



A Study on the Evaluation of Physical Facilities (Infrastructures) and Processing Operational Units of Major Slaughterhouses and Meat Retail Shops in Jammu Districts 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. Author FC managed the literature search. All authors read and approved the final manuscript.

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ABSTRACT

The present study was conducted in Jammu district of Jammu and Kashmir State to study the evaluation of physical facilities (infrastructures) and processing operational units of major slaughterhouses and meat retail shops in Jammu districts of Jammu and Kashmir. Three Major slaughter houses of Jammu district situated at Nagrota, Old Rehari and Gujjar Nagar were selected for the study. 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. Thus, a total of three Major slaughter houses and thirty meat retail shops were selected for the study. Data were collected through interview schedule as well as through observations. The data were coded, classified, tabulated and analyzed using the software;

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Statistical Package for the Social Science (SPSS 16.0). The presentations of data were done to give pertinent, valid and reliable answer to the specific objectives. Frequencies, percentage and mean were worked out for meaningful interpretation. All the slaughter houses located in urban areas were lacking important infrastructure which are necessary for hygienic meat production. Slaughter halls of different size were available inside slaughter houses but none of them were divided into different sections for hygienic meat production. Moreover, the existing buildings were also in poor condition. Inspection for hygienic maintenance of buildings, facilities and processing of carcasses was not made. No sanitary facilities were present in the slaughter houses. Primitive instruments were used which reduced their working efficiency. Meat retail shops lack many important facilities, which are necessary for maintaining the quality of meat. The cleaning practice was not very effective and there was no system for disposal of slaughter waste in both slaughterhouses and meat retail shops.

Keywords: Carcass; infrastructure; inspection; meat retail shops; sanitary facilities; slaughterhouses.

1. INTRODUCTION

India is an agriculture based country and livestock sector is one of the important components of agricultural economy. Livestock can be considered as the backbone of rural economy in India in terms of income, employment, social/gender equity, agricultural sustainability, diversification and foreign exchange earnings. India has largest livestock population (first in buffalo, second in cattle and goat, third in sheep and fifth in poultry population in comparison to world livestock population), with foremost position in milk production, 5th in meat production, 3rd in fish production, 5th in egg production and 6th in broiler production in the world [1]. Presently the country is producing 132 million tones of milk which is 16% of world milk production and 6.27 million tones of meat which is 2.21% of world's meat production. The contribution from buffalo, cattle, sheep, goat, pig, poultry and other species is about 23.33%, 17.34%, 4.61%, 9.3%, 5.31%, 36.68% and 3.37% respectively, to meat production in India [2]. It was noticed that about 8% cattle, 10.6% buffalo, 24.1% sheep, 58.7% goat and 95% pig are slaughtered each year [3]. In spite of having such livestock wealth and uniqueness of number and diversity of meat animal species, the meat and meat products are treated as the byproducts of animal husbandry.

Slaughterhouse is defined as any premises that is approved and registered by the controlling authority in which animals are slaughtered and dressed for human consumption. The purpose of a slaughterhouse is to produce hygienically prepared meat by the humane handling of the animal using hygienic techniques for slaughtering and dressing [2]. At the same time, it enables proper meat inspection to be carried out The resulting waste materials are thus suitably

