



Evaluation of existing poultry processing and marketing in the wet market of Gazipur city in Bangladesh

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Abstract

The poultry selling and processing practices followed in the poultry wet markets of Bangladesh are always being overlooked unknowingly. The research was conducted to observe the existing scenario of poultry selling and processing practices at the selected wet markets located in the Gazipur City Corporation of Bangladesh. A total of 43 poultry selling shops were randomly selected and interviewed using a semi-structured questionnaire. It was surprising to observe the absence of female personnel and involvement of few (6.9%) people over the age of 50 years in the wet markets. All the persons engaged in poultry selling and processing had no institutional training. The shops found to be abstained from following some important practices such as feed withdrawal period, isolation of diseased birds, ante and post mortem inspection. The proper bleeding time (1-2) min was recorded in 58.2% cases. The killing cone was recognized as the best device in terms bleeding time. The 72.1% of the outlets never cleaned the carcass prior to deliver the customers. The absence of ante- and post-mortem inspections may cause a great threat of disease outbreak. Taken together, the poultry selling and processing practices followed in the wet market needs to be assessed carefully to deliver safe and quality meat to the customers. In addition, organizing basic training on pre-slaughter management and processing for both seller and processor and also ensuring the regular ante- and post- mortem inspection could improve the present situation in order to produce quality poultry meat.

Key words: Demographic profile, slaughter, processing, inspection, washing

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Introduction

The increase of the acceptance of processed and frozen food in both residential homes and in the growing restaurant industry has elevated the demand for the poultry meat, especially in expanding urban areas. Poultry processing involve a set of activities that converts live bird into ready-to-cook whole carcasses, cut-up parts, or various forms of deboned meat

products (Alan, 2001). Everywhere in the globe consumers are progressively motivated to consume poultry meat. Poultry meat market is important because it is the cheapest and available animal protein source in particular for low-income communities of a country like Bangladesh. Poultry share 54% of the total meat consumption, and per capita broiler meat consumption

is 3.7 kg in Bangladesh (Khaled, 2015; DLS, 2016). It has reported that Bangladesh produce 1.6 million kg chicken meat per day (DLS, 2015). Both live and dressed poultry are sold in the wet markets of Bangladesh. People are now more eager to purchase dressed poultry due to their lifestyle with busy schedule. Better lifestyle influenced by high Gross National Income creates pressure to consume ready-made food (Anas, 2015). However, except few commercial big farms modern poultry processing plant is not available in the rural and urban areas of Bangladesh. Frozen dressed poultry as whole or few cut-up parts are now available in the recognized super shops where they demand premium prices. The substantial number of fast food restaurant chains is another major market area that needs frozen poultry. The limited number of modern poultry processing plants is also occupied to meet the demand of this growing market. But till now most of the consumer of Bangladesh prefer to purchase live birds and then the bird is instantly slaughtered and dressed in the wet market to make ready for kitchen.

Lack of trust in slaughtering method and bird's physiological condition, live poultry marketing is more popular to the consumer in Bangladesh. But marketing of live bird is considered as center point of spreading and maintenance of different infectious diseases in Asian countries (Sayeed *et al.*, 2017). Handling live poultry and poultry products may cause for zoonotic infections. Unfortunately, poultry and large animals are slaughtered and dressed randomly and indiscriminately everywhere like market, village and road side etc. without maintaining standard rules and regulations. That is the common scenario in all over the Bangladesh. There is no enforcement of animal slaughter and meat quality control act, 2011 and it's relating hygienic condition to produce quality meat. That's why the meat is handled and distributed in unhygienic way. Meat is very prone to microbiological attack. Microbiological contamination in handling and processing bring changes in meat that deteriorate the shelf life of meat and quality also. Furthermore,

personnel involved in that job are infected with food borne illness (Komba *et al.*, 2012). Meat from parasite infected animal acts as a source of infection to other animals and human being (Adzitey and Huda, 2012). Studies have shown that microbial load that causes food borne infection is higher in marketed broiler meat in Bangladesh (Hasan *et al.*, 2015). Recently, ensuring food and products safety has become extremely important public health concern at national as well as international level.

The meat of birds/animals can be contaminated with various microbes during slaughter, dressing and cutting, handling and storage not only from the exterior of the animal and its intestinal tract but also from knives, clothes, air, carts and equipment in general (Pal, 2012). Several studies were conducted to correlate pre-slaughter care to meat quality. Fletcher (2002) described that pre-slaughter management directly affect the meat quality. Muscle hemorrhages are asserted as one of the major faults in poultry carcass quality (Kranen *et al.*, 2000). It needs to fast the poultry 5-8 hours before slaughter. Pre-slaughter fasting causes empty the gastrointestinal tract that reduce fecal contamination of carcass throughout the time of slaughtering and processing which helps to improve the meat quality of poultry. Furthermore, it was reported that longer pre-slaughter feed withdrawal raises muscle pH, water holding capacity and colour (dark) of the meat (Bianchi *et al.*, 2008). Bleeding time affect the carcass quality. Incomplete bleeding increases the microbial growth as blood acts as medium for its nutrient, temperature, pH and relative humidity for bacteria. Blood components, especially haemoglobin, are powerful stimulators of lipid oxidation and may decline the shelf life of meat products (Alvarado *et al.*, 2007).

