Evaluation of slaughter and sanitation in slaughterhouse category ii

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Abstract. Meat is one of main source of animal protein that provides nutrition to humans, and it is produced through the slaughter process in a slaughterhouse. The existence of the slaughterhouse is important to ensure safe, healthy, wholesome, and halal meat. This study aims to evaluate the implementation of halal slaughter and sanitation during the slaughter process in the slaughterhouse category II. Total plate count (TPC), Salmonella sp, Coliform, and Escherichia coli were analysed by using the Bacteriological Analytical Manual (BAM) method. Halal slaughter was carried out under observation with GSP forms that refer to Decree of the Minister of Agriculture No. 413/310/7/1992, RI Government Regulation No 95/2012 and the Indonesian Ulama Council (LPPOM-MUI) as well as the Food, Drugs and Cosmetics Assessment Institute HAS 23103 (2012). The results of the total plate count (TPC), Salmonella sp, Coliform, and Escherichia coli in meat was under the maximum threshold set by the Indonesian National Standard (INS) and halal slaughter in slaughterhouse category II already meet the standard requirement of Islamic law based on the Halal Assurance System (HAS) of the Indonesian Ulama Council (MUI).

1. Introduction

Beef cattle provide meat that people eat every day. Meat is one of main sources of animal protein and it comes from the livestock industry through the slaughter process. The demand for meat is in line with the intensity of slaughter process. However, a demand does not always mean the facilities are improved to keep the conditions of the facility up to date. The slaughterhouse processes the meat that will affect beef cattle trading on production and consumption scales, so it is important to ensure the meat quality for consumers [1].

Meat contains many nutrients and thus makes a very suitable environment for the growth of microorganisms, especially bacteria. These bacteria often contaminate the meat during the slaughter process, and will affect the meat quality. Therefore, the cleanliness of the slaughterhouse is important in ensuring safe, healthy, wholesome, and halal meat [2]. Because of this, the government and the private sector have established many slaughterhouses in various regions in Indonesia. The law of the Republic of Indonesia [3] mandates that each district- city must have a slaughterhouse that meets the technical requirements set by the Minister of Agriculture [4].
The slaughter process must follow the rules set by the government. The slaughter stage is the critical point of halal meat as food. Halal rules during slaughtering also depend on an understanding of the meat cutting and handling techniques that are conducted by the slaughter-man. The slaughterhouse must have a halal and competent slaughter-man to fulfill the conditions. The growing Muslim population in Indonesia will directly increase the preference for halal food. In addition, [5] mentioned that an animal that is slaughtered in a halal way will have better quality of meat. Bacterial contamination and Sharia procedures during the slaughtering process are safety problems and concerns in the production of halal meat. Due to those conditions, the purpose of this study was to evaluate the implementation of halal slaughter and sanitation in a slaughterhouse category II.

2. Materials and methods
This study was conducted in slaughterhouse PT. Elders Indonesia (PTEI) located at Jl. Agatis, Bogor Agricultural University, Dramaga, Bogor. Microbiological analysis was performed in laboratory of Livestock Product Technology, Faculty of Animal Husbandry, Bogor Agriculture University.

2.1. Meat sample collection
Meat sampling was carried out at 08:00 am to 10:00 am (morning slaughter) in two months (August 2015 and March 2016). The samples were placed in sterile plastic, put in cool boxes containing ice gel, and then taken to the laboratory.

2.2. Implementation of halal slaughter, slaughter-man competence and facilities
The halal slaughter was carried out under observation with GSP forms which refer to Permentan No. 413/310/7/1992 concerning Animal Slaughtering and Meat Handling and its Adherence, RI Government Regulation No 95/2012 on Veterinary Public Health, Permentan No 13 / OT.140 / 2010 concerning the Requirements for Slaughterhouse and Meat Cutting Plant. The halal slaughtering forms refer to the Indonesian Ulama Council (LPPOM-MUI) Food, Drugs and Cosmetics Assessment Institute HAS 23103 (2012) concerning Guidelines for Fulfilling Halal Assurance System Criteria in slaughterhouses.

