST-Jammu. The data was coded, classified, tabulated and analyzed using the software; Statistical Package for the Social Science (SPSS 16.0). Frequencies, percentage, mean and standard deviation were worked out for meaningful interpretation.

3. RESULTS AND DISCUSSION

3.1 Awareness Regarding Meat Hygiene among Butchers and Meat Retailers

3.1.1 Awareness about importance of personal hygiene

Meat handlers do not maintain appropriate degree of personal cleanliness. Those who have certain illness or who behave inappropriately, can contaminate meat and transmit illness to consumers. Moreover, personal hygiene is an important component of meat hygiene. Table 1 shows that importance of personal hygiene were agreed by 76.66% of respondents and disagreed by 11.66% of respondents. The unawareness about this signifies the need to educate them for importance of personal hygiene. The findings were in agreement with the result of Junaidu et al. [10] and Sneed et al. [19] who reported that that personal hygiene plays an integral part in

ensuring safe products to the consumer if meat handlers take serious note on the cleanliness of their hands, body and clothing.

Table 1. Distribution of respondents according to their response to statement 1: Personal hygiene is important

Statement-1	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Agree	24 (80.00)	22 (73.30)	46 (76.66)
Disagree	04 (13.30)	03 (10.00)	07 (11.66)
Do not know	02 (6.70)	05 (16.7)	07 (11.66)

(Values in parenthesis indicate percentage)

3.1.2 Awareness about public health significance

Table 2 shows that majority (46.66%) of meat handlers agreed on the public health importance of their work/business, while 38.33% disagreed on its importance and, 15% of meat handlers did not know. Further analysis of table shows 50% of butchers agreed regarding its importance which highlights their better awareness compared to retailers. The findings were in agreement with the result of Junaidu et al. [10] Sneed et al. [19].

Table 2. Distribution of respondents according to their response to statement 2: This work has public health significance

Statement-2	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Agree	15 (50.00)	13 (43.30)	28 (46.66)
Disagree	11 (36.70)	12 (40.0)	23 (38.33)
Do not know	04 (13.30)	05 (16.70)	09 (15.00)

(Values in parenthesis indicate percentage)

3.1.3 Awareness about importance of hand washing

Good personal habits, such as washing hands properly with soap and water before and after handling meat are important for meat hygiene. Table 3 shows that majority (56.66%) of respondents agreed that hand washing is important. During the course of study, it was observed that proper hand washing facilities were not available at both slaughter houses and retail meat shops. Similar findings were observed by Junaidu et al. [10] who reported that good personal habits and personal hygiene plays an integral part in ensuring safe products to the consumer.

Table 3. Distribution of respondents according to their response to statement 3: Hand washing is important

Statement-3	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Agree	21 (70.00)	13 (43.30)	34 (56.66)
Disagree	06 (20.00)	05 (16.70)	11 (18.33)
Do not know	03 (10.00)	12 (40.00)	15 (25.00)

(Values in parenthesis indicate percentage)

3.1.4 Awareness about cross contamination

Cross contamination from one carcass to another carcass is possible when carcasses are stacked tighter during storage, transportation or sale. Table 4 shows that majority of meat handlers (46.66%) disagreed to it, and only 30% agreed. This unawareness can be probable reason for continued poor handling of carcasses. The findings were in agreement with Bolton [2] and Upadhyaya et al. [20].

Table 4. Distribution of respondents according to their response to statement 4: Cross contamination can happen from one carcass to another

Statement-4	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Agree	11 (36.70)	07 (23.30)	18 (30.00)
Disagree	15 (50.00)	13 (43.30)	28 (46.66)
Do not know	04 (13.30)	10 (33.30)	14 (23.33)

(Values in parenthesis indicate percentage)

3.1.5 Awareness about the impact of the food-handling environment on meat hygiene/quality

Environment is the sum total of all external conditions and influences affecting the life and development of any living being. Good

environment facilitates good working practices. Table 5 reveals that the importance of environment and its impact the impact of the food-handling environment meat hygiene/quality was agreed by 38.33% while 18.33% of respondents disagreed its important and 43.33% did not know. Similar findings were observed by Bolton [2], Kebede et al. [11] and Upadhyaya et al. [20] who reported that good working environment is an integral part for hygienic quality of meat and meat products.