Though research related to microbiological contamination is available but information of existing poultry pre-slaughter care, slaughtering and processing practices in wet market and the profile of the personnel involved in this area are yet to be studied. Therefore,

the present study was carried out to realize the existing scenario on pre-slaughter care and management and poultry processing practices in the wet markets of Gazipur City Corporation and also to assess them with the standard practices.

Materials and Methods

Selection of study area: The study was conducted in the Gazipur City Corporation (GCC) area of Bangladesh. Gazipur is one of the largest industrial cities under the Gazipur district located in the central Bangladesh. The district is well known for high poultry population and is considered as poultry zone in Bangladesh which led to select this location as study area. A total of 43 shops were randomly selected from 11 wet markets located in the GCC area (Figure 1) during September 2019 to February 2020.



Figure 1. Location of the study area.

Preparation of questionnaire: A semi-structured questionnaire in light of the objective of the study was prepared to conduct the research smoothly. The owner of the shops and/or employee (if any) was considered as individual respondent. The questionnaire was segmented into two parts. First part was consisted of

demographic information and the second part was associated with the practices in poultry selling and processing. The prepared questionnaires were then pre-tested among some poultry shops located in the wet market before final data collection. Based on the pre-testing outcomes, the final questionnaires were prepared after required corrections, modifications and adjustments. The research was fully dependent on primary data which were collected through face-to-face interview by trained personnel as well as researchers themselves.

Data analysis: The collected information was inserted into excel sheet (Excel 2011, Microsoft, Redmond, Washington, USA) and were analyzed with the add-in software ystat 2008 (Shinya Yamazaki, Koriyama, Japan) as per the requirement of the study.

Results and Discussion

Demographic profile of the personnel engaged in poultry shops: The demographic profile of the personnel engaged in the poultry selling and processing at the wet markets is presented in Table 1. All the respondents were male and have no institutional training in poultry processing. The respondents were varied in ages. More than half of the respondents (53.5%) were in the middle age (30-49 years). The majority respondents (58.8) were educated up to different stages of elementary level followed by drop out. It is also evident from Table 1 that the personnel difference was found in 51.1 % shops indicates selling and processing persons are different in these outlets. The number of personnel in each shop was dependent on the size of the shop.

Pre-slaughter care and management: The pre-slaughter care and management includes the steps catching, loading, transporting, feed withdrawal, dehydration and unloading of poultry. Generally, birds are recommended to handle properly before slaughter. Improper handling and catching during assembling, loading and unloading increase the chances of bruises, broken bones and internal hemorrhage's that negatively

affect the meat quality of poultry. As a matter of fact, pre-slaughter care and management contributes a good deal to the wholesomeness of dressed chickens. In the present study we observed feed withdrawal, transportation system, arrival time and poultry processing in the wet market located in the GCC area.

Table 1. Profile of personnel engaged in the poultry wet market.

Characteristics	Value
Gender	Male = 100.0%, Female= 0.00%
Age (years)	< 30 = 39.53%, 30-49= 53.5%, >50 = 6.96%
Education level	Elementary = 48.84%, Secondary = 32.56%, Higher secondary = 11.63%, Bachelor = 6.98%
Institutional training	Yes = 0.00%, No = 100.0%
Ways of experience	Personal = 100%, Govt. and NGO training = 0.00%
Personnel difference in selling and processing	Yes = 51.17%; No = 48.83%

Feed withdrawal: Bowel elimination before slaughter is one of the important factors of pre-slaughter care. Birds require fasting 5-8 hours before slaughter that helps to avoid unnecessary hazard during evisceration of the carcass. If the stomach is full at the time of slaughter, there is a great chance of carcass contamination with gastrointestinal content. Fasting starts from catching time at the farm and continues up to slaughter (Northcutt, 2001). But for off farm processors starting of feed withdrawal time mostly depends on the transportation time to arrive at the slaughter area. None of the shops in the study area were found to follow the feed withdrawal period that is completely against the slaughter act (MLJPA, 2011). The usual practice was to provide feed constantly in front of the bird. The reason behind this practice was to protect and/or increase the live weight of the birds

which in turn affect the profit. The absence to follow the feed withdrawal period and malpractice of constant feeding could be due to the ignorance of the people involved in this business.