handled to remove any potential danger or meat-borne infectious agents reaching the public or contaminating the environment [2]. Certain fundamental factors have to be considered in construction of slaughterhouse and components of a slaughterhouse. A suitable site in construction of conventional slaughterhouse should have the following: main portable water and electricity, main sewage, contiguity with uncongested road and rail system, proximity with public transport, proximity to supply of varied labour, freedom from pollution from other industries, odours, dust, smoke, ash [4]. In addition are the needs for remoteness from local housing and other developments to avoid complaints about noise and smell, good quality stock nearby, soil suitable for good foundations including pilling, freedom from flooding, and sufficient space for possible expansion are important factors [4]. The components of a slaughterhouse and other services should include the following; lairage, slaughter hall, gut and tripe room, detained meat room, offal room, condemned meat room, hide and skin room. Others include cutting room, refrigeration room, supply of hot and cold water under pressure, veterinary inspection room, disinfection facilities, personnel welfare room, veterinary office, and facilities for condemned meat offal or carcass disposal; incinerator, chemical treatment and disposal. Sub-standard and unmaintained slaughterhouse infrastructures seriously hamper standard operations for the production of safe and wholesome meat and meat products human consumption, thereby, posing problems of meat hygiene and thus, endangering human health. There are two types of slaughter houses operating in the country, organized and unorganized. In India, there are about 4,000 registered slaughter houses with the local bodies and more than 25,000 unregistered premises, where animals are slaughtered to fulfill the

demands of domestic consumers [5]. Beside these there are about 20 integrated abattoirs-cum-meat processing plants with state-of-the-art facilities for hygienic meat production to meet the export demands, where animals are received from the suppliers who procure the animals from the weekly markets [2]. Most of slaughter houses are highly ill managed, unhygienic, overcrowded [5]. The infrastructure facilities for hygienic slaughter and processing of meat are not adequate to meet the minimum standards of hygiene. Most of the slaughter-houses are lacking basic facilities like water, electricity, ventilation, drainage, ceramic flooring, overhead rails and waste disposal. In majority of the slaughter-houses animals are slaughtered in traditional ways on the open ground with/without further processing or dressing on the floor/rails. Carcasses are exposed to heavy contamination from dung and soil. The quality of meat produced in these existing slaughterhouses is unhygienic and carries high levels of microbial contamination. Enormous quantities of the by-products produced in these slaughter houses are not utilized efficiently and economically. There is also illegal slaughtering in many parts of India. The laws are not enforced upon illegal slaughter of animal. These altogether lead to poor quality of meat. Another safety hazards is caused by infected animals and birds and such animals and their meat not only cause food poisonings when consumed without cooking properly, but also present a risk of zoonotic diseases among persons who slaughter and process them [6]. This study was carried out to evaluate the physical conditions, and functional status of infrastructure as well as the process operations of major slaughterhouses and meat retailer shops of Jammu district.

2. MATERIALS AND METHODS

The present study was conducted in Jammu district of Jammu and Kashmir State to study the evaluation of physical facilities (infrastructures) and processing operational units of major slaughterhouses and meat retail shops in Jammu districts of Jammu and Kashmir. Three Major slaughter houses of Jammu district situated at Nagrota, Old Rehari and Gujjar Nagar were selected for the study. 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. Thus, a total of three Major slaughter houses and thirty meat retail shops were selected for the study. Data were collected through interview

schedule as well as through observations from November 2014 to may 2015. The data were coded, classified, tabulated and analyzed using the software; Statistical Package for the Social Science (SPSS 16.0). The presentations of data were done to give pertinent, valid and reliable answer to the specific objectives. Frequencies and percentage were worked out for meaningful interpretation.

3. RESULTS

3.1 Infrastructure at Slaughter Houses

3.1.1 General information and site of slaughter houses

A careful look at Table1 shows that the slaughter houses selected for the study were located in the urban areas and residential colonies. All the slaughter houses were properly connected with road to facilitate movements of vehicles. The two slaughter houses were located in the amid of dense population and were surrounded with few trees whereas the third slaughter house was environed with less population and no tree was observed around its surroundings. Two slaughter houses were built on high ground and no water logging was noticed whereas water logging was noticed in third slaughter house.

3.2 Access for Animals

An analysis of Table 2 reveals that three wheeler and trucks were commonly used to transport animals to the slaughter houses for slaughtering in SH21and SH2, SH3 respectively. Transportation by hoof was rarely used when sheep/goat are bring to slaughterhouses by local livestock owners.

