

ASSESSMENT OF ANIMAL WELFARE STATUS DURING TRANSPORTATION AND SLAUGHTERING OF RUMINANT ANIMALS AT LOCAL SLAUGHTER HOUSES IN BANGLADESH

K. C. Rudra, S. Mazumdar, S. A. Shanta, A. K. M. A. Rahman and M. A. Islam*

Department of Medicine, Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh *E-mail: maislam77@bau.edu.bd

ABSTRACT

Background: Most of the developing countries including Bangladesh where humane treatment of slaughter animals is not satisfactorily practiced mainly due to poorly developed and implemented animal welfare legislation resulting in stress conditions and excessive suffering of animals.

Objectives: The objective of this study was to assess the animal welfare knowledge and attitudes of animal transporters and butchers during transportation and slaughtering animals in local slaughter houses in Bangladesh

Materials and Methods: This study was carried out from July to October 2017 at 40 local slaughter houses of 10 Upazilas in Mymensingh district. A pre-structured questionnaire was used to collect information from butchers at pre- and during slaughtering animals. The welfare data of 123 ruminant animals (84 cattle, 31 goats and 8 sheep) which were subjected to slaughter was collected by direct observation and examination.

Results: Meat animals are usually purchased from the local market, some from farms and even from imported Indian cattle are usually transported from far away to slaughter houses. Significantly ($p < 0.01$) highest percentage of animals were transported by walking (42.28%), followed by truck (22.76%), pick-up van (20.33%), local vehicle (11.38%) and lowest by auto-rickshaw (3.25%). Small ruminants were kept in a lair-age for 1 to 2 days but most of the cattle were slaughtered upon arrival. Out of 123 animals investigated, 0.81 to 4.07% had lameness, 0.81 to 10.57% had skin lesions and 4.06 to 18.69% had dirty conditions in the different body regions. Diarrhea was recorded in 4.88% animals whereas 7.32% had nasal and 4.07% had ocular discharges. Lair-age was found in 85% slaughter houses with pacca (15.0%), kaccha (45.0%) and semi-pacca (40.0%) conditions but 80% had no bedding materials and 92.5% dirty floor condition. Mostly jute rope (89.43%) and halal method (100%) were used for casting and slaughtering of animals respectively without regular veterinary inspection. The stress caused by transportation and slaughtering of animals were not minimized due to lack of practice of animal welfare legislation in Bangladesh.

Conclusions: The insufficient knowledge of animal transporters and butchers about animal behavior and animal welfare suggests that there is a need to improve animal welfare situation through training to the concerned people. Humane slaughter of animals may reduce the incidence of injury to the animals and less bruise to the carcasses that improve the meat quality.

Keywords: Transportation, Slaughter house, Animal welfare, Animal handling, Butchers

Article Info: Article Code No. © LEP: JVMOHR/00008/2019

Received: 20 May 2019 Revised: 11 June 2019 Accepted: 20 June 2019 Published: 30 June 2019

Citation: Rudra KC, Mazumdar S, Shanta SA, Rahman AKMA and Islam MA (2019). Assessment of animal welfare status during transportation and slaughtering of ruminant animals at local slaughter houses in Bangladesh. *J. Vet. Med. OH Res.* 1 (1): 85-98



Copy right © 2019. The Authors. Published by LEP. This is an open access article under the CC-BY-NC-ND License (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