Table 5. Distribution of respondents according to their response to statement 5: Impact of the food-handling environment on meat hygiene/quality

Statement-5	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Agree	13 (43.30)	10 (33.30)	23 (38.33)
Disagree	03 (10.00)	08 (26.66)	11 (18.33)
Do not know	14 (46.70)	12 (40.00)	26 (43.33)

(Values in parenthesis indicate percentage)

3.1.6 Awareness about microorganism in meat

Meat is a perishable food item and utmost precaution must be taken to safeguard it right from bleeding of slaughter animals till final consumption. Though muscle tissue of living animal is free of microorganisms in most cases, it gets contaminated by the body surface and visceral organ contamination during slaughtering and dressing operation if due precautions are not taken. The finding of Table 6 point out that only 26.66 responded were agreed ,whereas 40.00% of meat handlers disagreed and 33.00% of respondents were not aware regarding the growth of microorganism in meat if not properly handled. It was felt that education in this direction should be provided to meat handlers to improve the hygienic status of meat. Similarly Kebede et al. [11] reported that meat contains an abundance of nutrients required for the growth of bacteria in adequate quantity.

3.1.7 Awareness about presence of pathogens and their growth in meat

Microbial activity plays a major role in deterioration and spoilage of meat and safety of meat is compromised. Bacteria multiply rapidly between 40°F to 140°F It is clear from Table 7 that a merely 20% respondents agreed, whereas 40% of respondents were not aware about presence of pathogen and their growth in meat. The findings are in agreements with the findings of Kebede et al. [11] reported that meat contains an abundance of nutrients required for the growth of bacteria in adequate quantity.

Table 6. Distribution of respondents according to their response to statement 6: Meat can carry microorganisms

Statement-6	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Agree	11 (36.70)	05 (16.70)	16 (26.66)
Disagree	10 (33.30)	14 (46.70)	24 (40.00)
Do not know	09 (30.00)	11 (36.70)	20 (33.33)

(Values in parenthesis indicate percentage)

Table 7. Distribution of respondents according to their response to statement 7: Meat permits survival/multiplication of pathogens/toxin formation

Statement-7	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Agree	09 (30.00)	03 (10.00)	12 (20.00)
Disagree	12 (40.00)	12 (40.00)	24 (40.00)
Do not know	09 (30.00)	15 (50.00)	24 (40.00)

(Values in parenthesis indicate percentage)

3.1.8 Awareness about importance of meat inspection

Many diseased and abnormal conditions can be identified during meat inspection and thus inspection of meat by veterinarians/ meat inspectors is must. It is obvious from the Table 8 that majority of the respondents (43.33%) disagreed whereas only 38.33% of respondents agreed to it. Negative opinion regarding meat inspection should be changed by consistent educational efforts. On the contrary Davies et al. [5] and Hathaway [9] reported that *ante-mortem* and *post-mortem* inspection of carcass enable the detection of observable abnormalities and also have the potential to detect new diseases which may be of direct public health significance,

thereby ensuring good quality meat and safety to the consumers.

Table 8. Distribution of respondents according to their response to statement 8: Inspection of meat by meat inspectors/veterinarians is important

Statement-8	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Agree	14 (46.70)	09 (30.00)	23 (38.33)
Disagree	14 (46.70)	12 (40.00)	26 (43.33)
Do not know	02 (6.70)	09 (30.00)	11 (18.33)

(Values in parenthesis indicate percentage)

3.1.9 Awareness about risk of producing unsafe and unhygienic meat

Due care should always be taken to minimize the risk of producing unsafe and unhygienic meat by adopting good production practices. Table 9 reveal that a majority of the respondents (41.7%) did not know that care should be taken to minimize the risk of producing unsafe and unhygienic meat. The findings were also in agreement with the results of Oluwafemi et al. [15] who reported that the current slaughtering, processing and marketing in many places are not in compliance with the standard quality and hygiene practices. It may act as source of contamination and ill health for consumers and takes lot of expenditure and duration of time to produce hygiene meat.