3.3 Availability of Different Infrastructure inside Slaughter Houses

A perusal of Table 3 clearly indicates that all three slaughter houses lacked many important buildings which were necessary for hygienic meat production. Lairage were available in all three slaughter houses but they were in poor state of maintaince and insufficient to accommodate large number of animals. One slaughter hall was available at two slaughter houses and in third slaughter house three slaughter halls of different size were available but none of them were divided into different sections for hygienic meat production. Others units inside slaughter houses were unavailable except veterinary office, which was also lacking in one slaughterhouse.

Table 1. General information and site of location of slaughter houses

Site	SH1	SH2	SH3
Location	Urban	Urban	Urban
Area	Residential	Residential	Residential
Connectivity by road	Properly connected	Properly connected	Properly connected
Surrounding	Densely populated	Densely populated	Low population density
Vegetation	Treeless	Few tree	Dense tree
Water logging	Yes	No	No

Table 2. Access for animals in slaughter houses

Mode	SH1	SH2	SH3
Truck	No entry for big vehicles like trucks	Commonly used	Commonly used
Three wheeler	Commonly used	Sometime used	Sometime used
Vain	Used	Sometime used	Sometime used
Rail	Not used	Not used	Not used
By hoof	Rarely used	Rarely used	Rarely used

Table 3. Availability of different infrastructure inside slaughterhouses

Building structure	SH1	SH2	SH3
Lairage			
lairage	Available	Available	Available
Sufficient space	Not Available	Not Available	Not Available
Sufficient supply of drinking water	Available	Available	Available
Sufficient feed	Not Available	Not Available	Not Available
Ante mortem section			
Ante mortem section	Not Available	Not Available	Not Available
Slaughter hall: Sections inside slaughter hall			
Stunning section	Not Available	Not Available	Not Available
Bleeding section	Not Available	Not Available	Not Available
Skinning section	Not Available	Not Available	Not Available
Dressing section	Not Available	Not Available	Not Available
Evisceration section	Not Available	Not Available	Not Available
Postmortem section	Not Available	Not Available	Not Available
Other Units inside slaughter house			
Isolation blocks/emergency slaughter unit	Not Available	Not Available	Not Available
Chill room	Not Available	Not Available	Not Available
Detained and condemned meat Rooms	Not Available	Not Available	Not Available
Hide and skin store	Not Available	Not Available	Not Available
Gut and tripe room	Not Available	Not Available	Not Available
Offal room	Not Available	Not Available	Not Available
Meat cutting room	Not Available	Not Available	Not Available
Veterinary office	Available	Available	Not Available
Dispatch room	Not Available	Not Available	Not Available
Effluent treatment plant	Not Available	Not Available	Not Available

3.4 Condition of Slaughter House Buildings and Other Facilities

Condition of lairage and slaughter hall has an important effect on many aspects of slaughter, dressing and production of safe and suitable meat for human consumption. The lairage at

slaughter houses were full and half walls made up of bricks. The space inside lairage was insufficient thus animals were overcrowded and inadequately rested. In such condition, chances of soiling and cross contamination of animals with food borne pathogens were maximized.

An analysis of Table 4 unveils that the hall at slaughter houses had cemented walls, tin roofing and concrete cemented floors. It was observed that the walls and flooring were in poor state in slaughter halls. The plaster was coming out from walls, many cracks and holes in the walls as well as roofs were visible. The gradient for drainage waste water was not proper. Also, there was no separation between clean and dirty section and thus incidences of reversal, intersection or overlapping between the live animals and meat, and between meat and by products or waste were frequently observed which undermined the whole concept of hygienic meat production.