Source, transportation and arrival time of the live birds: According to the respondents, the live birds of the wet markets located in Gazipur City Corporation are purchased either through direct contact with the poultry farm owner or from the suppliers. The highest percentages (60.4%) of the respondents purchased live birds directly from the poultry farm owner whereas 23.3% were dependent on the suppliers (Table 1). However, 16.3% of the respondents relied on both suppliers as well direct contact with poultry farm owner. The purchasing trend directly from the poultry farm owner may be due to the availability of poultry farms adjacent to the wet market. The live birds transported to the wet market by pickup truck (27.9%), pickup truck and van (18.6%), van (53.5%) depending on the distance. The birds were carried to the wet markets in crates made of bamboo or plastic. As shown in Figure 2, the live birds arrived to the wet markets at any time of the day; however, the predominant arrival time was 7:00 to 10:00 pm (74.4%). Live birds also received in the wet market at the afternoon (14.0%) and morning (11.6%) (Figure 2). Although none of the shops followed feed withdrawal procedure as shown in Table 1, the predominant arrival time suggests the great opportunity to apply this very important practice in the wet market. Transportation is one of the unavoidable stressor of poultry before slaughter. Death losses increase with the poor poultry welfare at transportation. Mortality of broiler influenced by transport distance and season of the year (Vecerek *et. al.*, 2006). Ideally live birds need to transport at the cooler hours of time especially in the summer season to reduce the shrinkage, weight loss and mortality rates of bird. Birds expose to heat before slaughter lead to pale, soft, and exudative (PSE) meat, which in turn results lower possessing yields, increased cooking losses, and reduced juiciness (Aberley *et. al.*, 2001). The published report disclosed that average live weight shrinkage for

each hour of transportation is 0.23% (Bianchi *et al.*, 2005). In addition, longer transportation time increases the mortality rate of broiler chicken. After arrival it is recommended to allow birds to rest for some times before slaughter.

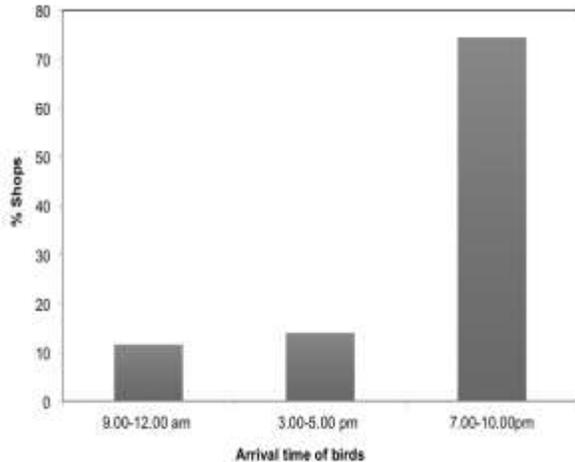


Figure 2. Arrival time of birds in the poultry wet markets of Gazipur.

Isolation of sick or damage poultry/ Ante mortem inspection: Mortality, injuries, damage to health and changes indicate stress of broilers. Several factors in which birds are exposed during loading and transport to the slaughterhouse are responsible for such stress. Some of the poultry species carry disease without showing sign. In the present study, it was seen that only 37.2% poultry shops isolate the sick, dehydrated or physically damaged birds after arrival to the shops. The remaining 62.8% shops did not follow the isolation practice (Table 2). The shops followed the isolation practice were found to keep the isolated birds either in the same shop (56.3%) where healthy birds were placed, in the slaughter area (31.2%) or in the separate room (12.5%). This finding indicates only 12.5% shops which is 4.7% of the total shops studied followed the isolation rules properly. The tendency of the salesman to give priority to sale such isolated birds was also observed. Thus, it may cause the spread of disease to the processors as well as customers. Generally, it is recommended to inspect the bird's health after arrival

and isolate the damage and sick birds very cautiously in separate areas. As close contact of infected sick or dead birds is one of the risk factor for human infection (Areechokchai *et al.*, 2006; Dinh *et al.*, 2006; Zhou *et al.*, 2009).

Slaughter method: Before slaughter, birds are usually removed from cages or crates individually and hold securely with two hands over the wings. Therefore, care is required to avoid injury and squeezing the body, which can stop the breathing of the bird. Bone breaks, dislocations and bruising are common injuries which can occur when catching poultry, resulting in pain and poor carcass quality (HSA, 2013). In the present study birds were removed from the cages or crates by grasping wings (60.4%) only, legs (14.0%) only, both wings and legs (25.6%) before slaughter (Table 2). According to international animal welfare recommendations (DEFRA, 2002; OIE, 2017), broilers should be caught and loaded while the birds are in an upright position. Recent studies also revealed the upright position as the best practice in terms of bird's welfare and injury (Lima *et al.*, 2019; Kittelsen *et al.*, 2018). Based on this recommendation the present study showed the lack in improper catching of birds in 40% cases. It was also observed during the study that the grasping of wings only also could not confirm the upright position properly.