INTRODUCTION

Animal welfare is a human responsibility which includes consideration in all aspects of animal welfare, including proper management, feeding, watering, housing, disease prevention and treatment, responsible care and humane handling. Inappropriate handlings before slaughter of animals are exposed to different stress inducing factors such as vibration, physical fatigue, skin injury, noise, high temperature that cause to reduce meat quality. Animal welfare is becoming a growing concern worldwide.¹ Animal welfare problems are always related to inadequate facilities and equipment, distractions obstructing animal movement, lack of training of personnel, poor maintenance of equipment and improper handling.² Nowadays, animal welfare problems receive great attention and scientific research activities are increasing. Stress response in animals is adaptive to a certain degree, but when the stress level passes a certain threshold, animals do not adapt and enter a stressed state.³ The stressful situation can cause psychological and physiological disturbances. Stress before slaughter can cause undesirable effects on the end quality of meat, such as pale, soft, exudative (PSE) meat and dark firm dry (DFD) meat as a result of poor animal welfare. If the animals are stressed before and/or during slaughter, it affects not only animal welfare but can also give non-desirable consequences on the meat quality.⁴ Pre-slaughter transport and handling of animals are accompanied by many stressful events, which affect animal welfare and meat quality.⁵ Pre-slaughter handling involves a number of critical points which include loading of animals at the farm, transport from farm to abattoir, unloading of animals at the abattoir, and slaughter.⁶ The abattoir system in the developed world is quite different from that in the developing world. While the abattoir system in the developed world provides services that are geared towards meat quality whereas the abattoir system in the developing world typically may not always consider animal welfare and meat quality issues.⁷ Developing countries, like Bangladesh modern restraining devices of animals are not available in local slaughter houses. Additionally, there is no application of humane slaughtering methods and the animals are transported to slaughter houses without any legal restrictions, so slaughter depends on the expectations of the local slaughter men and slaughterhouse owners / managers.⁸ Most of the cattle are slaughtered without stunning in Bangladesh, not only due to religious reasons, but also because of continued traditions and lack of further knowledge about modern slaughter techniques. Published reports on the animal welfare status during transportation and slaughtering of animals in Bangladesh are very limited.⁸⁻¹⁰ Considering these facts, the present study was conducted to evaluate the animal welfare status during transportation and handling animals at pre-and during slaughtering at the local slaughter houses.

MATERIALS AND METHODS

A study on the status of animal welfare during transportation and handling of animals by butchers was conducted in local slaughter houses of Mymensingh district in Bangladesh during the period from July to October 2017. During the visit, the concerned peoples of slaughter houses were informed of the purpose of the study and assured that their participation will be voluntary and their identity would be kept confidential. The on-spot questionnaire was conducted for half an hour with slaughter house workers. The welfare data of animals which

were subjected to slaughter was collected by direct observation and examination in slaughter house.

Slaughter area and animals

A total of 40 slaughter houses were selected from 10 Upazilas of Mymensingh district for this study. The Mymensingh Sadar consisted of 18, Tarakanda 8, Phulpur 12, Haluaghat 11, Ishwarganj 14, Gouripur 13, Trisal 12, Valuka 14, Phulbaria 10 and Muktakasa 11 animals. The size and capacity of these slaughter houses varied from 5 to 8 slaughtering ruminant animals (cattle, goat, and sheep). A total 123 animals of which 84 cattle, 31 goats and 8 sheep were subjected to slaughter and examined during this study. The animal handling and welfare was more or less similar in all local slaughter houses in Mymensingh district.

Data collection

Data were collected through questionnaire, examination and visual inspection of animals and taking photographs. Face-to-face interviews with the slaughter house workers were carried out using a questionnaire with multiple-choice and semi-closed questions to collect animal-linked parameters related to welfare. The first part of the questionnaire referred to the welfare assessment parameters such as way of transportation of animal, type of animal (breed, species, age, sex), body condition score (BCS), body injury or lesions, lameness, cleanliness of different body parts, most important diseases (ocular and nasal discharge, diarrhea), eye mucus membrane. The animal welfare measurement parameters were particularly on feeding, housing, and health, which were selected from the Welfare Quality[®] Assessment Protocol for Cattle (Welfare Quality[®], 2009) established by the European Union. The only item recorded regarding feeding and watering whether the animals were fed and watered while they were kept in a lairage.

The second part of the interview covered the data on animal transportation and handling procedure and management system prior to slaughter of animals. The collected parameters were casting material and procedure, slaughtering tools, sharpness of tools, and injury of the skin after slaughter. At all times, workers of slaughter house had the opportunity to clarify questions and add personal information and remarks.

Body condition scoring (BCS)

A four point body condition score system for cattle was used, in which a score of 0 was very thin, and a score of 3 was very fat. Cattle were classified as BCS 0 = very thin, BCS 1= thin, BCS 2 = ideal, and BCS 3 = obese. A BCS 2 was considered to be acceptable for good body condition.

Cleanliness score

A scoring chart divided the animal body into five identifiable areas which were rated on a scale with anchor points at each end (0: clean and 1: dirty). The five regions were: neck, fore limb, hind limb, flanks and hip.