3.5 Availability of Other Facilities inside Slaughter House

During the course of present study, it was observed that other facilities viz. ventilation, drainage, water supply, electricity and disposal of waste for efficient operation of slaughter houses were provisioned but slaughtering and further processing of higher numbers of animals than the permissible limit had made them insufficient. Ventilation was sufficient as the slaughter halls at two slaughter houses had one third walls and half walls in third slaughter house but hygiene was compromised. The drainage was totally blocked because of dumping of solid waste into it. The water was available in plenty but it was not used in the required amount thus cleaning of premises was never satisfactory. The electricity was supplied by government; no source of

artificial light was noticed in slaughter halls. There was no system for disposal of slaughter waste and only one slaughter house had land available for future expansion.

3.6 Pre-operation Hygiene Inspection in Slaughter Houses

Many aspects of poor cleanliness of slaughter halls, equipments and work force have the potential to result in significant contamination of meat. An examination of Table 6 brings to light that except inspection of equipments by butchers, none of others like buildings, facilities or personal were inspected at slaughter houses.

3.7 Cleaning Practices in the Slaughter House Premises

A perusal of Table 7 exhibits that cleaning of slaughter houses was done only at the end of day's operation, but the quality of cleaning practices was insignificant. Due care was not given to remove solid waste such as meat and fat trimmings, blood clots and visceral contents. Butchers were very careful about cleaning their equipments before starting their work and also at the end of work but none cleaned them between slaughtering of different animals. Except floors of slaughter house none of the slaughter house infrastructure was cleaned. The cleaning of equipments and slaughter house infrastructure was done with plain water.



Fig. 1. Transport of animal in stressed condition for slaughtering



Fig. 2. Slaughter hall of different size lacking important sections



Fig. 3. Unhygienic condition slaughter hall lacking processing units



Fig. 4. Unclean Walls and floor of slaughter halls



Fig. 5. Slaughter hall lacking proper drainage slope and waste disposal system



Fig. 6. Uncovered transport of carcass

Table 4. Condition of slaughter house buildings and other facilities

Condition	Lairage			Slaughter hall		
	L1	L2	L3	SH1	SH2	SH3
Height of wall	Full wall	Full	Half wall	1/3 wall	1/3 wall	Half
Types of wall	Brick wall	Brick wall	Brick wall	Cemented	Cemented	Cemented
Types of roof	Tin	concrete	Tin	Tin	Tin	Tin
Type of floor	Concrete	Concrete	Concrete	Concrete	Concrete	Concrete

3.8 Availability of Sanitary Facilities

As evident from the Table 8 that no sanitary facilities like toilets, washbasin and bathrooms were available at slaughter houses. These important facilities to maintain personal hygiene were lacked and created a risk for hygienic meat production.

3.9 Availability of Different Equipments in Slaughter Houses

An analysis of Table 9 reveals that except for very important equipments for slaughtering of animals viz. knives and sharpening steel, other equipments were not available in slaughter houses.

Table 5. Availability of other facilities inside slaughter house

Facilities	SH1	SH2	SH3
Ventilation	Sufficient	Sufficient	Sufficient
Drainage	Proper	Not proper	Not proper
Water supplies:			
i. Premises own hand water	Not available	Not available	Not available
ii. Government supply	Available	Available	Available
Water quality	Clean	Clean	Clean
Electricity supply:			
i. Government supply	Available	Available	Available
ii. Generator facility	Not available	Not available	Not available
Disposal of waste	Poor	Poor	Poor
Land available for further expansion	Not available	Not available	Available
Arrangement of light	Poor	Poor	Poor

Table 6. Pre-operation hygiene inspection in slaughter houses

Hygiene inspection	SH1	SH2	SH3
Slaughter hall inspection	Not doing	Not doing	Not doing
Equipments inspection by butchers	Doing	Doing	Doing
Inspection for personal hygiene	Not doing	Not doing	Not doing
Inspection of delivery vehicle	Not doing	Not doing	Not doing

