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Gross and Histological Evaluation of Fresh Chicken Carcass: Comparison Between Slaughtered and Cervical Dislocated Methods

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Abstract: The study was conducted to evaluate the gross and histological appearances of fresh chicken carcasses between slaughtered and cervical dislocated methods. In this study, 5 adult broiler chickens with homogenous weight were slaughtered and another 5 chickens were cervically dislocated. The chickens were left at room temperature for 30 min prior to gross examination and sampling for histological examination. The gross appearance of muscle and internal organs was evaluated and compared. The internal organs were fixed with 10% formalin for 72 h before went through the process of dehydration, clearing, impregnation, embedding process into paraffin wax and process of sectioning and staining with Haematoxylin and Eosin. The sections were examined under light microscope. Results in this study revealed that the gross examination of the carcass killed by slaughtering method had showed pallor appearance as compared to the chickens killed by cervical dislocation method which appeared reddish in almost all of the organs. Histologically, there was no significant different in terms of distribution or composition of erythrocytes in the visceral organs except in lungs, kidney and liver where the chickens killed by slaughtering method contains less erythrocytes as compared to the chicken killed by cervical dislocation.

Key words: Chicken, slaughtering, cervical dislocation, gross, histology

INTRODUCTION

There were various methods in order to kill a chicken. It can be done by slaughtering, cervical dislocation, decapitation, electrical stunning, gas mixtures (90% argon in air or a mixture of 30% carbon dioxide and 60% argon in air) and conventional electrical waterbath stunning systems [120 mA per bird (50 Hz, Alternating Current, AC) for 4 seconds]. One study showed that decapitation following stunning did not result in consistent carcass quality defects compared to conventional killing[1]. The same study also showed that there was no differences in 24 h lightness value, yellowness, cook yield, tenderness, or ultimate pH between conventionally killed and decapitated birds. However, blood loss and breast meat redness were inconsistent.

The variations in commercial slaughter techniques affected either appearance or the residual blood content of the carcasses produced[2]. Dislocation of the neck vertebrae can be done by damaging the cranium to damage the lower brain region, causing rapid unconsciousness. In order to be humane, dislocation must cause severance of the brain from the spinal cord and carotid arteries. This is best achieved by using a stretching motion rather than by crushing the vertebrae. The neck is extended and dislocated by thrusting downward and backward.

Islamic slaughtering method is when animal is killed by completely severing the windpipe, the gullet and the jugular vein using the sharp object (e.g knife) to inflict a precise cut. Only one side of the neck (ventral aspect) is cut, so the birds bleed slowly. The spinal cord should not be cut (as when the head is cut off), because the feathers "set" are hard to pick. The esophagus should not also be cut to prevent microbial contamination from leakage. This is to be done quickly and precisely to avoid undue suffering to the animal.

This study was conducted with the aim to evaluate the fresh chicken carcasses between the slaughter and cervical dislocation method.

MATERIALS AND METHODS

Animals: The study was carried out using 10 broiler chickens weighing between 2.0 to 2.2 kg. The chickens were randomly divided into 2 groups which consist of 5

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chickens each. The chickens were deprived for food for 12 h with water provided *ad-libitum* prior to euthanasia. This is to avoid spillage of the intestinal contents into the abdominal cavity. The first group of chicken was slaughtered by cutting the trachea, common carotid arteries and jugular veins completely using a sharp knife. The second group of chicken was killed by using cervical dislocation (un-slaughtered) method. The neck was extended and dislocated using a sharp downward and backward thrust. All chickens were left aside at room temperature for 30 min before the carcasses were opened and examined.

Gross examination: For each carcass, the skin was removed to expose the muscle. The appearance of muscle was examined and photograph was taken. The abdominal cavity was then exposed by removing the pectoral muscle and the internal structures and organs were examined grossly. The brain, crop, gizzard, duodenum, heart, spleen, liver, pectoral muscle, kidney and lungs were removed from the body and the comparison were made between the two groups. The heart and spleen of chickens of both groups were dissected and weighed.