Table 9. Distribution of respondents according to their response to statement 9: Care should be taken to minimize the risk of producing unsafe and unhygienic meat

Statement-9	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Agree	13 (43.30)	09 (30.00)	22 (36.66)
Disagree	08 (26.70)	05 (16.70)	13 (21.66)
Do not know	09 (30.00)	16 (53.30)	25 (41.66)

(Values in parenthesis indicate percentage)

3.1.10 Awareness about corrective measures

Table 10 shows that the majority of meat handlers (50%) agreed that it is not proper to sell meat when gross abnormality is detected. In these conditions corrective measures towards an abnormality of carcass or meat, can either be full condemnation of carcass or an infected organ or sale with an instruction that meat should be cooked properly before consumption. The findings were in agreement with Bolton [2] and Upadhyaya et al. [20] who reported that contamination levels can be decreased by keeping more than two kinds of meat in a shop with proper separation of meat areas in the shops.

Table 10. Distribution of respondents according to their response to statement 10: Corrective measure should be taken when anything unusual with the meat is noticed

Statement-10	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Agree	12 (40.00)	18 (60.00)	30 (50.00)
Disagree	08 (26.70)	04 (13.30)	12 (20.00)
Do not know	10 (33.30)	08 (26.70)	18 (30.00)

(Values in parenthesis indicate percentage)

3.1.11 Awareness about cross contamination through hands

Unhygienic Slaughtering, dressing, handling and faulty inspection of meat present many opportunities for cross contamination. It is established that dirty hands can lead undue cross contamination, that may cause meat borne diseases. Table 11 reveals that majority of meat handlers (40.00%) agreed that hand can be greatest risk for cross contamination. Similar finding have been earlier reported by Oluwafemi et al. [15].

Table 11. Distribution of respondents according to their response to statement 11: Hands are great risk for cross contamination

Statement-11	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Agree	13 (43.30)	11 (36.70)	24 (40.00)
Disagree	09 (30.00)	10 (33.30)	19 (31.66)
Do not know	08 (26.70)	09 (30.00)	17 (28.33)

(Values in parenthesis indicate percentage)

3.1.12 Awareness about time required for hygienic meat production

Production of wholesome meat that is safe and suitable for human consumption required detailed attention to be paid to different aspect of slaughter and dressing of animals as well as transportation, display and sale of meat. Table 12 indicates that 40% of respondents expressed that hygienic meat production would take too much time; whereas majority of meat retailer (50%) reported that they do not know how much time it will take for hygienic meat production. Labour intensive meat handling practices may be reason behind it. The findings were also in agreement with the results of Oluwafemi et al. [15] who reported that, the current slaughtering, processing and marketing in many places are not in compliance with the standard quality and hygiene practices. It may act as source of contamination and ill health for consumers and takes lot of expenditure and duration of time to produce hygiene meat.

Table 12. Distribution of respondents according to their response to statement 12: Hygienic meat production will take too much time

Statement-12	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Agree	13 (43.30)	11 (36.70)	24 (40.00)
Disagree	11 (36.70)	04 (13.30)	15 (25.00)
Do not know	06 (20.00)	15 (50.00)	21 (35.00)

(Values in parenthesis indicate percentage)

3.1.13 Awareness about applying meat hygiene practice in present situation

Table 13 clearly indicates that majority (50.00%) of respondents agreed that present situation was not proper to apply meat hygiene practices, while only, 21.66% of respondents reported that applying meat hygiene practices in present condition were not difficult. Similar finding have been earlier reported by Oluwafemi et al. [15] that maintaining an effective sanitation protocol and proper storage will limit possible contamination of the meat through dirty equipment and contact surfaces, and prevent spoilage and food poisoning among consumers.