Table 7. Cleaning practices in the slaughter house premises

Cleaning practices	SH1	SH2	SH3
Time of cleaning practices in slaughter house			
1. At the beginning of the day of operation	Not doing	Not doing	Not doing
2. During the day of operation	Not doing	Not doing	Not doing
3. At the end of the day of operation	Doing	Doing	Doing
Status of cleaning			
1. Equipment	Doing	Doing	Doing
2. Benches	Not doing	Not doing	Not doing
3. Floors	Doing	Doing	Doing
4. Walls	Not doing	Not doing	Not doing
5. Doors	Not doing	Not doing	Not doing
6. Door handles	Not doing	Not doing	Not doing
7. Roof	Not doing	Not doing	Not doing
Cleaning of equipments and building infrastructure			
1. Equipments	Plain water	Plain water	Plain water
2. Infrastructure	Plain water	Plain water	Plain water

Table 8. Availability of sanitary facilities

Sanitary facilities	SH1	SH2	SH3
Toilet facilities	Not available	Not available	Not available
Facilities for hand washing	Not available	Not available	Not available
Possibility for bathing/showering	Not available	Not available	Not available
Cloth changing room for meat handlers	Not available	Not available	Not available

Table 9. Availability of different equipments in slaughter house

Equipment	SH1	SH2	SH3
Solid cutting table	Not available	Not available	Not available
Water sharpening stone	Available	Available	Available
Sharpening steel	Available	Available	Available
Knives	Available	Available	Available
Wrapping table	Not available	Not available	Not available
Paper or plastic foil for meat wrapping	Not available	Not available	Not available
Tool holder	Not available	Not available	Not available
Meat mask/safety gloves	Not available	Not available	Not available
Boning aprons/safety apron	Not available	Not available	Not available
Knife sterilizer	Not available	Not available	Not available

4. INFRASTRUCTURE OF RETAIL MEAT SHOP

4.1 Site and Size of Meat Retail Shops

A careful look at the Table 10 reveals that cent percent meat retail meat shops were located in the residential areas. The shops were also categorized according to their size into three groups' viz. small (less than 40 sq. ft.), medium (41-60 sq. ft) and large (more than 60 sq. ft). Majority of the shops (53.30%) were small whereas 16.70% of shops were large and 30% of shops were medium sized. The small size of majority of shops hinders in hygienic processing, display and sale of meat.

Table 10. Site and size of retail meat shops

Site of shop	Meat retail shops (N=30)	
	Frequency	Percent
Residential	30	100.00
Non-residential	0	0.00
Size of shops		
Small	16	53.30
Medium	9	30.00
Large	5	16.70

4.2 Structure of Retail Meat Shops

A perusal of Table 11 unfolds the status of walls, roofs and floor observed at various meat retail shops. Cent percent of retail meat shop had full walls boundary. With regard to type of wall of meat retail shops it was found that a

considerable proportion (53.30%) of shops had cemented concrete walls whereas 46.70% of retail meat shops had tiled cemented walls. Further it was observed that majority (80.00%) of shops had concrete roof whereas only 20.00% of retail meat shops had tin roof. Cent percent of shops had cemented floor.

Table 11. Structure of retail meat shops

Structure of building	Meat retail shops (N=30)	
	Frequency	Percent
Height of wall		
Full wall	30	100.00
Half wall	0	0.00
Types of walls		
Brick walls	0	0.00
Concrete walls	16	53.30
Any other	14	46.70
Types of roof		
Tin	6	20.00
Concrete	24	80.00
Thatched	0	0.00
No roof	0	0.00
Types of Floor		
Cemented floor	30	100.00
Brick	0	0.00
Kuccha (mud flooring)	0	0.00

4.3 Availability of Other Facilities in Retail Meat Shops

Many facilities like ventilation, electricity, light etc provide good working environment. Thus, during the course of study retail meat shops were

enquired for availability of basic amenities and other facilities which had bearing on hygienic processing, display and sale of meat and meat products. An examination of Table 12 unfolds that majority of shops (50%) had poor ventilation where as only 30% had good ventilation.