Microscopic examination: The samples were fixed in 10% formalin for 72 h before went through the process of dehydration, clearing and impregnation and then embedding into paraffin wax. The processed samples were chilled on cold plate before sectioned into 5μm thick by using microtome (Machine brand: Shandon Southern Duplex Processor). The sections were floated on the warm bath tub before placing onto the slide. The slide with the sectioned samples was placed on a hotplate to deparaffinize before staining with Haematoxyllin and Eosin. The sections were then examined under light microscope (Leica DM LB2, Germany) to identify, compare and to evaluate the presence of RBC. A total of 8 slides were examined for each samples under magnification of x200.

Scoring method: Scoring was done based on distribution of erythrocytes as follow:

Absent = 1
Occasional = 2
Moderate = 3
High = 4
Profuse = 5

Statistical analysis: All the data were analysed using Independent-T Test (Mann Whitney U Test). This was done using SPSS software, Version 11.0.

RESULTS

Gross observation: The carcass of chicken killed by slaughtering method showed slightly whitish appearance as compared to the carcass of chicken killed by Cervical Dislocation (CD) which appeared reddish. Besides that the liver of the chickens killed by slaughtering method showed that it has undergone discoloration and became pallor as compared to the chickens killed by cervical dislocation method which appeared reddish and enlarged.

Other organs that show significance changes in its gross appearance were lungs, kidneys, heart, spleen and duodenum. Organs of the chickens which were killed by cervical dislocation method showed severe congestion. It can be visibly seen by comparing the color of the organs with the chickens killed by slaughtering method where the organs appeared pale in color. The heart and the spleen for each chicken were weighed prior to sampling and the result was compared between the 2 methods. The results revealed that the heart and spleen of the chickens killed by slaughtering method had less weight compared to those killed by cervical dislocation method Fig. 1 and 2.

Histological observation: The histological appearances of lung tissue, liver, kidney and spleen of chicken killed by slaughtering method showed less distribution of erythrocytes as compared to the chickens killed by Cervical Dislocation (CD) where the distribution of erythrocytes were widely distributed and looks compact Fig. 3 and 4. The distribution of erythrocytes was scored and was analyzed in the form of mean scores Table 1.

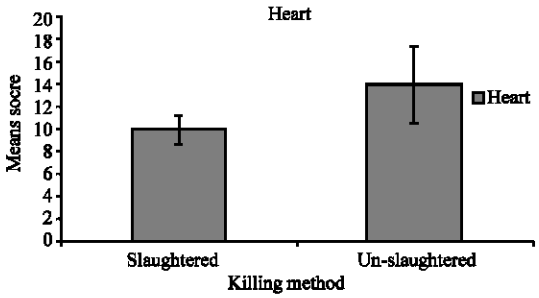

Fig. 1: Mean weight of heart between slaughtered and cervical dislocated chickens

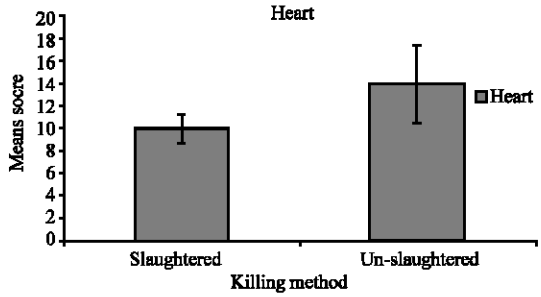

Fig. 2: Mean weight of spleen between slaughtered and cervical dislocated chickens

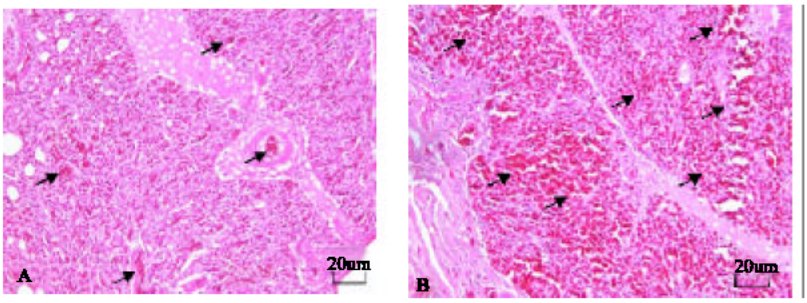

Fig. 3: Histological sections of the lung of chicken killed by (A) slaughter technique and (B) cervical dislocation. Note that in (A) there had less distribution of erythrocytes as compared to (B) where there are high number of erythrocytes (arrow), widely distributed and compacted. (H and E 200X)