Table 13. Distribution of respondents according to their response to statement 13: It is difficult to apply meat hygiene practice in present situation

Statement-13	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Agree	13 (43.30)	17 (56.70)	30 (50.00)
Disagree	09 (30.00)	04 (13.30)	13 (21.66)
Do not know	08 (26.70)	09 (30.00)	17 (28.33)

(Values in parenthesis indicate percentage)

3.1.14 Retailers opinion on display, storage and sale of meat

The display, storage and sale of carcass/meat should be perfect from hygienic point of view. An analysis of Table 14 reveals that majority of meat retailers (73.30%) agreed that they should maintain separate areas for sale and meat production, whereas (70%) agreed for storage of leftover meat in deep freezer or refrigeration. The findings were in agreement with Bolton [13] and Upadhyaya et al. [20] who reported that contamination levels can be decreased by keeping more than two kinds of meat in a shop with proper separation of meat areas in the shops. Similarly, Junaidu et al. [10] reported that almost all the respondents agreed that improper storage of meat might be harmful to health. An overwhelming proportion (73.30%) of meat handlers agreed that maintain hygiene in slaughtering, dressing and display of carcass would help to attract more customers. It is also clear from Table 14 that a considerable proportion (60%) agreed that arrangements and maintaince required for hygienic meat would not affect their business. It was further found that 36.70% of meat retailers agreed that there were chances of improvement in the status of meat hygiene at their shops. The finding were in agreement with Ruban et al. [16] who reported that the maintenance of strict hygiene during slaughter and processing is of prime importance to produce meat with good microbial quality and better shelf life, thereby ensuring safety to the consumers and they will prefer the meat with good microbial quality, hygienically slaughtered and processed.

Table 14. Distribution of respondents according to their opinion on display, storage and sale of meat

Statements	Meat retailers (N=30)		
	Opinion	Frequency	Percent
Having separate areas for sale and meat processing is important.	Do not know	03	10.00
	Disagree	05	16.70
	Agree	22	73.30
Leftover meat should be stored properly in ice boxes or refrigerator	Do not know	04	13.30
	Disagree	05	16.70
	Agree	21	70.00
Sale of hygienic meat will enable the business to win more consumers	Do not know	05	16.70
	Disagree	03	10.00
	Agree	22	73.30
Maintaince of meat hygiene has little impact on daily running of business	Do not know	04	13.30
	Disagree	08	26.70
	Agree	18	60.00
Status of meat hygiene at your shop can be better than now	Do not know	16	53.30
	Disagree	03	10.00
	Agree	11	36.70

3.2 Awareness of Butchers and Meat Retailers about Meat Associated Health Hazards

3.2.1 Awareness about different modes of transfer of diseases

Communicable disease can spread through various modes and an awareness of such modes is prerequisite to prevent the spread of such diseases. As evident from the Table 15 that majority of respondents (86.66%) know that contact with infected person is the mode of disease transmission whereas disease transmission through meat handling and meat consumption was known by 46.66% and 31.66% of meat handlers, respectively. Similar finding have been earlier reported by Sneed et al. [19] who reported that if meat handlers take serious note on the cleanliness of their hands, body and clothing, this will help in preventing incidence of cross-contamination and thereby, reducing transmission of various zoonotic diseases. Similarly Labie [13], Mbata [14] and Bradeeba [3] observed that contaminated and raw meat consumption act as source of various infectious and zoonotic diseases.

3.2.2 Awareness about animal diseases of zoonotic significance

Zoonotic diseases constitute unique group of infectious diseases that affect man as well as animals. The joint expert committee of WHO and FAO (1959) has defined zoonoses as those diseases which are naturally transmitted between vertebrate animals and man. As evident from the Table 16 that majority of the respondents (90%) were aware of bird flu, whereas rabies, tuberculosis and tetanus were known to 70%, 61.66% and 43.33% respectively. Further the result indicates that brucellosis (10%), anthrax (20%), salmonellosis (16.66%), taeniasis (15%) and fasciolosis (26.66%) were some diseases with comparatively less awareness among meat handlers. While none of the meat handlers were aware of Leptospirosis and Campylobacteriosis. The findings were in agreement with the result of Ghimire et al. [8] who reported that majority of pork handlers in Nepal were unaware of zoonotic diseases like Campylobacteriosis as they were either illiterate or having low level of education. The findings ae in contrast with the findings of Brown et al. [4] who studied the leptospirosis awareness among butchers and reported that majority of butchers were aware of leptospirosis.