Lameness score

Lameness is painful to the animal; it is a serious welfare issue as animal injured badly during handling and improper transportation. Locomotion scoring is based on the observation of cattle standing and walking (gait), with special emphasis on their back posture. Data were collected when cattle, sheep and goat were present in different traditional slaughter area. A score of 0 to 3 was used, where 0 was assigned when the animal was not lame (normal gait), 1 was given when the animal was mild lame, 2 for moderate lameness in animals and 3 was recorded when the animal was suffering from severe lameness.

Skin lesions and injury of body regions

During data collection on slaughter area, cattle, sheep and goat were inspected for different lesions on different parts of animal body. The lesion and injuries was observed directly and data was collected by observation of two sides of the body with some modification: the area around the carpal and tarsal joints, any lesions on head, abdomen and tail and percentage of cattle per Upazila that presented skin lesions in each area was calculated.

Disease conditions

Direct observations / clinical examinations but without touching the animal was done to observe whether the disease is present or not. Nasal discharge, eye discharge, diarrhea were examined under this study. A scale, 0 = little or no evidence of discharge; 1 = evidence of clearly visible flow / discharge from the nostrils; transparent to yellow / green and often of thick consistency was used.

Pre-slaughter handling of animals

A total of 31 respondents butchers were selected purposively and interviewed using semi-structured questionnaires. The availability of lairage and its conditions was also assessed. Observations were also made to further assess the pre-slaughter handling and casting procedure of animals and injury of skin in any parts of skin after casting. The slaughtering tools and its sharpness (knife, machete and scalpel) were also observed.

Data Analysis

The collected data were analyzed using descriptive statistics and the results presented in the form of percentages in tables. The Chi-square test was also applied for test of significance.

RESULTS

A total of 123 ruminant animals (84 cattle, 31 goats and 8 sheep) were examined to study the animal welfare status during transportation and pre-and at slaughtering period and their results are presented in **Table 1**.

Transportation of animals

The cattle, goats and sheep were walked in groups of approximately five animals to the local abattoirs or transported in different-sized vehicles (**Table 1**). Most of the animals were to slaughter houses by walking (42.28%) after purchase in local market (**Table 1**). When

Animal welfare in slaughtering animals

purchased from far distance then animals were transported to slaughter houses by truck (22.76%) and pickup (20.33%). The small ruminants such as sheep and goat were transported by local vehicle (11.38%) and auto-rickshaw (3.25%). The animals were fitted with rope halters, some of which passed through the nasal septum, or a simple rope around the neck. Animals were kept in a lair-age for 1 to 2 days or were slaughtered upon arrival (numbers not quantified). Imported cattle e.g., Haryana and Kankrej breeds and indigenous cattle, sheep and goat were slaughtered in Mymensingh Sadar, Gauripur, Valuka, and Muktagasa. Both local and cross breed cattle, local sheep and Black Bengal goats were slaughtered in the other Upazilas's slaughter houses.

Body condition Scoring (BCS)

Body condition is a subjective assessment of the amount of fat or amount of stored energy, which animals carries. Significantly ($p < 0.01$) highest percentage (69.11%) of animals in all slaughter houses showed BCS 2 (**Table 1**).

Table 1. Conditions and measures associated with animal welfare at pre-and during-slaughtering period					Table 2. Assessment of animal welfare to health conditions and facilities at abattoir				
SN Factors/ measures	No. of animal status			Overall No. (%)	SN Body regions	No. of animals affected			Overall No. (%)
	Cattle (n=84)	Goat (n= 31)	Sheep (n=8)			Cattle (n= 84)	Goat (n= 31)	Sheep (n=8)	
A. Transportation					A. Skin lesions				
1. Walking	35	14	3	52 (42.28)*	1.Head	01	0	0	01 (00.81)
2. Truck	28	0	0	28 (22.76)	2.Neck	04	0	0	04 (03.25)
3. Pick up	16	08	1	25 (20.33)	3.Shoulder	05	1	0	06 (03.25)
4. Local vehicle	05	07	2	14 (11.38)	4.Fore limb	02	2	0	04 (03.25)
5. Auto- rickshaw	0	02	2	04 (03.25)	5.Back	06	5	1	12 (09.76)
B. BCS status					6.Hind limb	07	4	2	13 (10.57)
1. Score 1	22	07	0	29 (23.58)	Total	25	12	3	40 (32.52)
2. Score 2	57	21	7	85 (69.11)*	B. Dirty skin				
3. Score 3	05	03	1	09 (07.32)	1.Neck	03	02	0	05 (04.06)
C. Lameness					2.Forelimb	08	03	1	12 (09.76)
1. Sound	79	29	8	116(94.31)*	3. Flank area	07	06	4	17 (13.82)
2. Mild	04	01	0	005(04.07)	4.Hips	12	07	1	20 (16.26)
3. Moderate	01	01	0	002(01.63)	5.Hind limb	14	06	3	23 (18.69)
4. Severe	01	0	0	001(00.81)	Total	44	24	9	77 (62.60)
					C. Discharges				
					1.Nasal	5	3	1	09 (07.32)
					2. Ocular	3	2	0	05 (04.07)
					3.Diarrhea	2	4	0	06 (04.88)
					Total	10	9	1	20 (16.26)