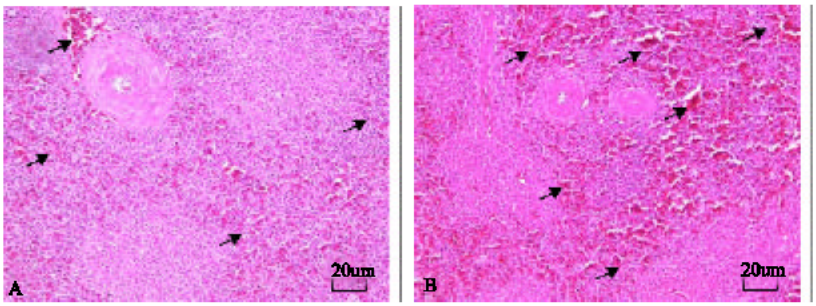

Fig. 4: Histological sections of the spleen of chicken killed by (A) slaughter technique and (B) cervical dislocation. Note that (A) had less distribution of erythrocytes as compared to (B) where there are high number of erythrocytes (arrow) and widely distributed. (H and E 200X)

Table 1: The distribution of erythrocytes in tissue samples

	Erythrocyte number (cells/hpf)	
Organs	Slaughter	Cervical dislocation
Brains	1.0±0.0	1.6±0.9
Kidney	2.2±0.5	2.6±0.9
Lungs	3.2 *±0.8	4.8±0.4
Spleen	2.4 *±0.6	3.2±0.5
Liver	2.4 *±0.6	3.2±0.5
Gizzard	1.0 *±0.0	1.6±0.6
Heart	1.4 *±0.6	2.0±0.0
Duodenum	2.0 *±0.7	3.4±0.6
Breast Muscle	1.0±0.0	1.2±0.5

All values are expressed as mean±std.dev. For each row means with different superscripts are significantly different ($p<0.05$)

DISCUSSION

The results of this study revealed that there was a significant different in gross appearance of the organs of chickens killed between two different methods. The common characteristic of gross lesions of dead chickens and euthanized moribund chickens was discoloration of liver[3]. This was similar to the findings in slaughtered chicken where the organ such as lungs, liver, kidney, duodenum and pectoral muscle appeared pallor. However, in chicken killed by cervical dislocation method, all the organs appeared reddish in color. This was because slaughtering method results in rapid gush of blood draining of which most of it from the chicken's body. About 40-60% of total blood volume is lost at exsanguinations[4]. This also explained why some organs such as heart and spleen in the chickens killed by cervical dislocation method tend to be heavier than those of slaughtering method. In this experiment, only heart and spleen were weight. This was because, heart is an organ which carries more blood compared to other organs and the spleen is the organ that stored blood, produced lymphocytes and destroy worn-out erythrocytes.

The microscopic comparison and evaluation in this study revealed that there was a significant finding in erythrocytes distribution within the tissue of some organs. The most significant organ where the distribution of erythrocytes was intense and can be easily seen under microscope (X200) is the lung followed by the liver, kidney and spleen. The blood retention can only be seen in the chickens killed by cervical dislocation method.

Origins of haemorrhages were found, only at sites of rupture of venous structures such as postcapillary venules and small collecting veins[5]. In slaughtering method, the distribution of erythrocytes was less intense. Chickens killed by cervical dislocation method causes the

spinal cord to become severely damaged and causes the nerves fibers to the heart damaged leading to cardiac arrest, thus resulting in stagnation of the blood in the blood vessels. That is why with this method the organs appeared reddish in color macroscopically and have wide distribution of erythrocytes microscopically.

CONCLUSION

Chickens killed by slaughtering method give more benefits to consumers as compared to the chickens killed by cervical dislocation. This is because in slaughtering method, it results in the rapid gush of blood draining most of it from the animal's body. The blood must be drained completely before its head is removed. This purifies the meat by removing most of the blood that acts as a medium for microorganisms. This microorganism will produce waste and harmful substance that can cause chemical changes in meat making the meat less healthy and less nutritious. The blood has to be removed to ensure the meat remains fresh longer as compared to other methods of killing.

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