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Preliminary study on major causes of carcass condemnation and associated financial losses in chickens slaughtered at a private poultry slaughterhouse in Bishoftu, Ethiopia

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A cross-sectional study was conducted from December 2019 to March 2020 to detect the major causes of carcass condemnation and to estimate the attributed financial loss in chickens slaughtered at a private poultry slaughterhouse in Bishoftu, Ethiopia. The study involves a postmortem (PM) inspection of 400 randomly selected chickens. From a total of 400 chickens subjected to PM examination, 77 (19.25%) of them had abnormalities. Of these, 35(8.75%) chickens were totally condemned, while 42 (10.5%) were partially rejected. The major causes of total carcass condemnation observed during this study were machine damage (4.25%), poor bleeding (2.5%), emaciation (1.25%), and septicemia (0.5%). While bruise (7.25), fracture of bone (2%), arthritis (1%) and machine damage (0.25%) were the major causes of partial condemnation, respectively. The high bruises occurrence in the slaughterhouse was due to poor handling of the poultry during transportation and hoisting. The annual financial loss incurred due to carcass condemnation to the slaughterhouse in the study period was estimated to be ETB 660,480 or USD 19,144.34. Improving the management of harvesting, transportation, and adjustment of the equipment used at slaughter can reduce the effect on the carcass and financial losses. This type of study especially, on poultry was not reported so far in Ethiopia therefore; this finding can be used as baseline information for further investigation and controlling of factors responsible for chicken meat condemnation in a poultry slaughterhouse.

Key words: Carcass, condemnation, financial, losses, poultry, slaughterhouse.

INTRODUCTION

Poultry production and poultry meat consumption are tremendously growing in the world. This is due to its low fat and high essential nutrient composition, relatively low investment cost and rapid return rate (Chouliara et al., 2007). In Ethiopia, poultry production is an integral part of the agricultural system and it is becoming a preferable

source of income and employment to rural and urban societies. It is preferred over other livestock production sectors because of its rapid production efficiency and returns in small areas with a reasonable initial capital. In Ethiopia, there are more than 60 million chicken populations, of which 95% are indigenous and the rest 5% are exotic and hybrid populations according to the CSA 2016/2017 report. Ethiopia produces more than 61,840 tons of poultry meat annually; this is less than 2% share in Africa and 12% of East Africa (CSA, 2014).

In the poultry production industry, various diseases and different pathological changes can affect chicken meat quality. These will result in the whole or part of the organ or carcass condemnation and cause huge financial loss to the poultry industry as well as the national economy (Ansari-Lari and Rezagholi, 2007). Septicemia is a systemic disease caused by pathogenic microorganisms and their toxins in the blood. This will cause different microscopic and macroscopic lesions to the chicken meat and internal organs including swelling, watery tissues, petechial hemorrhage and discoloration of the skin which are responsible for the condemnation of the carcass during the quality inspection (Lohren, 2012). Bruising is the other most common pathological lesion in poultry slaughterhouse manifested by discoloration of subcutaneous and skins of chicken due to the accumulation of blood in the peripheral vessels. Tumor, ascites, airsaculitis, and synovitis are also among the pathological abnormalities affecting the chicken meat quality (Silva and Mota, 2003).

Slaughterhouses are the locus of disease surveillance where unusual signs, abnormal growths/anomalies, lesions, or specific disease examined to avoid food-borne zoonotic diseases and reduce financial losses incurred due to the abnormalities (Alton et al., 2010). In addition, the slaughterhouses help to know the incidence of the acute, chronic, mild and subclinical diseases that occur in production animals and point to control and prevention measures (Mallia et al., 2000). Pathological lesions due to pathogens or other non-infectious conditions are important cause for carcass condemnation and attributed financial losses identified in abattoir or slaughterhouses (Fallavena, 2003). Several studies were conducted to detect the causes of carcass and organ condemnation in ruminant animals, however, the causes of chicken carcass condemnation and associated financial losses were not reported so far in Ethiopia. Therefore, this research paper presents the major causes of carcass condemnation and accompanying direct economic losses in chickens slaughtered at a private poultry slaughterhouse in Bishoftu, Ethiopia.