Significant at ($p < 0.05$)

Lameness

Table 1 shows that the majorities of the slaughtered animals (94.31%) were found sound in locomotion investigation during pre-slaughter stage. However, 0.81 to 4.07% animals showed varied degree of lameness (**Photo 1**) at pre-slaughter (**Table 1**).

Skin lesions

The occurrence of skin lesions varied from 0.81 to 10.57% in different body regions of animals recorded at pre-slaughter period (**Table 2**). Significantly ($p < 0.05$) highest percentage (10.57%) of animals had skin lesions (**Photo 2 & 3**) in hind limb in comparison to other body regions especially head regions (0.81%) of animals (**Table 2**).

Cleanliness

The majority of the animals (81.30 to 95.93%) were found to have clean condition in different parts of body. The dirty percentage in different body parts (**Photo 4 & 5**) varied from 4.06 to 18.69% (**Table 2**).

Diseases and discharges

Table 2 represents the findings of disease conditions and discharges at pre-slaughter examination. Of the 123 animals examined, only 6 (4.88%) had diarrheic syndrome. In addition, 9 (7.32%) animals had nasal (**Photo 6**) and 5 (4.07%) had ocular (**Photo 7**) discharge at pre-slaughter period (**Table 2**).

Pre-slaughter inspection and veterinary certification

There was no regular veterinary inspection prior to slaughtering in the selected slaughter house. But, veterinary inspection was found to be performed in 17 slaughter houses (weekly) 12 slaughter houses (monthly) and the rest slaughter houses (rarely). There was no veterinary certification (seal on carcass) for human consumption except Mymensingh Sadar. The animals were fed and watered in all abattoirs except 4 slaughter houses and the feeding was generally ceased 8 to 12 hours before slaughter.

Lairage status and facilities in slaughter houses

The lairage status of slaughter houses at different Upazillas in Mymensingh district is shown in **Table 3**. Lairage facility was present in 85.0% of the slaughter houses but most (92.5%) of their condition was dirty. Most of the lairage is kacha (45.0%), followed by semi-pacca (40.0%) (**Photo 8**) and pacca (15.0%), respectively and most (90.0%) of the lairage manger was found dirty. Most (80.0%) of the lairage did not use any bedding material (**Table 3**).

Restraining materials and slaughtering tools

Jute ropes (**Photo 9**) were used for casting highest percentage (89.43%) of animals in most of the slaughter houses in Mymensingh district, and both jute and nylon ropes were used in Phulpur, Haluaghat Upazila local slaughter houses (**Table 3**). The restraining of large ruminants was performed usually by 3 to 4 persons (**Photo 10**) and small ruminants by 1 to 2 persons (**Photo 11**). The total casting process generally required 3 to 4 minutes. For large animals, country / local restraining method was used in most of the slaughter houses with halal method.

Animal welfare in slaughtering animals



Photo1. Lameness in the hind legs of a goat at the slaughter house



Photo 2. Skin lesions on both the legs of a goat at the slaughter house



Photo 3. Skin injury (healed) lesions in a goat at the slaughter house



Photo 4. Dirty body coat of an ill-health goat at the slaughter house



Photo 5. Dirty hind limb surface of a cattle at the slaughter house



Photo 6. Nasal discharge of a goat at the slaughter house



Photo 7. Muco-purulent discharges from eyes of a goat at the slaughter house



Photo 8. Rough semi-pacca floor of a slaughter house



Photo 9. Restraining of a cattle by using jute rope at the slaughter house



Photo 10. Slaughtering of a cattle by halal method at the slaughter house



Photo 11. Slaughtering of a goat by halal method at the slaughter house



Photo 12. Different types of tools used for slaughtering and processing of carcasses

