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Meat Handling Practices Among Retail Meat Shops in Dharan Sub-Metropolitan City

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Abstract

The study was conducted to assess the status of sanitation and hygienic practices among retail meat shops in Dharan Sub metropolitan city. A total of 117 retail meat shops were randomly selected and interviewed by using a self-prepared semi-structured questionnaire. 98.3% of respondents were unaware of Slaughterhouse and Meat Inspection Act, 52.1% of the butchers didn't wear an apron, 76.1% of butchers did not have an evisceration facility, antemortem and post mortem practices were rarely practiced and more than 80% did not use detergent-water for cleaning function. On a 21-point rating score for good hygienic practices, 41.88% of meat shop fell into the poorer category getting less than 45% score showing significant association ($p < 0.05$) with the type of meat, sex of the worker and training received. General hygiene practices in most of the meat shop of Dharan have not been observed satisfactory. Since poorer meat handling practices are directly related to poorer meat quality, this study recommends immediate and effective intervention to ensure the quality and safety in the meat market of Dharan.

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primary production to when it is ready for consumption and one of the main sources of food-borne illnesses and death (WHO, 2007). The types and extent of microbial contamination depend on sanitation procedures and hygienic practices during meat handling, storage, distribution, and processing. *Staphylococcus aureus*, *Salmonella*, *Shigella* species and *Campylobacter* are the common contaminants in the meat (Birhanu et al., 2017). Meat contamination, deterioration and post-harvest meat losses in abattoirs and retail meat outlets result from the use of contaminated water, unhygienic practices like poor handling, use of a contaminated table to display meat intended for sale, and the use of contaminated knives and other equipment in cutting operations (Fasanmi et al., 2010; Li et al., 2006).

Introduction

Meat is a highly perishable food and ideal for the growth of a wide range of spoilage and pathogenic bacteria (Birhanu et al., 2017). It is prone to contamination at various stages from

The annual consumption of meat in Nepal is approximately 250,000 metric tons. Despite its widespread consumption in Nepal, meat is one of the most unsafe food items sold in the market. Poor hygienic practices during slaughtering and marketing of meat are one of the major contributing factors for unsafe meat in Nepal (Bajagai, 2019).

The government of Nepal formulated and enacted the Animal Slaughterhouse and Meat Inspection Act 1999 and Regulation 2001 to regulate the meat market. But, the implementation of the Act is very poor, as most of the meat shop in the country are not able to meet the basic requirements of the Act and Regulations and Standards for meat handling and hygiene practices of butchers are not adequate (Bajagai, 2019; Joshi et al., 2003). Except for very few registered meat shops most are failing to meet the minimum criteria for the production of safe and healthy meat (Bhattarai et al., 2017). Lack of slaughterhouse, lack of proper infrastructure in the slaughtering places and meat shops, shortage of adequately trained personnel, improper slaughtering, and handling of meat and the most importantly the lack of meat inspection and examination, have caused a cumulative effect on improper meat hygiene in almost every part of the country. Meat products coming from such conditions often deteriorate due to bacterial infection or contamination, which may cause serious food poisoning or disease in consumers (Joshi et al., 2003).

According to the report, Nepali eats an average of 11.15 kg of meat per year which was 9.8 kg per year in 2008 and 9.7 kg in 2014 (Ekantipur, 2014). Dharan is one of the largest consumers of meat and meat products in the Nation (Bantawa et al., 2018). The meat shops are scattered all over the city. Butchers slaughter goats, buffalo, pig, and poultry in their premises with poor hygienic conditions (Upadhayaya and Ghimire, 2018). Although in recent days the condition of meat shops has been improved, mainly in terms of working surfaces, freezing and wire netting facilities, hygiene and sanitary practices remain unsatisfactory (Bhattarai et al., 2017). The need for exploring the existing sanitation and hygienic practices by the retail meat shop of the city is justifiable that could be important for designing the preventive program to address public health problems related to meat borne diseases. The study is, therefore, focused on assessing the status of the hygienic and sanitation practices in the growing meat business of Dharan city.

Materials and Methods

Study site and time

The study area was Dharan Sub-metropolitan city, Sunsari District, Province No. 1, Nepal. It is divided into 20 wards. The study was conducted between October-December 2019.

Study design and questionnaire survey

A cross-sectional survey was conducted among retail meat shops located in Dharan Sub-metropolitan City. All the meat handlers who were members of either of two local meat organizations (Masu Byabasayi Shang and Masu Prabidhaik Byabasayi Sang) were included in the study. A total of 117 retail meat shops were randomly selected and interviewed using a semi-structured questionnaire.