The consumers' attitudes towards food and agriculture are changing based on regional, cultural and religious influences (Alzeer *et al.*, 2020). According to the literature, there are four international slaughtering methods namely Mohammedan or Halal (Islamic), Jatka (Hindu), Kosher (Jewish) and Stunning (commercial). There are specific rules for each slaughtering method and the responsible person should be trained up. This training should include adequate information on hygienic laws, regulations, anatomical positions of the neck, animal stress physiology, and the appropriate equipment to be used for slaughter (Aghwan & Regenstein, 2019). For instance, the Halal method requires an observant Muslims as a slaughter

man, who knows the rules and conditions set by Islam with regard to slaughtering.

Table 2. Response of the wet market poultry shops towards pre-slaughter care, management and selling practices, and compatibility with the standard procedure.

Parameter	*No.	%	Compatibility with standard practice			
			Yes		No	
			*No.	%	*No.	%
Source of live birds						
Farm	23	60.4				
Supplier	10	23.3			Not applicable	
Farm and supplier	7	16.3				
Types of vehicle						
Van	23	53.5				
Pickup truck	12	18.6			Not applicable	
Van and pickup truck	18	27.9				
Arrival time						
Morning	5	11.6				
Afternoon	6	14.0	32	74.4	11	25.6
Evening	32	74.4				
Sick birds isolation						
Yes	16	37.2	16	37.2	27	62.8
No	27	62.8				
Isolation area						
Within the shop	9	56.3				
Separate room	2	12.5	2	12.5	14	87.5
Slaughter area	5	31.2				
Grasping birds from cage/crate						
Wings	26	60.4				
Legs	6	14	26	60.4	17	39.6
Legs and wings	11	25.6				
Ante-mortem inspection						
Yes	43	100	0	0	43	100
No	0	0				
Maintenance of feed withdrawal period						
Yes	43	100	0	0	43	100
No	0	0				
Selling system						
Live only	17	39.6				
Dressed only	5	11.6			Not applicable	
Live and dressed	21	48.8				

*No.: Number of shop.

For the Halal method the bird's legs and wings should be grasped with one hand, and the head of the bird to be slaughtered in the direction of the Qiblah (facing towards Mecca). Furthermore, approved animals or birds should be slaughtered upon pronouncement of the Islamic invocation 'Bismillah Allahu Akbar' (in the Name of Allah, Allah is the greatest). This is ideal, but Bismillah alone is also permitted by some, and some want the three words repeated for every bird or animal. The neck should be held on the flat position until complete bleeding. As shown in Table 3, 93% of the poultry shops were found to practice the Halal method only. Conversely, 7% follow both Halal and Jatka methods. No shop in the study area was found to hang the bird before slaughter, which is usually followed in Halal method at industrial level. The high percentage of using Halal method in the study area is due to the majority of the Muslim population. Surprisingly, without having any institutional training (Table 1), the slaughtering methods were followed properly in most of the shops. The persons involved in this job are from Muslim family and they are trained up informally. However, around 20% shops failed to follow the procedure properly. For instances, it was seen that the slaughter man serves more than the jugular vein, trachea and carotid artery that is completely against the Halal method. Institutional training could meet this gap.

Bleeding: Slaughter is the main way of bleeding and amount of bleeding varies on slaughter method. The higher level of bleeding resulted in Islamic hanging slaughtering method compared to other methods. Improper bleeding affects the carcass quality and decreases the shelf life of raw meat. Amount of blood retain in the carcass influence the bacterial growth and level of contamination (Ali *et al.*, 2011). Bleeding time depends upon the age, sex and health status of poultry; however, 1-2 minutes is considered as ideal for bleeding of birds. In the present investigation, after slaughter 76.7% shops placed the birds in a killing cone with the head hanging below and 16.3% left the freshly slaughtered birds in a large drum. Only 7%

shops were found to abstain from using any devices (Table 2). The association of bleeding time and use of bleeding device has been illustrated in Figure 3. Bleeding time recorded 1-2 min in 69.7% cases when killing cone was used whereas only in 28.6% cases the similar bleeding time was recorded when drum was used as bleeding device. No use of device increased the bleeding time ranged from 5-10 min (in 33.3% cases) to >10 min (in 66.7% cases). In 42.9% cases the required bleeding time was 5-10 min when drum was used as device. The bleeding device enables poultry to be calm and quiet, facilitates the bleeding and allows hands-free working before dressing. All the workers of the shops recognized this step as useful and trouble-free to dress the poultry. It was also noticed that the workers at the poultry wet market have no idea about the importance of maintaining bleeding time, duration and its effect on meat quality. This could be the one reason behind the association between bleeding time and types of device as shown in Figure 3.

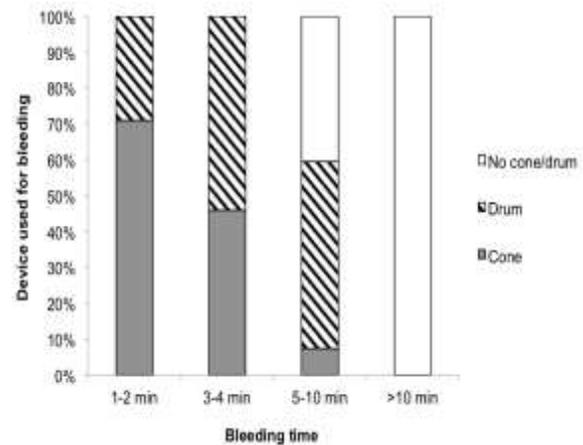


Figure 3. Association between bleeding time and device during poultry processing at the wet market.