SN Parameters	Lairage status	No. (%)	SN Parameters	Lairage status	No. (%)
1. Lairage	Available	34 (85.0)	4. Manger & water	Present	04 (10.0)
	Absent	06 (15.0)		Absent	36 (90.0)
	Dirty	37 (92.5)	5. Cleaning interval	Daily	26 (65.0)
	Clean	03 (07.5)		Alternate day	14 (35.0)
2. Types of lairage	Kacha	18 (45.0)	6. Restraining materials	Jute rope	110 (89.43)
	Semi-pacca	16 (40.0)		Nylon rope	13 (10.57)
	Pacca	06 (15.0)	7. Slaughtering tools	Sharp	60 (98.84)
3. Bedding materials	Present	08 (20.0)		Blunt	01 (01.66)
	Absent	32 (80.0)			

For small ruminants, all four legs were tied by ropes and were left on soil floor for 5 min before slaughter in all local slaughter houses in Mymensingh district. The slaughtering tools such as knife, seizure, scalpel and machete were used in most of the slaughter houses (**Photo 12**). A total of 61 tools were found to be used for slaughtering of which 98.84% were sharp (**Table 3**).

Slaughtering procedure

Most of the slaughter houses under this study followed halal method for slaughtering animals. Muslim (Halal) slaughter involves the sticking of an animal without it having been previously stunned. The animal is handled and stuck while still conscious. It is believed by defenders of this method that this ensures a thorough bleed-out of the animal, leads rapidly to unconsciousness and is painless.

DISCUSSION

Animal welfare refers to the state of the animal treatment that an animal receives is covered by other terms such as animal care, animal husbandry and humane treatment. Protecting an animal's welfare means providing for its physical and mental needs. Animal rights mean that animals are not to use for food, clothing, entertainment or experimentation but animal welfare allows these uses as long as 'humane' guidelines are followed.

To our knowledge, no any animal welfare organization is concerned with animals slaughtering issues in Bangladesh. Nowadays, animal welfare is not only a concern of developed nations, but also it has become an issue for official attention on a global level.¹¹ However, other than the OIE standards, the Animal Cruelty Act 1920 was enacted by the British Government for Indian Sub-continent is still active in Bangladesh. This study addressed all animal welfare issues at local slaughter houses in Mymensingh district in Bangladesh.

During transport, particularly on rough roads, transmission of vehicle floor vibration to animals can be significant and can create uncomfortable conditions by displacing the center of gravity of the animal, resulting in body disturbance, poor welfare and ultimately impaired meat quality.¹² The type of vehicle, the bedding, the distance travelled to the destination may have

some bearing but the final decision must have the welfare of the animal as the paramount consideration. No animal should be transported unless it is fit for the intended journey, and all animals should be transported in conditions guaranteed not to cause them injury or unnecessary suffering. During handling and transport, animals were subjected to many different potential stressors like heat, cold, poor air quality that affect the welfare and health of animals up to death.³ There were no special vehicles for animal transportation in Bangladesh. Special type of vehicle should be required having rubber sheet in the ridge if the vehicle that can save the animal from injury. In Tarakanda and Haluaghat Upazilas, slaughter houses located at livestock market and most of the animals were transported by walking to the slaughter houses. Several animals were injured by the rough handling during pre-slaughter casting at the Muktagacha, Gauripur and Ishwarganj Upazilas slaughter houses.

Pre-slaughter events begin the moment animals are led and loaded on a truck / vehicle at the farm to be sent for slaughter. Transportation often involves unusual and tense exposure like crowding, noisy vehicles without access to food and water or space to rest, pre-transport management, vibrations, social regrouping, restraint, loading and unloading, transportation duration and climatic factors.¹³ Long transportation hours in poor condition transportation vehicles may be unfavorable to animal welfare¹⁴ and transportation to the abattoir should not take more than 16 hours.¹⁵ Pre-slaughter stress during transportation has also been reported to influence the immune responses of cattle,¹⁶ which may result in the release of stress hormones.¹⁷ Stress activates the animal's hypothalamic-pituitary-adrenal activity, triggering release of various stress hormones such as catecholamines and cortisol, thus glycogen depletion prior to slaughter, elevated ultimate pH and poor muscle-meat conversion. Pre-slaughter stress sometimes results to animals attaining bruises, resulting to the affected parts of the carcass being trimmed and condemned for human consumption, downgrading of the carcass and thus profit losses.¹⁵ Ensuring good transportation is not only of animal welfare and meat quality importance but it is also of economic importance.¹⁸ Pre-slaughter handling stress does not only affect the welfare of the animals, but also to a greater extent has an impact on the quality of meat produced from animals of different species.¹⁹⁻²² Pre-slaughter handling affects meat quality attributes like color, pH and texture.^{20,21,23} Stress-related behavioral and physiological changes have been reported to reduce the quality of meat through glycogen depletion and elevated ultimate pH.²¹ Rapid depletion of muscle glycogen during handling, transportation, pre-and post-slaughter results to low lactic acid production, thus dark, firm and dry meat produced. Glucose in the blood and glycogen in the muscle promotes glycolysis and thus the formation of lactic acid resulting in tougher meat with higher cooking losses. Longer transportation time and higher stocking density significantly affected pH and thus reduced meat quality.