During the survey, the interviewer introduced him/herself to the respondent and explained the purpose of the study and assured the respondent that the information would be handled confidentially before commencing with the questions. The questionnaire was focused on personal and general hygienic practices during the handling of meat. To minimize the biased response during the interview, hygienic practices have also been recorded through observation by the interviewer.

Measurement of sanitation and hygiene practice level

The level of sanitation and hygiene practices followed by the meat shops were measured by using the scoring system stated by (Khanal and Poudel, 2017; Paudel et al., 2013). The correct practice was scored as 1 while the wrong or non-practice as 0. There were 21 total statements related to meat hygiene and sanitary practices; one score was assigned per statement and was categorized into binary variables 'poor' (<45% score) and 'fair' (>45% score).

Statistical analysis

For the statistical analysis, the data collected were tabulated and analyzed statistically by using SPSS Statistics Version 20 and Microsoft- Excel 2007. Frequencies and percentages were run to determine distributions. Chi-square (χ^2) test was used to find the relationship between sociodemographic characteristics and practice scores. A p-value of less than 0.05 was considered statistically significant.

Results

Sociodemographic status

Out of 117 meat shops under study, 75.2% of the shops were run by males and handled most of the meat shop activities. Almost all butchers were found to follow the Hindu religion. 74.4% of

meat handlers in Dharan were found to be Adibasi/Janajati community. Among 117 meat shops under study, 43 were chicken meat shops followed by pork, buff, and mutton. 20.5% of the butchers were involved in another side business besides running the meat shop. Most of the butcher (91.5%) had mentioned that they work for more than 8 h in the meat shop (shown in Table 1).

Table 1
Demographic characteristics of the meat handlers (n=117)

Variables	Categories	Frequency	Percent
Sex	Female	29	24.8
	Male	88	75.2
Religion	Hindu	113	96.6
	Muslim	4	3.4
Ethnicity	Brahmin/Chhetri	23	19.7
	Dalit	7	6
	Adibasi/Janajati	87	74.4
Time spent in meat shop	Less than 8 h	9	6.8
	More than 8 h	108	93.2
Type of meat	Chicken	43	36.8
	Pork	30	25.6
	Mutton	20	17.1
	Buff	24	20.5
Side job	No	93	79.5
	Yes	24	20.5

Location and status of meat shops

More than two-third (67.5%) of meat shops were in the market area away from their residence. 13.7% of meat shops were selling the meat in an open environment, and 44.4% had temporary structures (shown in Table 2). Most of the meat shops (80.3%) were near the dumping site or drainage and road. It is obvious that the nearer the meat shops to the road and sewer, more will be the chances of physical, chemical, and microbial contamination.

Table 2
Location and status of meat shop (n=117)

Variables	Categories	Frequency	Percentage
Location	Market area	79	67.5
	Residential	38	32.5
Distance from road	Less than 100 ft	86	73.5
	More than 100 ft	31	26.5
Distance from sewer/dumping	Less than 200 ft	94	80.3
	More than 200 ft	14	19.7
Shop type	Open space	16	13.7
	Permanent closed type	49	41.9
	Temporary closed type	52	44.4
Waste disposal	Nearby open space	30	25.6
	Municipality sewer	76	65
	Own soak pit	11	9.4

Education and knowledge status of meat handlers

Nearly half (42.7%) of meat shops had not registered the business or failed timely renewal. 59.8% of the butchers mentioned that they had received training in meat handling practices and meat hygiene. More than 50% of the butchers had not received any formal education. Only two butchers knew about the Slaughterhouse and Meat Inspection Act, 2055 (SIMA) (shown in Table 3).

Table 3
Education and knowledge status of meat handlers (n=117)

Variables	Categories	Frequency	Percentage
Registration	Yes	67	57.3
	No	50	42.7
Knowledge of SIMA	Yes	2	1.7
	No	115	98.3
Education	Formal	53	45.3
	Non-formal	64	54.7
Training received	Yes	70	59.8
	No	47	40.2

Note. SIMA stands for Slaughterhouse and Meat Inspection Act, 2055

Sanitation and hygienic practices followed by the meat shop

The summary of sanitation and hygiene practices followed by meat shops of Dharan city is shown in Table 4. Only 47.9% of the butchers were found wearing an apron (a protective cloth), but in most cases, it was not properly washed and cleaned. 85.5% of butchers had not covered their hair during meat handling. Even those who had covered their hair were wearing normal winter cap, not the hair net. 84.6% of the butchers handled the meat and money with the naked hand at the same time. Nearly half of the butcher had found to wear jewellery (watch, bracelet, ring etc.) while handling the meat. 28.4% of the butchers had cuts, wounds, and tear in their hands without covering or bandage. Less than half (48.7%) butchers had mentioned that they wash their hands after handling other items and suspected meat.