The evaluation form for halal slaughter is in accordance with [6] and has been modified to fit the needs of this study. Weighting is based on a critical point with a total weight (B) and grading the score (S) of the evaluation results is a score of 3 if it meets the requirements, a score of 2 if it is not in accordance with the requirements, a score of 1 if it does not fit the requirements, and a score of 0 if not exist or not implemented.

2.3. Microbiological examination
The microbiological quality of meat examined was Total Plate Count (TPC). The bacteria that were examined included Coliform, Escherichia coli and Salmonella spp., conducted according to [7].

3. Result and discussion

3.1. Halal slaughter procedure
According to [8] slaughtering an animal in accordance with Islamic law must meet the following requirements: (a) the animal must be a permitted species for Muslims and required slaughtering; (b) the animal must be alive and healthy at the time of slaughtering; (c) the slaughter-man must be an adult, sane (mentally competent) and possess an intractable faith and knowledge of basic animal slaughter and welfare; (d) the slaughter-man must pronounce aloud and in full dignity the following Arabic words: “Bismillah, Allahu Akbar”; (e) the slaughter should be done by a throat cut, which helps induce rapid and complete bleeding; (f) the slaughter act should be done once, which is difficult to achieve in large animals [9]; (g) the ritual slaughter must be conducted with a strict protocol of cleanliness.
During the halal slaughtering, a slaughter-man uses the knife with a length of 25-30 cm. Using sharp knife to reduce the pain is a critical point of halal slaughtering. According to Grandin and Regenstein [10] a straight sharp knife that is twice the size of the neck can reduce the pain. A previous study conducted by Velarde et al., [11] reported that the length of the knives dedicated to halal ritual slaughtering in different abattoirs varies between 29 ± 1.79 cm for cattle, 22.2 ± 1.82 for sheep and 13 cm for poultry. Regenstein et al., [12] also stated that Islam has emphasized gentle and humane treatment of animals before and during slaughtering. The animal must be treated humanely with no source of stress in order to reduce the animal’s suffering. This might mean allowing the animal to rest, giving water to the animal, not sharpening the knife in front of the animal and avoiding slaughtering in front of other animals. Soeparno et al., [13] emphasized that there is a need for regulation and supervision of cows before and after slaughter as well as socialization about animal welfare. Based on observations, the whole slaughtering stage in slaughterhouse PTEI has applied halal slaughter. This shows that halal guarantees can be applied to fulfill the community’s right to get halal meat.

The World Organisation for Animal Health (formerly the Office International des Epizooties) formally promoted animal welfare and recommended halal slaughter procedures become a reference for the world of animal health for 178 countries, with an aim of reducing the cruel treatment of slaughtered animals and obtaining halal meat products. In the slaughter process, a slaughter-man must consider some ethics. According to MUI fatwa a slaughter-man must: (a) be a Muslim and baligh; (b) have an understanding of the sharia slaughtering procedures; (c) have expertise in the slaughter.

### 3.2. Stunning

The stunning process is the stage of resting the animal, ensuring the animal is unconscious and insensible to pain before the slaughter process. The cattle are placed in a knocking box (size 2x1 m) through alley-ways in order to stun them. Indonesia has begun to apply the stunning process, which

| Indicators                                                                 | W | Observation result                                                                                                                                                                                                 | S | NK | Corrective action |
|----------------------------------------------------------------------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----|-------------------|
| 1. Slaughter without stunning was carried out by halal slaughter-man in accordance with Islamic law | 3 | Slaughter was carried out with stunning to maintain the animal welfare due to difficulties in reducing pain. Based on MUI guidance (2009) about the Animal Slaughtering Certification Standards | 3 | 9  | -                 |
| 2. A sharp knife was used pressing once without being lifted                | 3 | Sharp knife (25-30 cm) and equipped with a sharpener                                                                                                                                                    | 3 | 9  | -                 |
| 3. Must cut blood vessels, airways, and food channels at once              | 3 | In accordance with the procedures                                                                                                                                                                         | 3 | 9  | -                 |
| 4. After slaughtering, water is not poured over the wound                  | 3 | In accordance with the procedures                                                                                                                                                                         | 3 | 9  | -                 |
| 5. The animal must really die (not moving) and complete blood loss (blood stops flowing) before conducting the next step in the slaughter process | 3 | In accordance with the procedures                                                                                                                                                                         | 3 | 9  | -                 |
| **Total**                                                                 |   |                                                                                                                                                                                                              |   | 45 |                   |
is generally carried out in slaughterhouses that have stunning tools and trained operators. Indicators and observations are presented in Table 1.