Body condition scoring can be measured using only indicators or a combination of visual and palpation of key bone structure for fat cover. The key areas for evaluations are the backbone, ribs, pin bones, tail head and brisket. Body condition scoring is needed for determining the animal welfare (particularly animal health status). In this study, about 76.43% (BCS \geq 2) healthy animals have been observed prior to slaughter.

Lameness is a common condition in ruminant animals. There are very few circumstances where lameness is not a painful condition. As a general rule therefore, any animal that is suffering lameness in one or more legs must not be transported unless for reasons of veterinary diagnosis or treatment. Transport of animals with non-limb fractures (i.e. tail or jaw) may be done directly to slaughter with special provisions. Very few injured animals were observed in the local slaughter houses in Mymensingh district. Injuries due to long distance transports have been reported by others as well.⁹ Appropriate veterinary treatment should be given and if necessary emergency slaughter can be performed which does not cause them any unnecessary suffering.

Only healthy animals should be slaughtered for human consumption. The veterinarian must carry out an ante-mortem inspection of the animal and must be satisfied that the animal was healthy before slaughter. In this study about 55% animals were inspected by local veterinary surgeon prior to slaughter houses. Very few diseased animals were intended to slaughter.

The use of a lairage prior to slaughtering is necessary provided with hygienic floor, bedding materials. Unnecessary and long resting periods in a lairage without feeding and watering, as in the case of the Phulpur, Muktagacha, Valuka and Trisal slaughter house, raises concerns regarding animal welfare because the animals experienced thirst and hunger. According to the 2012 OIE guidelines,²⁴ the time at a slaughter house should not exceed 12 hours and if it does exceed 12 hours then the animals should be provided with sufficient feed and water. The lairage facilities available in Mymensingh Sadar and Gauripur, Haluaghat Upazilas was able to provide some feed and water. Most of the lairage had kacha floor and there was no bedding material. Lack of sufficient feed, dirty floor and lack of water was the common picture in all lairage in Mymensingh district. Therefore, the floor of slaughter houses must be realized and maintained so as to minimize the risk of animals slipping, falling or injuring limbs.

Halal method of slaughter with hacking cuts using a result in vigorous struggling and obvious distress.² All slaughter houses in Mymensingh districts follow halal method for slaughtering animals. According to the OIE guidelines,²⁴ one key requirement for full frontal cutting across the throat is that the blade or knife be of sufficient length so that the point of the knife remains outside the incision during the cut. Instead, the point of the knife was used for stabbing the throat region while cutting. In addition, it was found that short knives required more time than long knives to perform the slaughter, and a sawing motion was applied during the cutting procedure. According to the OIE regulations,²⁴ after incision of the blood vessels, no carcass-scalding treatment or dressing procedures should be done on the animals for at least 30 seconds, or in any case, until all brainstem reflexes have ceased. A lack of oxygen to the brain due to rapid bleeding that causes death of slaughtered animals. In Haluaghat, Valuka, Gauripur and Phulpur, some butchers poured water into the trachea after cutting the throat. Blood entering the respiratory tract is a welfare concern because the sensation caused by blood entering the respiratory system is likely to be very stressful.²⁵ The results confirm that the OIE standards have not yet been implemented in Bangladesh.