3.2.3 Awareness about transfer of certain diseases from animals/meat handling

Meat handlers constitute a unique group of individuals with immense public health significance because they can not only contract the diseases from animals/meat but also transmit it through improper handling of meat. As evident from Table 17 that significant proportions of meat handlers (78.33%) were aware that bird flu could be transmitted through handling of infected bird whereas tuberculosis, tetanus and fasciolosis are another such diseases of meat handlers were awared by 43.33%, 25.00% and 25.00% of the respondents respectively. Similar findings were

observed by Sahay et al. [17] who carried out a study on meat associated health hazards among butchers and retailers at Bareilly, Uttar Pardash, and reported that butchers and retailers were aware of zoonotic diseases like bird flu, rabies, tuberculosis and anthrax while less awareness was about diseases like taeniasis, salmonellosis, brucellosis and leptospirosis.

3.2.4 Opinion on continuation of meat production operations by meat handlers after encountering certain disorders / diseases

Table 18 displays that all meat handlers(100%) considered jaundice and leprosy to be diseased in which one should not work whereas 88.33%, 60%, 41.66%, 51.66% and 68.33% of meat handlers opinioned that they should continue their work when encountered with corresponding disordered or diseases like eye, ear or nasal discharge, tonsillitis, conjunctivitis, eczema and diarrhea, respectively. It was observed during course of study that physical fitness to continue meat production operation was given more importance by meat handlers than disease transmission while soliciting their opinion. The findings are in agreement with the findings of Sahay et al. [17] who reported that majority percent of butchers and retailers considered jaundice and leprosy to be diseased in which one should not work while in case of some disease/symptoms of diseases with which one can work are discharge from eyes, ear and nose, tonsillitis, eczema and diarrhea.

Table 15. Distribution of respondents according to their awareness about different modes of transfer of diseases*

Mode	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Contact with infected person	26 (86.70)	26 (86.70)	52 (86.66)
Drinking water	20 (66.70)	21 (70.00)	41 (68.33)
Food	13 (43.30)	11 (36.70)	24 (40.00)
Meat handling	17 (56.70)	11 (36.70)	28 (46.66)
Meat consumption	12 (40.00)	07 (23.30)	19 (31.66)
Inhalation	06 (20.00)	04 (13.30)	10 (16.66)

(Values in parenthesis indicate percentage)
** Multiple responses*

Table 16. Distribution of respondents according to their awareness about animal disease of zoonotic significance*

Disease	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Bird flu	28 (93.30)	26 (86.70)	54 (90.00)
Rabies	15 (50.00)	17 (56.70)	42 (70.00)
Brucellosis	03 (10.00)	02 (6.70)	05 (8.33)
Tuberculosis	18 (60.00)	19 (63.30)	37 (61.66)
Anthrax	02 (6.70)	03 (10.00)	05 (8.33)
Tetanus	11 (36.70)	09 (30.00)	20 (33.33)
Salmonellosis	03 (10.00)	04 (13.30)	07 (11.66)
Taeniasis/cysticercosis	03 (10.00)	05 (16.70)	08 (13.33)
Fasciolosis	04 (13.30)	04 (13.30)	08 (13.33)
Campylobacteriosis	0 (0.00)	0 (0.00)	0 (0.00)
Leptospirosis	0 (0.00)	0 (0.00)	0 (0.00)

*(Values in parenthesis indicate percentage), * Multiple responses*

Table 17. Distribution of respondents according to their awareness about transfer of certain diseases from animals/meat handling*

Disease	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Bird flu	26 (86.70)	21 (70.0)	47 (78.33)
Rabies	08 (26.70)	06 (20.00)	14 (23.33)
Brucellosis	02 (6.70)	0 (0.00)	02 (3.33)
Tuberculosis	13 (43.30)	13 (43.30)	26 (43.33)
Anthrax	04 (13.30)	02 (6.70)	06 (10.00)
Tetanus	03 (10.00)	08 (26.70)	11 (18.33)
Salmonellosis	04 (13.30)	01 (3.30)	05 (8.33)
Taeniasis/cysticercosis	03 (10.00)	01 (3.30)	04 (6.66)
Fasciolosis	04 (13.3)	03 (10.0)	07 (11.66)
Campylobacteriosis	0 (0.00)	0 (0.00)	0 (0.00)
Leptospirosis	0 (0.00)	0 (0.00)	0 (0.00)