It was learnt that 41% of butchers would assess physical illness and symptoms of disease before slaughtering the animal while postmortem inspection was almost absent i.e., only 3.4% inspected the meat after slaughtering. Only 23.9% of the meat shop had separate evisceration facility. More than half (52.15%) butchers

mentioned that they did not use a separate knife for the evisceration. It was observed that more than half (54%) had the practice of covering the meat with a cloth and/or spraying the meat with water to make it look fresh. 87.2% of meat shops had a refrigerator for the storage of all leftover meat but the rest 12.8% had no such provision, about 33.3% displayed the meat on the working table or wall.

Table 4
Sanitation and hygienic practices followed by the meat shops

Meat handling practices	Response	Frequency	Percentage (score)
<i>Wearing protective cloth and apron while working?</i>	Yes (1)	56	47.9
	No (0)	61	52.1
<i>Covering of hair while working?</i>	Yes (1)	17	14.5
	No (0)	100	85.5
<i>Wearing of jewellery in hand while handling?</i>	Yes (1)	59	50.4
	No (0)	58	49.6
<i>Presence of wound or illness in butchers' hand?</i>	Yes (0)	8	6.8
	No (1)	109	93.2
<i>Handling money and meat concurrently?</i>	Yes (0)	99	84.6
	No (1)	18	15.4
<i>Handwashing after handling suspected meat?</i>	Yes (1)	57	48.7
	No (0)	60	51.3
<i>Hand washing at the start of meat handling?</i>	Yes (1)	88	75.2
	No (0)	29	24.8
<i>Inspection of the animal before slaughtering (Antemortem)?</i>	Yes (1)	48	41.0
	No (0)	69	59.0
<i>Inspection of the carcass (postmortem)?</i>	Yes (1)	4	3.4
	No (0)	113	96.6
<i>Separate evisceration facility?</i>	Yes (1)	89	76.1
	No (0)	28	23.9
<i>Use of detergent for cleaning utensils?</i>	Yes (1)	21	17.9
	No (0)	96	82.1
<i>Use of detergent for cleaning the working table?</i>	Yes (1)	14	12
	No (0)	103	88
<i>Eating/drinking habits while meat handling?</i>	Yes (0)	87	74.4
	No (1)	30	25.6
<i>Separate knife for evisceration and by-product?</i>	Yes (1)	61	52.1
	No (0)	56	47.9
<i>Display of meat?</i>	Wall hanging (0)	39	33.3
	Chill storage (1)	78	66.7
	Separation of by-product form carcass?		
<i>Covering of meat with wet cloth or spray of water?</i>	Yes (1)	104	88.9
	No (0)	13	11.1
<i>Touching/handling of by unauthorized person?</i>	Yes (0)	54	46.2
	No (1)	63	53.8
<i>Weighing machine in touch with other objects?</i>	Yes (0)	48	41.0
	No (1)	69	59.0
<i>Storage of unsold meat?</i>	Yes (0)	78	66.7
	No (1)	39	33.3
<i>Adequate control of fly and insect?</i>	Working table (0)	15	12.8
	Chill storage (1)	102	87.2
	Yes (1)	30	25.6
No (0)	87	74.4	

Regarding the cleaning facility, the majority (82.1%) of the butchers mentioned that they

cleaner the utensil only with the water/cloth; the rest 17.9% were found to use water with detergent. Similarly, the majority (88%) of butchers used either plain water or cloth for the cleaning of the working table and 12% had the practice of using water with detergent.

Regarding the hygienic practices, it was found that in 41% of cases the meat was found to be handled or touched by an unauthorized person other than the butcher. 74.4% of the butchers had the habit of eating and drinking while working. The weighing machine was found touching other objects (towel, jug, plastics, etc.) in 66.7% of the meat shops. In 88.9% of cases, meat by-products like head, shank, abdominal parts, offal, organ meat were separated properly from the carcass. It was observed that more than two-third (74.4%) of meat shops lacked proper protection against dogs, rodents and insects and flies and dust. Further, there was no proper waste disposal system. 65% of meat shops disposed of the waste in a municipal sewer and 25.6% in nearby open space.

Distribution of level of hygienic meat handling practices

The study revealed that 49 out of 117 (i.e., 41.88%) meat shop had poor sanitation and hygienic meat handling practices (score <45%), and the remaining 58.12 % had a fair level (score >45%), with an average score of 10.21 out of 21 (shown in Table 5). This implies that only around 50% of sanitary and hygienic practices and behavior have been followed by the meat shops/seller in Dharan.