According to Bangladesh's 2005 Livestock Policy and Action Plan, animals can be slaughtered in open places using traditional methods, but this does not allow adequate drainage of blood from slaughtered animals, proper flaying, and hygienic meat processing. These results

suggest that the conditions remain the same today. In addition to the poor sanitary conditions, the animals are subjected to considerable mistreatment and none of the three welfare principles (sufficient feeding, adequate housing, or maintaining health) are fulfilled.

There are emergent needs to establish a sufficient number of modern slaughter houses in Bangladesh and to train the staff involved in slaughtering. The animals observed in this study were subjected to considerable mistreatment during every step of the handling process, including long-distance transportation, lairage, casting, and slaughter. Additionally, the workers' safety is extremely questionable.

This study contributes to understand the present status in the slaughter house of Mymensingh district in Bangladesh. During this study, poor animal welfare was detected in slaughter houses; mainly due to lack of awareness and absence of knowledge in animal welfare. In selected slaughter houses, there were lack of animal welfare among the butchers and poor animal handling prior to slaughter. Lack of proper management system in the slaughter house is a major cause of poor animal welfare. The indications of compromised welfare of the animals deduced from the interviews were no special vehicle for animal transportation, overcrowding in vehicles, lack of feed and water supply in lairage, improper handling prior to slaughter. The international livestock industry must be encouraged to practice increasingly better handling and welfare of slaughter animals. But there was no ideally established slaughter house supported by Department of Livestock Services (DLS) or local government / NGO's. Most of the slaughter house infrastructure did not match with the guidelines of an ideal slaughter house, the butchers does not follow the rule of pre-slaughter handling of animal. It is recommended to establish an ideal slaughter house following OIE guide lines in each district under govt. project. For good animal welfare, a slaughter house plant must be equipped with well-designed stunning and handling equipment which is kept well maintained by trained, conscientious employees. Existing rules of slaughter house and meat inspection should be executed with ensuring veterinary inspection regularly prior to slaughter of animal.

Food animals face unnecessary stress and suffering at pre- and during slaughtering mainly due to workers lack the expertise, skills and technology to ensure humane treatment. Slaughter animals are exposed to different conditions during transportation and slaughtering at the slaughter houses especially in developing countries like Bangladesh. Developed world have developed the measures to improve the animals' livelihood, together with ensuring good quality animal products for the consumers. However, the developing nations have been dragging behind due to several factors like traditional customs and beliefs practiced by different ethnic groups. To ensure maximum product quality, this knowledge should be importance to everyone in the production chain, from the stockman, farmer, transporter, abattoir worker and the designers of animal facilities. Therefore, knowledge of animal stress inducers, animal response-behavior and its subsequent effect on meat quality is of importance to ensure an efficient and economic enterprise.

CONCLUSIONS

The overall conclusion from this study that the transportation and pre-and during slaughtering of ruminant animals had a negative effect on animal welfare. Animal welfare should be

prioritized in all animal production sectors especially on the farm, smallholder levels, during transportation and at the slaughter houses to ensure the good quality meat production. To ensure maximum quality meat production and economic returns, people associated with meat production chain including stockman, farmer, transporter, slaughter houses worker, the designers of animal facilities and consumers must be well-informed of animal welfare and its subsequent effects on meat product quality. Animal welfare and the quality of meat produced by food animals are dependent on all the chain activities to which they are subjected to from birth to slaughter. The introduction of animal welfare as a topic of interest during professional training of veterinarians and other professionals and support the implementation of humane slaughter practices at the slaughter houses with the application of government laws and legislations. Research works and the system used for the developed world might not be working in the developing world, hence the need to intensively investigate meat production system in developing world including Bangladesh.

CONFLICT OF INTEREST

We certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

ACKNOWLEDGEMENTS

Thanks are extended to all the slaughter house workers for their cooperation during this research works.