(Values in parenthesis indicate percentage)
** Multiple responses*

Table 18. Distribution of respondents according to their opinion on continuation of meat production operations after encountering certain disorders / diseases

Disordered/Disease	Opinion	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Discharge from eye, ear or nose	Continue	28 (93.30)	25 (83.30)	53 (88.33)
	Continue after recovery	02 (6.70)	03 (10.00)	05 (8.33)
	Should not continue	0 (0.00)	02 (6.70)	02 (3.33)
Inflammation of tonsil	Continue	30 (100.00)	30 (100.00)	60 (100.00)
	Continue after recovery	0 (0.00)	0 (0.00)	0 (0.00)
	Should not continue	0 (0.00)	0 (0.00)	0 (0.00)
Conjunctivitis	Continue	15 (50.00)	10 (33.3)	25 (41.66)
	Continue after recovery	13 (43.30)	16 (53.30)	29 (48.33)
	Should not continue	02 (6.70)	04 (13.30)	06 (10.00)
Eczema on hands, forearms or face	Continue	12 (40.00)	19 (63.30)	31 (51.66)
	Continue after recovery	01 (3.30)	0 (0.00)	01 (1.66)

Disordered/Disease	Opinion	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
	Should not continue	17 (56.70)	11 (36.70)	28 (46.66)
Diarrhoea	Continue	19 (63.30)	22 (73.30)	41 (68.33)
	Continue after recovery	09 (30.00)	06 (20.00)	15 (25.00)
	Should not continue	02 (6.70)	02 (6.70)	04 (6.66)
Diarrhoea and vomiting	Continue	05 (16.70)	0 (0.00)	05 (8.33)
	Continue after recovery	19 (63.30)	20 (66.70)	39 (65.00)
	Should not continue	06 (20.00)	10 (33.30)	16 (26.66)
Fever	Continue	21 (70.00)	24 (80.00)	45 (75.00)
	Continue after recovery	06 (20.00)	0 (0.00)	06 (10.00)
	Should not continue	03 (10.00)	06 (20.00)	09 (15.00)
Jaundice	Continue	0 (0.00)	0 (0.00)	0 (0.00)
	Continue after recovery	0 (0.00)	0 (0.00)	0 (0.00)
	Should not continue	30 (100.00)	30 (100.00)	60 (100.00)
Leprosy	Continue	0 (0.00)	0 (0.00)	0 (0.00)
	Continue after recovery	0 (0.00)	0 (0.00)	0 (0.00)
	Should not continue	30 (100.00)	30 (100.00)	60 (100.00)

(Values in parenthesis indicate percentage)

3.2.5 Opinion about various ailments encountered in animals or carcasses

Animals to be slaughtered are not always free from diseases. Provision of ante-mortem and post-mortem inspection confirms that the meat passed for human consumption is safe and suitable. Partially condemned meat relates to the conditions of carcass which are not served. These are mostly non-infectious or mild infectious. Non-infectious conditions include fractures, bruises, non-suppurative wounds, localized burns, hematoma etc. Infectious condition includes abscess, suppurative wound and hydatid cyst which require laboratory diagnosis. Such meat can be passed for human consumption after trimming /removing affected portions. Carcass of animal along with its blood and offal is said to be unsound or condemned totally when affected with following conditions viz. anthrax, black quarter, tetanus, tuberculosis, salmonellosis, fowl typhoid, blue tongue, rabies, sarcocystis, multiple hydatid cyst, emaciation, malignant or multiple tumors etc.

An analysis of Table 19 reveals that 50%, 58.33%, 55%, 95%, 83.33% and 100% of meat handlers opinioned that either they should not slaughter the animals or condemned the whole carcasses when encountered with corresponding aliments like fracture, wounds, fever, jaundices, multiple tumor and abnormal odor from carcass, respectively whereas 53.33%,45%, 5% and 10% of meat handlers opinioned that either they should condemned the affected part or no action is required when animals or carcasses encountered with corresponding aliments like emaciation, fever, fracture and wounds, respectively. The finding indicates that lapses exist between meat handlers' decision and the scientifically correct decision. Final decision about the fitness of carcass and offal's must rest only with the veterinarian. Similar findings were observed by Sahay et al. [17].