Table 5
Distribution of level of hygienic meat handling practices

Categories/Level	Frequency (n=117)	Percent
Poor (score <45%)	49	41.88
Fair (score >45%)	68	58.12
Score (0-21)	Mean	Range (min-max)
	10.21	6-16
	(48.60%)	

Association of socio-demographic characteristics with meat handling practices

Hygienic meat handling practices were categorized into two levels as fair and poor. Chi-square test revealed that the type of meat handled ($p=0.014$), sex of the butcher ($p=0.008$) and training received ($p=0.001$) was found significantly

associated with meat hygienic meat handling practices. While there was no significant association between location ($p=0.714$), educational status ($p=0.291$), registration ($p=0.136$) and ethnicity ($p=0.215$) with hygienic meat handling practices as shown in Table 6.

Discussion

The present study was conducted to assess the existing sanitary and hygienic practices followed by a retail meat shop located in Dharan City. It was found that nearly 50% of the retail meat shops were not able to meet the criteria for a satisfactory (fair) level. Out of the 117 meat shops under study, 49 were found with a very poor hygiene level. Even in the fairer category, butchers were not able to meet most of the hygienic practices to be followed. Improper handling and unsafe hygiene inevitably lead to contamination of meat, eventually affecting the health of consumers (Algabry et al., 2012). It is unfortunate that till today, the “Slaughterhouse and Meat Inspection Act 1999” has been a failure in terms of implementation. In Nepal, the Act and Regulation have not been enforced to date (Upadhayaya and Ghimire, 2018).

It was observed that wearing protective cloths and hair cover was rarely practised. Such covering not only protects the meat handlers but also minimizes cross-contamination (Upadhayaya and Ghimire, 2018). The practice of wearing jewellery and the presence of wounds and cuts in butchers' hands were common. Pieces of jewellery are the potential source of microorganisms as the skin under the jewellery provides a favourable habitat for the contaminating microorganisms to proliferate. Meat handlers are probable sources of contamination for microorganisms, all possible measures must be taken to reduce or eliminate such contamination (Upadhayaya and Ghimire, 2018). It was found that 84.6% of the butchers handled meat and money concurrently. Khanal and Poudel (2017) also found that most of the butchers in Chitwan district of Nepal handled money with naked hands while handling the meat. The person handling money should not be allowed to handle food during retailing or serving. Since money (paper notes and coins) is usually dirty, it can contaminate the meat with several microorganisms during the exchange (Muinde and Kuria, 2005).

Hand washing practices before starting and after handling the suspected meat was also very less practiced by the butchers. A similar result was also observed by Upadhayaya and Ghimire (2018) and Bhattarai et al. (2017) in Chitwan and Dharan respectively. Poor personal hygiene practices like negligence in washing could contaminate the meat as hands are rarely free from microorganisms (commonly *Staphylococcus aureus* that is present on the skin, nose, and hair). Thus, it is recommended to use detergent and hot running water to reduce the microbiological load on hands (Desmarchelier et al., 1999).

In Dharan, antemortem and post mortem inspection of animal and carcass was rarely practiced this result agrees with those of Upadhayaya and Ghimire (2018) and Bhattarai et al. (2017). The main aim of meat inspection is to provide safe and wholesome meat for human consumption. The antemortem inspection concerns with three main areas: public health, animal health and animal welfare. In the present study, the positive response for the antemortem and post-mortem inspection does not mean any clinical examination but rather implies the observation by butchers themselves based on their experiences. Another study conducted by Joshi in Kirtipur municipality found no pre and post mortem meat inspection by any government authority (Joshi et al., 2003). The study conducted in Dharan municipality in 2012 also supported that no antemortem inspection of animals and post-mortem inspection of carcass and viscera were carried out. Practices regarding slaughtering facility and storage of meat were very poor in many retail shops in Nepal. Practices like lairage facility, separate evisceration facility, selling meat without skin, storage of leftover meat in freeze were found less practiced in several previous studies (Bhattarai et al., 2017; Upadhayaya and Ghimire, 2018).

Observation found that after cutting the meat, the knife, chopping board and most of the utensils were wiped with rags and/or with plain water only. The use of detergent for utensil cleaning was practiced in less than 20% of the meat shops. Covering of meat with wet cloth was practiced in 46.2% of the cases. Though the intention was not wrong, the covering of meat with a wet cloth and water spray may contaminate the meat with pathogenic microorganisms.