[14] has issued Fatwa No. 12/2009 on Animal Slaughtering Certification Standards stating that stunning the animal is recommended to reduce its pain during slaughter. Limon et al., [15] reported that Animal stunning aims to ensure that the animal does not feel any pain during the act of slaughtering. Based on Gaznur et al., [16] the stunning technique performed at the PTEI RPH uses a captive bolt stunning. It is an iron rod in a cylinder that is activated by an explosive charge that resembles an empty cartridge propelled by pressure. After a charge, cartridge bullets are left inside the weapon and can be taken out and replaced. Trained operators can guarantee the accuracy of using the stunning gun so as to not cause the cow to die. Operators must wear a hearing protective device (HPD) during the stunning process. Stunning has a tipping point with the use of bullet sizes. Black bullets with a size of 4.5 mm for large cattle (≥500 kg), green bullets with a size of 4.5 mm for large cattle (500 kg), and red bullets with a size of 6 mm (≥ 550 kg). The stunning position is on the forehead about 2 cm above the cross line between two eyes or directly in the cerebrum.

Stunning is also critical point in halal slaughter, where the use of stunning gun should not cause the cow to die because one of the halal requirements is that the cow must be slaughtered in a state of life. Failure in the stunning process is only allowed 5% of the total number of slaughters performed in one day.

3.3. Microbiological quality of meat
Meat quality can be determined from the spread of microorganisms that grow on a sample of the meat, and in general this consists of bacteria, fungi, and mold [17]. In this study, the results of the meat microbiology examination would refer to the Indonesian National Standard [19]. Total Plate Count (TPC), Salmonella sp, Escherichia coli and Coliform in fresh meat from PTEI slaughterhouse is under the maximum threshold according to [18]. These threshold values have a maximum value of 1x10⁶ cfu/mg⁻¹ for TPC, detection of Salmonella sp is negative, E. coli is 1 x 10¹ cfu/mg⁻¹ and Coliform is 1 x 10² cfu/mg⁻¹. The implementation of good management will reduce the spread of microorganisms in meat during slaughtering.

| Time of observation | The number of microbes (cfu/mL⁻¹) | TPC | Salmonella sp. | E. Coli | Coliform |
|---------------------|-----------------------------------|-----|---------------|---------|---------|
| August 2015         | 3.1 x 10³                         | Negative | < 3 | Negative |
| March 2016          | 6.2 x 10³                         | Negative | Negative | 5.1 x 10¹ |

Salmonella is a pathogenic bacterium that is normally present in the intestines and polluted air [19]. *Coliform* and *E. coli* are normal microbes in the digestive tract with certain pathogens. *Staphylococcus aureus* bacteria is found in air, water, or equipment used in food processing, and normally found in the nose, throat, and skin [20], but not all *Staphylococcus aureus* are pathogenic. The results of meat testing from the PTEI slaughterhouse showed no salmonella contamination was detected in meat. This could be because the viscera was removed and separated properly and correctly.

*E. coli* is a facultative anaerobic gram-negative bacteria. *E. coli* can be used as an indicator of faecal contamination and poor sanitary conditions for water. It can contaminate the meat when the slaughterhouses use contaminated water, when cleaning the tools used in the meat cutting, or when the meat is washed with water containing *E. coli*. Based on the results of *E. coli* testing, it is indicated that PTEI slaughterhouse has been properly sanitized.

4. Conclusion
The slaughter process carried out in the PTEI Slaughterhouse has good standards and follows the halal slaughter already established as the standard requirement of Islamic law based on the Halal Assurance...
System (HAS) of the Indonesian Ulama Council (MUI). The results of total plate count (TPC), Salmonella sp. Coliform, and Escherichia coli in meat was under the maximum threshold set by the Indonesian National Standard (INS).

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