REFERENCES

01. Seng PM and Laporte R (2005). Animal welfare: The role and perspectives of the meat and livestock sector. *Review Science and Technology* 24: 613-623
02. Grandin T (1994). Farm animal welfare during handling, transport, and slaughter. *Journal of American Veterinary Medical Association* 204: 372-377
03. Bulitta FS (2015). Effect of handling on animals welfare during transport and marketing. Doctoral Thesis, Swedish University of Agricultural Sciences, Uppsala. https://pub.epsilon.slu.se/12824/1/bulitta_f_151116.pdf (Accessed on 26 June 2019)
04. Gregory N, Fielding H, Wenzlawowicz M and Holleben K (2010). Time to collapse following slaughter without stunning in cattle. *Meat Science* 85: 66-69
05. Ljungberg D, Gebresenbet G and Aradom S (2007). Logistics chain of animal transport and abattoir operations. *Bio System Engineering* 96: 267-277
06. Gebresenbet G, Wikner I, Bobobee EYH, Maria G and Villarroel M (2012). Effect of transport time and handling on physiological responses of cattle. *Journal of Agricultural Science and Technology* 2: 800-814
07. Adzitey F (2011). Effect of pre-slaughter animal handling on carcass and meat quality. *International Food Research Journal* 18: 485-491
08. Hasan FMM, Hossain MM, Akhtar S and Rahman MH (2004). Management of slaughter houses and meat selling centers in Mymensingh. *Bangladesh Journal of Animal Science* 33: 1-10
09. Alam MR, Gregory NG, Uddin MS, Jabbar MA, Chowdhury S and Debnath NC (2010). Frequency of nose and tail injuries in cattle and water buffaloes at livestock markets in Bangladesh. *Animal Welfare* 19: 295-300

10. Ahsan M, Hasan B, Algotsson M and Sarenbo S (2014). Handling and welfare of bovine livestock at local abattoirs in Bangladesh. *Journal of Applied Animal Welfare Science* 17: 340-353
11. Nielsen BL, Dybkjaer L and Herakin MS (2011). Road transport of farm animals: effect of journey duration on animal welfare. *Animal* 5: 415-427
12. Randall JM (1992). Human subjective response to lorry vibration: Implications for farm animal transport. *Journal of Agricultural Engineering Research* 52: 295-307
13. Kadim IT, Mahgoub O, Al-Kindi A, Al-Marzooqi W and Al-Saqri NM (2006). Effects of transportation at high ambient temperatures on physiological responses, carcass and meat quality characteristics of three breeds of Omani goats. *Meat Science* 73: 626-634
14. Tarrant PV, Kenny FJ, Harrington D and Murphy M (1992). Long distance transportation of steers to slaughter: effect of stocking density on physiology, behavior and carcass quality. *Livestock Production Science* 30: 223-238
15. Njisane YZ and Muchenje V (2017). Farm to abattoir conditions, animal factors and their subsequent effects on cattle behavioural responses and beef quality- A review. *Asian-Australasian Journal of Animal Science* 30: 755-764
16. Hulbert LE, Carroll JA, Burdick NC, Randel RD, Brown MS and Ballou MA (2011). Innate immune responses of temperamental and calm cattle after transportation. *Veterinary Immunology and Immunopathology* 143: 66-74
17. Odore R, D'Angelo A, Badino P, Belino C, Pagliasso S and Re G (2004). Road transportation affects blood hormone levels and lymphocytes glucocorticoid and beta-adrenergic receptor concentrations in calves. *Veterinary Journal* 168: 297-303
18. Whiting TL (2000). Comparison of minimum space allowance standards for transportation of cattle by road from 8 authorities. *Canadian Veterinary Journal* 41: 855-860
19. Ferguson DM and Warner RD (2008). Have we underestimated the impact of pre-slaughter stress on meat in ruminants? *Meat Science* 80: 12-19
20. Muchenje V, Dzama K, Chimonyo M et al. (2009). Some biochemical aspects pertaining to beef eating quality and consumer health: A review. *Food Chemistry* 112: 2790-289
21. Muchenje V, Dzama K, Chimonyo M, Strydom PE and Raats JG (2009). Relationship between pre-slaughter stress responsive and beef quality in three cattle breeds. *Meat Science* 81: 653-657
22. Hemsworth PH, Rice M, Karlen MG et al. (2011). Human-animal interactions at abattoirs: Relationships between handling and animal stress in sheep and cattle. *Applied Animal Behavioural Science* 135: 24-33
23. Lahucky R, Palanska O, Mojto J, Zaujee K and Huba J (1998). Effect of pre-slaughter handling on muscle glycogen level and selected meat quality traits in beef. *Meat Science* 50: 389-393
24. OIE (2018). *Terrestrial Animal Health Code. Volume I. 27th edn. Animal Welfare.* www.rr-africa.oie.int/docspdf/en/Codes/en_csat-vol1.pdf (Accessed on 25 June 2019).
25. Grandin T (2014). Animal welfare and society concerns finding the missing link. *Meat Science* 98: 461-469