Poultry processing at the wet market

Removal of feather for carcass dressing: The dressing of poultry birds in the wet market is an important public health issue. Generally, the need for dressing poultry birds at the wet market depends on the

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consumer preference whether they would like to get them home as live or dressed. Removal of feather includes scalding and de-feathering.

Table 3. Response of the wet market poultry shops towards poultry processing practices and compatibility with the standard procedure.

Parameter	*No.	%	Compatibility with standard practice			
			Yes		No	
			*No.	%	*No.	%
Slaughter method						
Halal	114	93.1				
Both Halal and Jatka	15	6.9	34	79.1	9	20.9
Maintenance of bleeding time (1-2 min)						
Yes	25	58.2				
No	18	41.8	25	58.2	18	41.8
Use of bleeding device						
Cone	33	76.7				
Drum	7	16.3	33	76.7	10	23.3
No device	3	7.0				
Dressing system						
Manual	28	65.1				
Machine	2	4.7	15	34.9	28	65.1
Manual and machine	13	30.2				
Evisceration practice						
Yes	43	100				
No	0	0			Not applicable	
Carcass cleaning						
Yes	31	72.1				
No	12	27.9	31	72.1	12	27.9
Types of cuts						
Whole	43	100				
Cut up parts	0	0			Not applicable	
Packaging materials						
Yes	43	100				
No	0	0			Not applicable	
Post-mortem inspection						
Yes	43	100				
No	0	0	0	0	43	100
Cleaning slaughter area						
Daily	39	90.6				
Weekly	2	4.7	39	90.6	4	9.4
Bi-weekly	2	4.7				
Cleaning agent						
Detergent	17	39.5				
Disinfectant	15	34.9	15	34.9	28	65.1
Water only	11	25.6				

*No.: Number of shop

The process de-feathering consists of three steps picking, pinning and singeing. Scalding is the first step for the preparation of feather removal. The process of immersing slaughtered poultry in hot water to loosen the feathers for plucking is called scalding (Barbut, 2002). It is an immersion time and hot water temperature combination process that has various effects on meat quality (Sams and McKee, 2010). Scalding time and temperature varies upon age, sex and species of birds. There are two types of scalding firstly soft scalding, carcasses are immersed in 50 to 53°C hot water for 120s, secondly hard scalding, and carcasses are immersed in 59 to 64°C hot water for 45 to 90s (Barbut, 2002; Sams and McKee, 2010). Soft scalding is used for broiler and hard one for waterfowl. After scalding birds are plucked out using picker machine or by hand manually. Then thumb and a sharp knife are used to remove feather follicle, if any in the plucked poultry is called pinning. The present study revealed that after being sold according to the live weight, the poultry birds were slaughtered and dressed based on consumer demand. This was the common practice found in all the wet market shops studied. Almost all the outlet was found to be equipped with dressing facilities. Of the 43 shops visited, majority (65.1%) prepared carcass using a sharp knife that exclude the feather with skin directly. In contrary only 4.7% outlet used picker machine for poultry dressing followed by scalding. However, 30.2% shops followed both manual removal of skin along with feather and picker machine dressing directly (Table 3). Manual feather removal is a risky operation as the feather colonized by sero groups of bacteria belonging to *E. coli* (Dho-Moulin and Fair brother, 1999). The consumer also has a chance of great loss in weight due to manual removal of skin. After picking, none of the shops were found to follow pinning process in the wet market.

Evisceration: In commercial poultry processing plant, evisceration of poultry is one of the major steps which include opening the body cavity and removing the viscera either using fully automated mechanical devices (in commercial plant), mechanically or

manually. Therefore, special care is always required not to punch the viscera pack (intestine, liver, gizzard, heart), which would contaminate the carcass with high microbial loads (Barbut, 2015). Defaulting in processing causes downgrade the carcass quality. In the study area it was observed that all the shops opened abdomen and removed the viscera pack manually after dressing (Table 3). The manual processing of evisceration suggests special attention in personal hygiene of the processors to reduce the risk of microbial contamination. A random personal experience sharing with wet market customers as well as close observation disclosed the fact of cheating by the processors during evisceration at the wet market in many cases. The shopkeepers hide the edible parts like giblet and skin while eviscerating. After collection of large amount of giblet or other such edible parts, the shopkeepers sell it separately to the other customer. However, in few cases it was found that customers had lack in preference for those edible parts.