The floor of shops must be impervious made up of good quality marbled slab/cemented tiles or good quality concrete cement with proper gradient for draining waste water. It is clear from the Table 12 that a majority of shops (56.70%) had ill formed floors without sufficient gradient for drainage of waste water. Only 43.30% of shops had good drainage system.

Table 12. Availability of facilities in retail meat shops

Facility available in shop	Meat retail shops (N=30)	
	Frequency	Percent
Ventilation in shops		
Good	9	30.00
Poor	15	50.00
No provision of ventilation	6	20.00
Drainage from shop		
Proper	13	43.30
Not proper	17	56.70
Water supply:		
I. Premises own hand pump		
Available	0	0.00
Not available	30	100.00
II. Community/government supply		
Available	30	100.00
Not available	0	0.00
Water quality		
Clean	12	40.00
Not clean	18	60.00
Electricity supply		
Government	25	83.30
Generator facility	05	16.70
No electric supply	0	0.00

Water is very essential for washing carcasses after transportation from slaughter houses and also to maintain personal hygiene as well as cleanliness of shop. Sufficient safe and potable water was not available in majority (60%) of shops. Cent percent of shops were dependent on government supply which was irregular and available for limited time. The improper storage of water in dirt coated plastic buckets and unclean tank was generally observed.

An adequate direct natural light or artificial light are prerequisite for proper display and sale of

meat and an uninterrupted provision of light depends on uninterrupted supply of electricity. It is clear from the Table 12 that significant proportion (80%) of retail meat shops dependent on electricity supply from government which was quite irregular. Further, table indicates that 20% of meat retail shops had generator / inverter connection for source of light.

4.4 Availability of Transportation, Display and Storage Facilities

It was observed that after slaughtering and dressing of sheep and goat, the retailer transported the dressed carcasses to their respective shops for sale. An analysis of Table 13 displays that majority of retailers (53.30%) were using three wheeler for transportation of carcass from slaughterhouses to retail meat shops, whereas 23.30%, 16.70% and 6.70% of retailers were using two wheelers, van and cart for transportation of carcasses. Table 13 further explains that care was taken to cover the carcasses while transportation. Considerable proportions of respondents (60%) were using cloths to cover the carcasses. It was further observed that though carcasses were covered, it was not effectively covered and chance of hazards of chemical, physical and biological contamination was high. Stacking of carcasses one over the other increased the chance of cross contamination. The vehicles used for transportation were dirty and ill designed for transportation of carcasses/meat.

A proper display of a commodity to be sold is essential to attract potential consumers. A perusal of Table 13 exhibits that the retailers were using various combination of display method to attract consumers. Open display of carcass by hanging was observed by majority of meat retail shops (96.70%) while open display by keeping it on table surface was observed in 3.30% of meat retail shops. Refrigerated glass box was not seen in any meat retail shops. The Cent percent retailers were noticed to wrap the carcass in cloths to protect the carcasses from dust, dirt and direct sunlight. None of them use any special method to protect carcasses from environmental contamination.

During the course of study it was observed that consumers generally preferred to consume meat from freshly slaughtered carcasses, thus need for storage of meat was not felt by many retailers. As evident from table 53.30% of retailers possessed refrigeration facility in their

shops while 46.70% retailers had no facilities for storage.

4.5 Cleanliness Practices in the Retail Meat Shops

The retail meat shop should maintain sufficient cleanliness and have protection from direct sunlight, dust and wind. An analysis presented in Table 14 evidences that 66.70% of retailers got their shop cleaned at the beginning of day's operation while 60.00% also cleaned the shop during the day's operation and 83.30% at the conclusion of day's operation. The cleaning practice was not very effective, and time of cleaning was flexible.

Time spent on cleaning in a day is a good estimate of effectiveness of cleaning and the Table 14 further unveils that in 66.70% of retailer shops cleaning was completed within one hour while 33.30% of shops, it took between one to two hours.