Table 19. Distribution of respondents according to their opinion on various ailments encountered in animals or carcasses

Aliment	Opinion	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Fracture	Do not slaughter	16 (53.30)	14 (46.70)	30 (50.00)
	Condemn the affected part	14 (46.7)	13 (43.3)	27 (45.00)
	Condemn the whole carcass	0 (0.00)	0 (0.00)	0 (0.00)
	No action required	0 (0.00)	03 (10.00)	03 (5.00)
Wounds	Do not slaughter	12 (40.00)	07 (23.30)	19 (31.66)
	Condemn the affected part	14 (46.70)	21 (70.00)	35 (58.33)
	Condemn the whole carcass	0 (0.00)	0 (0.00)	0 (0.00)
	No action required	04 (13.30)	02 (6.70)	06 (10.00)
Emaciation	Do not slaughter	18 (60.00)	10 (33.30)	28 (46.66)
	Condemn the affected part	0 (0.00)	0 (0.00)	0 (0.00)
	Condemn the whole carcass	0 (0.00)	0 (0.00)	0 (0.00)
	No action required	12 (40.00)	20 (66.70)	32 (53.33)
Fever	Do not slaughter	16 (53.3)	17 (56.70)	33 (55.00)
	Condemn the affected part	0 (0.00)	0 (0.00)	0 (0.00)
	Condemn the whole carcass	0 (0.00)	0 (0.00)	0 (0.00)
	No action required	14 (46.70)	13 (43.30)	27 (45.00)
Jaundices	Do not slaughter	30 (100.00)	27 (90.00)	57 (95.00)
	Condemn the affected part	0 (0.00)	0 (0.00)	0 (0.00)
	Condemn the whole carcass	0 (0.00)	03 (10.00)	03 (5.00)
	No action required	0 (0.00)	0 (0.00)	0 (0.00)
Multiple tumors visible on carcass	Do not slaughter	0 (0.00)	0 (0.00)	0 (0.00)
	Condemn the affected part	02 (6.70)	08 (26.70)	10 (16.66)
	Condemn the whole carcass	28 (93.30)	22 (73.30)	50 (83.33)
	No action required	0 (0.00)	0 (0.00)	0 (0.00)

Aliment	Opinion	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Abnormal odour from body	Do not slaughter	0 (0.00)	0 (0.00)	0 (0.00)
	Condemn the affected part	0 (0.00)	0 (0.00)	0 (0.00)
	Condemn the whole carcass	30 (100.00)	30 (100.00)	60 (100.00)
	No action required	0 (0.00)	0 (0.00)	0 (0.00)

(Values in parenthesis indicate percentage)

Table 20. Distribution of respondents according to their opinion regarding condemnation of various diseased organs

Aliment	Opinion	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Cyst on liver	Trimming of affected parts	16 (53.30)	04 (13.30)	20 (33.33)
	Condemn whole organ	14 (46.70)	26 (86.70)	40 (66.66)
	No action required	0 (0.00)	0 (0.00)	0 (0.00)
Tumors on liver	Trimming of affected parts	0 (0.00)	0 (0.00)	0 (0.00)
	Condemn whole organ	30 (100.00)	30 (100.0)	60 (100.00)
	No action required	0 (0.00)	0 (0.00)	0 (0.00)
Parasite inside liver	Trimming of affected parts	0 (0.00)	0 (0.00)	0 (0.00)
	Condemn whole organ	30 (100.00)	30 (100.0)	60 (100.00)
	No action required	0 (0.00)	0 (0.00)	0 (0.00))
Septic or gangrenous condition of lung	Trimming of affected parts	0 (0.00)	0 (0.00)	0 (0.00)
	Condemn whole organ	30 (100.00)	24 (80.0)	54 (90.00)
	No action required	0 (0.00)	06 (20.00)	06 (10.00)
Nodules on lungs	Trimming of affected parts	06 (20.00)	0 (0.00)	06 (10.00)
	Condemn whole organ	24 (80.00)	30 (100.00)	54 (90.00)
	No action required	0 (0.00)	0 (0.00)	0 (0.00)
Cyst on lungs	Trimming of affected parts	10 (33.30)	06 (20.00)	16 (26.66)
	Condemn whole organ	20 (66.70)	24 (80.0)	44 (73.33)
	No action required	0 (0.00)	0 (0.00)	0 (0.00)