Inspection, washing and packaging: Inspection is commonly done after evisceration. Inspection is essential to ensure that only wholesome birds that are free of disease reach the market. The requirement of inspection is varying from country to country. Generally, the inspection is carried out by the assigned veterinarian or government officials. As shown in the Table 3, post-mortem inspection was completely absent in all the shops interviewed during the study period. This is alarming in terms of public health issues. After inspection, the washing of carcass is an essential step to remove the debris. Chicken meat can potentially become contaminated with bacteria during transportation, slaughter, evisceration, partitioning, and packing (Owens, 2010; Facciola *et. al.*, 2017). Carcasses are commonly sanitized in processing plants through a series of washes using chlorinated water to reduce surface contamination. High pressure, low volume nozzles are becoming more popular to remove the debris (Barbut, 2015). Then various devices are used to wash different items in the processing plant commercially. Finally, the carcasses are packaged. The

present study revealed 72.1% shops never cleaned the carcass after evisceration. In contrary, only 21% cleaned the carcass with tap water before delivery to the customers. The highest number shops refrained from following the carcass cleaning steps due to lack in knowledge in this area. The shops were found to deliver whole bird suggesting no consumer preference for cut up parts. All the shops were observed to package the carcass in a polythene bag. The use of polyethylene bag as a packaging material is obviously an important issue in terms of creating green environment.

Sanitation: The poultry processing areas can be heavily contaminated with dressing materials, blood, offal, feathers, fat and feces. So the processing area and equipment need to get more attention for cleaning and disinfecting regularly not only to reduce zoonotic disease but also to ensure safe and quality carcass. In the present study, it was revealed that 90.6% shops cleaned the processing premises regularly whereas 4.7% shops cleaned weekly or bi-weekly (Table 3) indicates majority shops followed standard procedure of cleaning. However, only 34.9% shops used disinfectant as cleaning agent while 39.5% shops used detergent and the remaining 25.6% used water only (Table 3). The respondents are not aware about the importance of disinfectant and also the differences between detergent and disinfectant. It was also observed that the personnel engaged in poultry selling and processing were not aware about personal protection and thus none of them found to use personal protective equipment (PPE). In addition, distance between selling and slaughtering facilities were very limited. This could be the result of lack in awareness about personnel hygiene and meat quality during processing.

Comparison of typical poultry processing practice with wet market: The steps involved in a typical poultry processing have been described by Barbut (2015) and are illustrated in the Figure 4. These steps are exclusively followed in the commercial processing

plant. However, in the wet market the situation is rather different as live birds come from separate areas to market and processing starts after selling the bird. In the wet market all the birds are not sale at a time. Birds remain in the market throughout the day and night in crates or cages. Therefore, there is a great opportunity for shopkeepers to apply pre-slaughter management and care practices that has positive effect on carcass quality. In addition, more conventional methods are applied during processing poultry in the wet market. After analyzing the data collected from the poultry wet market a schematic diagram on poultry processing was prepared and compared with the typical poultry processing steps. As shown in Figure 4, the processing of poultry starts with the supply of poultry in both standard as well as in the present study area. In the wet market, processing of a bird is dependent on the customer preference after being sold as live. The big difference is found after the de-feathering steps. In the standard procedure a series steps are followed before after evisceration including the mandatory inspection step. However, in the market the processors go directly for evisceration after de-feathering and/or skin removal. Soon after the evisceration the head and feet are removed from the carcass followed by washing and packaging. There are a substantial number of gaps in the poultry processing at wet market which needs to be addressed further for safe and quality poultry meat.

Conclusion and recommendations

Poultry is the versatile protein source for people throughout the globe. Poultry plays a vital role in meeting the animal protein demand in Bangladesh. The investigation mentioned the existing scenario of entire selling and processing of poultry in the retail outlet of Gazipur district. The researcher found shopkeepers purchase live bird from nearby poultry farm either direct contact or from supplier. Most cases the bird reached the shop at night time and day long the owner of the shop sold these birds to the customer either dressed or live. Most of the outlet practiced manual dressing system to remove feather with skin. Slaughter

man were not trained with slaughter and dressing the bird. Person involved in selling the birds weren't aware about pre-slaughter care that has great loss in meat

quality and people engaged in that activities are risk in various diseases.