During the course of study it was noticed that different furniture's, instruments and setting were not cleaned regularly. An investigation of Table 14 uncovers that in all shops meat cutting instruments and floor were cleaned. Benches, wall, door and door handlers were cleaned in 20.00%, 56.00%, 30.00% and 13.30% of shops respectively.

Handling of both liquid and solid waste influences both hygienic and general aesthetic appearances of retail meat shops. A perusal of Table 14 indicates that only, 33.33% of retail meat shops were maintaining good system of waste disposals, while rest of retail meat shops lacked in the regard.

Pests (insects and rodents) should be controlled to prevent their access to displayed or stored carcasses. As evident from table chemicals (30.00%) and mouse trap (6.70%) were normally used whereas 63.30% of shop had no measures against insect and rodents.

Table 13. Availability of transportation, display and storage facilities in meat retail shops

Facility available in shops	Meat retail shops (N=30)	
	Frequency	Percent
Transportation facility for carcass from slaughter houses to meat shops		
Cart	2	6.70
Two wheeler	7	23.30
Van	5	16.70
Three wheeler	16	53.30
Truck	0	0.00
Display facilities		
Open display by keeping on table surface	1	3.30
Open display by hanging	29	96.70
Glass box	0	0.00
Refrigerated glass box	0	0.00
Method to prevent dust		
Wrapping carcass by cloth	30	100.00
Wiping by cloth	0	0.00
Frequent washing	0	0.00
Storage facilities		
Refrigeration	16	53.30
Deep freeze	0	0.00
Ice box	0	0.00
No facility	14	46.70
Packaging facility during transportation		
Carcass covered in cloth	18	60.00
Uncovered	12	40.00
Carcass covered in plastic sheet	0	0.00

Table 14. Cleanliness practices followed at retail shops

Cleanliness practices	Meat retail shops (N=30)	
	Frequency	Percent
Cleaning shop		
At the beginning of the day of operation	20	66.70
During the day of operation	18	60.00
At the end of the day of operation	25	83.30
Cleaning of other facilities		
Equipment	30	100.00
Benches	60	20.00
Floors	30	100.00
Walls	17	56.70
Doors	9	30.00
Door handles	4	13.30
Time spent on cleaning per day		
< 1 hrs	20	66.70
1-2 hrs	10	33.30
< 2 hrs	0	0.00
Waste disposal system		
Good	10	33.30
Poor	20	66.70
Pest control system		
Control of rodent and insect by chemicals	9	30.00
Use of electric fly killer	0	0.00
Control of rodent by mouse trap	02	6.70
No control measure	19	63.30

5. DISCUSSION

All the slaughterhouses were located in the urban areas with residential colonies around them. The slaughter houses were lacking many important infrastructures which are necessary for hygienic meat production; moreover the existing buildings were also in poor state. Lairage were available in all the three slaughter houses but they were in poor state of maintaince and were insufficient to accommodate large number of animals. Similarly Joshi et al. [7] studied the slaughterhouses infrastructure and meat handling practices of butchers and, observed that most of the slaughter houses were located in residential areas and the lack of appropriate slaughtering facilities and unsatisfactory slaughtering techniques are causing unnecessary losses to meat as well as invaluable by-products from animal carcasses. Slaughter halls of different size were available inside slaughter houses but none of them were divided

into different sections for hygienic meat production. Others units were unavailable except the office of veterinary officer. Similar finding were observed by Adetunji et al. [8] who reported that poor hygienic condition of the abattoir, lack of sterilization points, continuous use of a single knife, contact with dirty or contaminated surfaces and lack of separation between clean and dirty processes yields unhygienic meat. Three wheelers were commonly used to transport animals to slaughter houses where as only one slaughter house had facility of trucks and vans for transportation of animals. Ventilation was sufficient as the slaughter halls at two slaughter houses had one-third walls and half walls in other slaughterhouse, but hygiene was compromised. The drainage was poor and totally blocked because of dumping of solid waste into it. The water was available in plenty but it was not used in the required amount thus cleaning of premises was never satisfactory. The electricity was supplied by government; no source of artificial light was noticed in slaughter halls. There was no system for disposal of slaughter waste. Inspection for hygienic maintaince of buildings, facilities and processing of carcasses was not made. Primitive instruments were used which reduced their working efficiency. Animals were slaughtered and dressed in unhygienic way. These findings were in agreements with findings of Upadhyaya et al. [9] who reported that infrastructure at slaughter houses and retail meat shops were lacking dressing facilities, drainage, differentiation between clean and unclean operations, and a general lack of basic maintenance of hygiene and sanitation.