Aliment	Opinion	Butchers (n=30)	Meat retailers (n=30)	Total (N=60)
Fluid in plural cavity around lung	Trimming of affected parts	0 (0.00)	0 (0.00)	0 (0.00)
	Condemn whole organ	21 (70.00)	24 (80.00)	45 (75.00)
	No action required	09 (30.00)	06 (20.00)	15 (25.00)
Swelling and edema of lymph node	Trimming of affected parts	0 (0.00)	0 (0.00)	0 (0.00)
	Condemn whole organ	26 (86.70)	23 (76.7)	49 (81.66)
	No action required	04 (13.30)	07 (23.3)	11 (18.33)
Tumor of lymph node	Trimming of affected parts	0 (0.00)	0 (0.00)	0 (0.00)
	Condemn whole organ	30 (100.00)	30 (100.0)	60 (100.00)
	No action required	0 (0.00)	0 (0.00)	0 (0.00)
Enlarged spleen	Trimming of affected parts	0 (0.00)	0 (0.00)	0 (0.00)
	Condemn whole organ	28 (93.30)	28 (93.3)	56 (93.33)
	No action required	02 (6.70)	02 (6.70)	04 (6.66)
Pus in kidney	Trimming of affected parts	0 (0.00)	0 (0.00)	0 (0.00)
	Condemn whole organ	30 (100.00)	30 (100.0)	60 (100.00)
	No action required	0 (0.00)	0 (0.00)	0 (0.00)

(Values in parenthesis indicate percentage)

3.2.6 Opinion about condemnation of various diseased organs

During dressing and examination of carcass and offal's, a number of lesions suggestive of different diseases are encountered. A decision can be taken to either trim the affected part or condemn whole organ as per scientific norms. An analysis of Table 20 reveals that 100%, 93%, 90%,81.66%,75.%, 73.33% and 66.66% of meat handlers opinioned that they should condemn the whole organ when an organ affected with following diseases /disordered like, (tumor on liver, parasite inside, tumor of lymph node and pus in kidney), (enlarged spleen), (septic condition of lung and nodules on lungs), (swelling and oedema of lymph node), (fluid in pleural cavity around lung), (cyst on lung) and (cyst on liver), respectively whereas 10%, 25%,18.33% and 6.66% of meat handlers opinioned that no action is required when an organ affected with following diseases /disordered like septic condition of lung, fluid in pleural cavity around lung, swelling and edema of lymph node and enlarged spleen, respectively. The finding indicates that lapses exit between meat handlers' decision and the scientifically correct decision. Final decision about the fitness of carcass and offal's must rest only with the veterinarian. The findings are in agreements with findings of Sahay et al. [17], who reported that meat handlers provide right opinion in case of jaundice, fractures, abnormal odour from carcasses, cyst on liver, tumor on liver, fluid in pleural cavity, lymph node oedema.

4. CONCLUSION

Meat is a perishable commodity and therefore from production till consumption it needs to be

disease free. Many pathogenic micro-organisms grow in the meat if hygienic procedures are not followed. Meat acts as a vehicle for disease transmission mainly bacterial, protozoan and helminthic. Contact with infected person and improper meat handling was considered as a major risk for transmission of diseases by most of meat handlers. Respondents have limited knowledge about cross contamination and presence of microorganisms in meat poor awareness was found regarding different zoonotic diseases (except bird flu), which can be transmitted through meat handling. Meat handlers avoided the meat handling work only when suffered major diseases. They were frequently wrong in judging the condition/diseases in which animals should not be slaughtered. So to produce quality hygienic meat and to prevent from meat associated health hazards short duration, government funded training need to be organized for butchers and meat retailers nearby their workshop to impart knowledge regarding meat hygiene and associated health hazards.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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