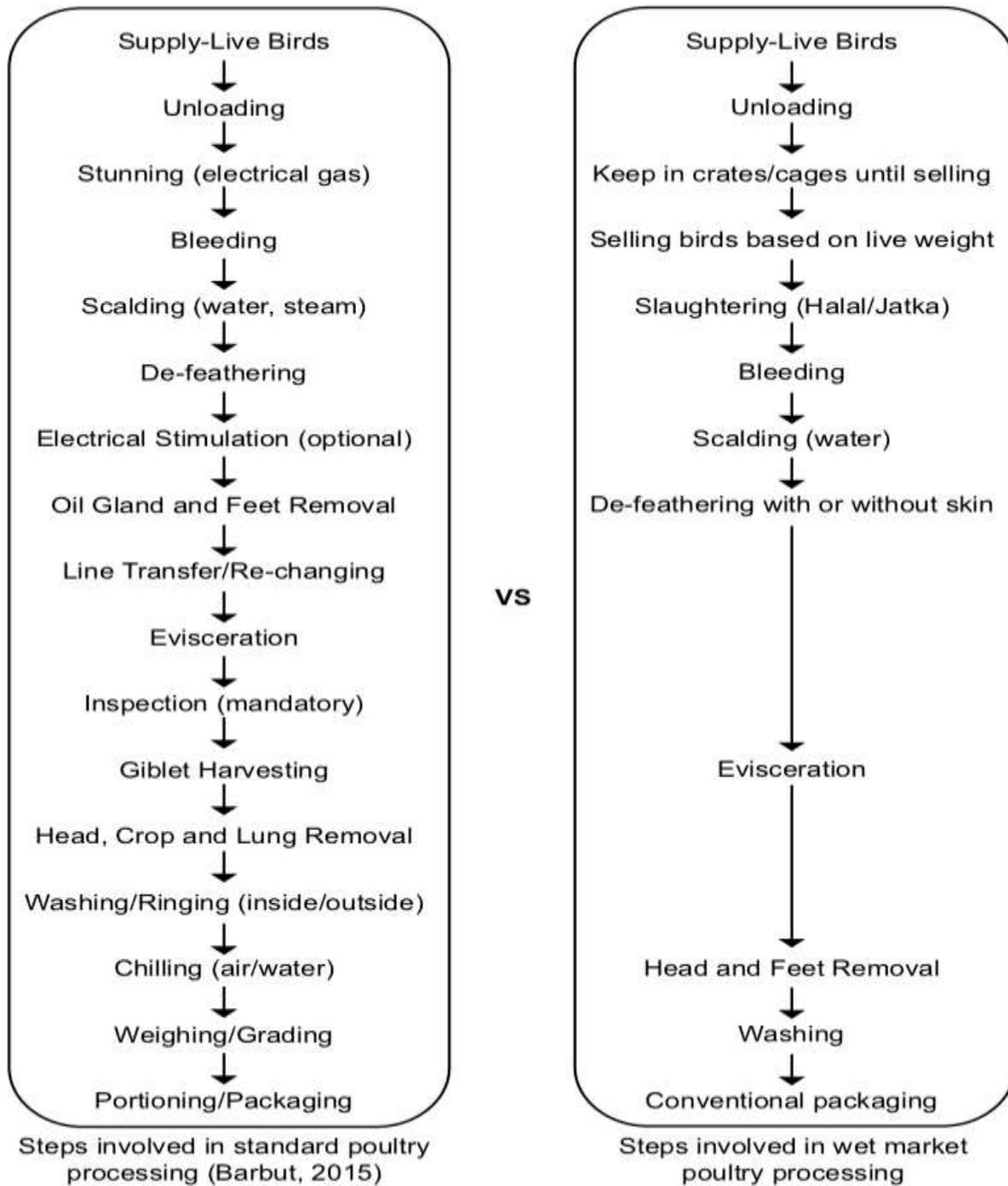


Figure 4. Comparison of the poultry processing steps followed in standard processing center and Wet Market.

Hygienic condition of the slaughtering area should be improved. None of the veterinarian is occupied in these market for anti-mortem and postmortem inspection. Local authority of government should inspect these areas regularly to reduce some faulty management system and implementation of slaughter act, 2011. Government and private organization which are engaged in poultry business should take initiative to make the person skilled about poultry care before slaughter, processing and about personal protection. Thus the present situation may be enhanced. It is also necessary to participate a registered veterinarian by govt. to the specified area to inspect the mentioned activities so that transmission of zoonotic disease will be lower in Bangladesh and consumer get safe and quality meat.