Table 6

Factors associated with hygienic meat handling practices (n=117)

Variables	Categories	Level of hygienic meat handling practices		Chi-square value	p-value
		Fair, n (%)	Poor, n (%)		
Type of meat	Buff	15 (62.5)	9 (37.5)	10.547	0.014*
	Chicken	30 (69.8)	13 (30.2)		
	Mutton	13 (65)	7 (35)		
	Pork	10 (33.3)	20 (66.7)		
Location	Market area	45 (57.0)	34 (43)	0.134	0.714
	Residential	23 (60.5)	15 (39.5)		
Registration status	Registered	35 (52.2)	32 (47.8)	2.228	0.136
	Not registered	33 (66)	17 (34)		
Education	Formal	28 (52.8)	25 (47.2)	1.114	0.291
	Non formal	40 (62.5)	24 (37.5)		
Ethnicity	Brahmin/ Chhetri	16 (69.6)	7 (30.4)	1.541	0.215
	Adibasi/ Janajati/ Dalit	52 (55.3)	42 (44.7)		
Sex	Male	45 (51.1)	43 (48.9)	7.113	0.008*
	Female	23 (79.3)	6 (20.7)		
Training	Not received	19 (40.4)	28 (59.6)	10.104	0.001*
	Received	49 (70)	21 (30)		

Note. Values in the parenthesis were percent in a row total. *Significant at $p < 0.05$

The practice of storage of leftover meat, display of meat and separation of meat carcass from meat by-products was quite satisfactory. Whereas other unhealthy practices like touching of weighing machine with other objects, eating habits while working, touching of meat by unauthorized personnel, less protection of meat from flies, insects and rodents were also observed during the study. Such carelessness may pose a greater risk for cross-contamination and may compromise the safety and shelf-life of meat. A similar result was also reported by (Bhattarai et al., 2017; Khanal and Poudel, 2017; Paudel et al., 2013; Upadhayaya and Ghimire, 2018).

The socio-demographic status with the hygienic practices, type of meat, sex of worker and training received were found significantly associated ($p < 0.05$) with hygienic practices. Among the meat type, pork meat handling practices were found poorer. 20 out of 30 pork meat shops fell into the poor category whereas 37.7% buffalo, 35% of mutton, and 30.2% chicken shop were categorized as poorer (less than 45% in hygiene score). This finding agrees with the reports of Bhattarai et al. (2017) in a similar setting. It may be due to the larger body size of the animal and the slaughtering and selling of the meat in open space. The common weakness of pork and buffalo shops were no use of protective cloth, no proper separation of by-products and carcass, poorer fly control, covering of meat with cloth, hanging of meat on the wall, less practice of washing hands, and touching of meat by an unauthorized person.

The education status of the meat handlers was found significantly associated with the hygienic score, a similar result was reported by Tegegne and Phyo (2017). However, Paudel et al. (2013) found no significant correlations between of education level with hygienic behaviors. A previous study in Dharan reported that there was a significant association between the education level of meat sellers and personnel hygiene (Bhattarai et al., 2017).

Sanitation and hygienic practices were found significantly ($p < 0.05$) associated with the sex of the worker; fairer practices were observed among females (79.3%) than males. In general, females are more responsible for cleaning and managing the waste. Also, this might be because females were more associated with handling the chicken meat shop.

There was a significant association between training received with hygienic practices. This result is consistent with the various previous studies (Khanal and Poudel, 2017; Paudel et al., 2013). Training given in sanitation and hygiene should be able to change personnel behavior and attitude as well as impart knowledge (Egan et al., 2007). However, training alone is not sufficient for long-lasting improvement in personnel hygiene. Several studies indicate that more than training is required to convince food industry workers to wash their hands (Michaels et al., 2002). According to Adams and Moss (2008) training of food handlers regarding the basic concepts and requirements of personal hygiene plays an integral part in ensuring safe products to

consumers. Food safety knowledge among food handlers is significantly related to better food handling practices (Nigusse and Kumie, 2012).

Conclusion

From the result, it can be concluded that the present sanitation and hygienic practices followed by the retail meat shops of Dharan are not satisfactory and adequate to avoid the possible cross-contamination and ensuring safer meat for the consumer. The study also reveals that unhygienic practices are more common in pork and buffalo meat in comparison to chicken and mutton meat. As training is strongly associated with good hygienic practices it is recommended that adequate training for meat handlers along with regular monitoring and strict registration be provided by the local authority.

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Compliance with Ethical Standards

Conflict of Interest

The authors declare no conflict of interest.

Ethical approval

The study did not involve any inhumane animal study.

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