All the retail meat shops were located in the residential areas. Majority of the shops (53.3%) were small whereas 16.7% of shops were large and 30% of shops were medium size. All retail meat shop had full wall and most of shops (80%) had concrete roof whereas only 20% of retail meat shop had tin roof. Major proportion of shop (56.7%) had ill formed floors without sufficient gradient for drainage of waste water while majority of shops (50%) had poor ventilation where as only 30% had good ventilation. Majority of meat retailers (53.3%) were using three wheeler for transportation of carcass from slaughterhouses to retail meat shops. Open display of carcass by hanging was observed by majority of meat retail shops (96.7%) while open display by keeping it on table surface was observed in 3.3% of meat retail shops. Similar finding have been reported earlier by Bogere & Baluka [10] who reported that all the meat

retailers displayed meat openly by hanging, while open display by keeping it on table surface was also observed. Most of the retailers (53.3%) possessed refrigeration facility in their shops while 46.7% retailers had no facilities for storage. Similar finding were observed by Thakur et al. [11] who reported that refrigeration was mostly employed for meat preservation by chicken sellers comparative to the mutton sellers. In all retail meat shops meat cutting instruments and floor were cleaned, while benches, wall, door and door handlers were cleaned in 20%, 56%, 30% and 13.3% of shops respectively. Cleaning was finished within one hour in 66.7% of retailer's shop, while 33.3% of shops took between one to two hours. The cleaning practice was not very effective. Similarly Adetunji et al. [8] and Upadhyaya et al. [9] observed that lack of proper cleaning practices not only deteriorate the quality of meat but also increase microbial load. Only 33.33% of retail meat shops were maintaining system for waste disposals, while rest of retail meat shop lacked in this regard. Chemicals and mouse trap were normally used against insect and rodents by 30% and 6.7% meat retailers respectively. The findings were also in agreement with the findings of Junaidu et al. [12] who reported that about 84% of the respondents used chemical as a method of pest control.

6. CONCLUSION

All the slaughter houses located in urban areas were lacking important infrastructure which are necessary for hygienic meat production. Moreover, the existing buildings were also in poor condition. Inspection for hygienic maintainance of buildings, facilities and processing of carcasses was not made. No sanitary facilities were present in the slaughter houses. Primitive instruments were used which reduced their working efficiency. Animals were slaughtered (by both Halal and Jhatka method) and dressed in unhygienic way.

Meat retail shops lack many important facilities, which are necessary for maintaining the quality of meat. Personal hygiene was poorly maintained by meat handlers owing to their illiteracy, unawareness, lack of facilities and nature of work. Proper hand washing facilities were unavailable at slaughterhouses and retail meat shops. The cleaning practice was not very effective and there was no system for disposal of slaughter waste in both slaughterhouses and meat retail shops.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the authors.

SUGGESTIONS

- Slaughter houses infrastructure (slaughter house facilities and equipments) should be redesigned and reconstruction on scientific line in order to gain the faith of consumers in meat produced at slaughterhouses.
- Authorities should closely monitor and regulate proper slaughtering, slaughtering facilities, meat production units and retail meat shops.
- There should be periodic surveillance of environmental contamination in the abattoir and the retail meat shops.
- There should be regular monitoring of slaughterhouses, meat retail shops and their sanitary facilities.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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