References

- Aberley ED, Forrest JC, Gerrard DE, Mills EW (2001). Principles of meat science. Dubuque: Kendall/Hunt Publishing Company. p. 94.
- Adzitey F, Huda N (2012). Effects of post-slaughter carcass handling on meat quality. *Pakistan Veterinary Journal*. 32 (2): 161-164.
- Aghwan ZA, Regenstein JM (2019). Slaughter practices of different faiths in different countries. *Journal of Animal Science and Technology*. 61(3): 111-121.
- Alan RS (2001). Poultry meat processing. Department of Poultry Science. Texas, A. and M. University. C. R.C. press LLC.
- Alvarado CZ, Richards MP, Keefe SFO, Wang H (2007). The effect of blood removal on oxidation and shelf life of broiler breast meat. *Poultry Science*. 86:156-161.
- Alzeer J, Rieder U, Hadeed KA (2020). Good agricultural practices and its compatibility with Halal standards. *Trends in Food Science & Technology*. 102: 237-241.
- Anas AZM (2015). Branded meat sector grows as middle class demand rises. Published in Financial Express on 1st February.
- Barbut S (2002). Poultry Meat Processing. CRC Press. New York, NY.
- Barbut S (2015). Live bird handling. S. Barbut (Ed.), The Science of Poultry and Meat Processing, University of Guelph, Guelph, Ontario, Canada. Chapter 4, pp. 1-24.
- Bianchi M, Petracci M, Cavani C (2005). Effects of transport and lairage on mortality, live weight loss and carcass quality in broiler chickens. *Italian Journal of Animal Science*. 4: 516-518.
- Bianchi M, Petracci, M, Venturi L, Cremonini MA Cavani C (2008). Influence of preslaughter fasting on live weight loss, carcass yield and meat quality in rabbits, 9th World Rabbit Congress - June 10-13, Verona - Italy.
- DEFRA (Department of Environment, Food and Rural Affairs) (2002). Code of Recommendations for the Welfare of Livestock: Meat Chickens and Breeding Chickens. DEFRA Publications. Accessed July. 2020.
- Dho-Moulin M, Fairbrother JM (1999). Avian pathogenic Escherichia coli (APEC). *Vet. Res*. 30: 299-316.
- Dinh PN, Long HT, Tien NT, Hien NT, le Mai TQ, le Phong H (2006). Risk factors for human infection with avian influenza A H5N1, Vietnam, 2004. *Emerging Infectious Diseases*. 12: 1841-1847.
- DLS (2015). Annual report on livestock. Division of Livestock Statistics, Ministry of Fisheries and Livestock, Farmgate, Dhaka, Bangladesh. Accessed August. 2020. <http://www.dls.gov.bd/>
- DLS (Department of Livestock Services) (2016). Yearly updated report for 2015-2016. Government of the People's Republic of Bangladesh, Farmgate, Dhaka, Bangladesh. Accessed February. 2020. <http://www.dls.gov.bd/>
- Facciola A, Riso R, Avventuroso E, Visalli G, elia SA, Lagana, P (2017). Campylobacter: From microbiology to prevention. *Journal of Preventive Medicine and Hygiene*. 58:79-92.
- Fletcher, D.L. 2002. Poultry meat quality. *World's Poultry Science Journal*. 58(2): 131-145.

- Hasn MM, Kabir SML, Hoda N, Amin MM (2015). Assessment of microbial load in marketed broiler meat at Mymensingh district of Bangladesh and its public health implications. *Research in Agriculture Livestock and Fisheries*. 2 (1): 87-95.
- Human Slaughter Association (HSA) (2013). Practical Slaughter of Poultry: A guide for the smallholder and small-scale producer. The Old School, Brewhouse Hill, Wheat Hempstead, Herts., AL4 8AN, UK. www.hsa.org.UK.
- Khaled SA (2015). Can commercial poultry sector play the pivotal role in building a healthy nation? Proceedings of the 9th international poultry show and seminar, Dhaka, Bangladesh.
- Kittelsen K, Granquist E, Aunsmo A, Moe R, Tolo E (2018). An evaluation of two different broiler catching methods. *Animals*. 8(8): 141.
- Komba EVG, Mkupasi EM, Mbyuzi AO, Mshamu S, Luwumbra D, Busagwe Z, Mzula A (2012). Sanitary practices and occurrence of zoonotic conditions in cattle at slaughter in Morogoro Municipality, Tanzania: implications for public health. *Tanzania Journal of Health Research*. 14 (2): 865-890.
- Kranen RW (2002). Haemorrhages in muscles of broiler chickens. *World's Poultry Science Journal*. 56(2): 93-126.
- Lima VA, Ceballos MC, Gregory NG, Mateus JR, Paranhos DC (2019). Effect of different catching practices during manual upright handling on broiler welfare and behavior. *Poultry Science*. 98(10): 4282-4289.
- MLJPA (Ministry of Law, Justice and Parliamentary Affairs) (2011). Animal Slaughter and Meat Quality Regulation Law 2011. Law Number 16. Accessed April. 2020.
- OIE (World Organization for Animal Health) (2017). Terrestrial Animal Health Code. Session 7.10. Animal Welfare and Broiler Chicken Production Systems. Accessed August. 2020.
- Owens CM (2010). Poultry Meat Processing. 2nd ed. CRC Press; Boca Raton, FL, USA:
- Pal M (2012). Raw meat poses public health risks. *The Ethiopian herald*. 15: 2-3.
- Sayda AM Ali, Hyder O Abdalla, Ibrahim M Mahgoub (2011). Effect of slaughtering method on the keeping quality of broiler chickens' meat. *Egyptian Poultry Science Journal*. 31(IV): 727-736.
- Sayeed A, Smallwood C, Imam T, Mahmud R, Hasan RB, Hasan M, Anwer MA, Rashid MA, and Hoque MA (2017). Assessment of hygienic conditions of live bird markets on avian influenza in Chittagong metro, Bangladesh. *Preventive Veterinary Medicine*. 142: 7-15.