MATERIAL AND METHODS

Study area

The study was conducted from December 2019 to march 2020 at one private poultry slaughterhouse in Bishoftu. The selected slaughterhouse produces and process poultry meat for consumer, which is located in Oromia regional states, East Shoa zone, Bishoftu, Ethiopia. Bishoftu is suited at 9°N and 40°E with an altitude of 1880m above sea level in the Central highlands of Ethiopia lying 47 km's to the Southeast of Addis Ababa, the capital city. It has annual rainfall of 871 mm of which 80% is received during long rainy season starting from June to September and the remaining in short rainy season extending from March to May, and the dry season from October to February. The mean annual maximum and minimum temperatures are 26 and 14°C respectively with mean relative humidity of 61.3% (NMSA, 2010). Poultry production and poultry slaughterhouses are among tremendously growing farming sector in Bishoftu town.

Chickens, farm and slaughterhouse

The chickens included in this study were broilers and they were brought from the slaughterhouse's owned poultry farm near to the slaughterhouse. The farm is major large-scale intensive broiler producers in the town as well as in the country and has an annual production capacity of 150,000 broilers. The farm has a chicken processing plant with a single processing line for 2000 birds per hour; they also further process some of the chicken meat into sausages. Currently, the farm operates at limited production, slaughtering only 4000 broilers per day (Boere et al., 2015).

Study design

A cross sectional study design was conducted from December 2019 to March 2020 to identify the major causes of carcass and organ condemnation. Active abattoir survey using the regular meat inspection procedure to identify the major causes of carcass condemnation and observation of checklist to estimate the financial loss due to organ condemnation were used for this study.

Sample size determination and sampling

The approximate sample size required for the present study was determined based on the formula given by Thrusfield (2005). By taking the expected prevalence of 50% carcass condemnation in poultry and a confidence level of 95% and absolute desired precision of 5%, the minimum sample size was 384 poultry. However, to increase the precision, 400 poultry total sample size were taken for the present study.

$$n= \frac{(1.96)^2 * P_{exp}(1- P_{exp})}{(d)^2}$$

Where: n = number of required sample size; Pexp = expected prevalence = 50%; d = desired accuracy level at 95% interval.

In this study, the poultry slaughterhouse were visited twice a week, on each visit day, about 20-25 broilers were selected by systematic random sampling techniques;where only the first chicken was chosen randomly and accordingly, a total of 400 broilers were examined.

Ethical approval

The farm and slaughterhouse owner was informed about the study and its objectives, and he granted his verbal, fully informed agreement. During the ante-mortem inspection, the study birds

Table 1. Proportion of postmortem finding in totally and partially condemned carcass.

Pathologic conditions	No (%) of Total condemnation	No (%) of partial condemnation
Fracture	0	8(2%)
Arthritis	0	4(1%)
Bruise	0	29(7.25)
Emaciation	5(1.25%)	0
Machine damage	18(4.25%)	1(0.25%)
Septicemia	2(0.5%)	0
Poor bleeding	10(2.5%)	0
Total	35(8.75%)	42(10.5%)

were handled according to standard protocols for animal use and care.

Study protocol

Active abattoir survey

Active abattoir survey was conducted based on observation of checklists and standard meat inspection procedures.Checklists were used to generate both quantitative and qualitative data from the abattoir, which used to quantify the total number of slaughtered chicken; total number of condemnation rate (TCR) and number of those condemned for specific conditions, also used to estimate the financial loss due to carcass condemnation.

Ante mortem examinations were conducted only for identification of the physical condition, health status and presence of pre-slaughter death of broiler chicken. Postmortem examination was directed by visualization, inspection, palpation and systematic incision of visceral organ and carcass by using the regular meat inspection procedure guide lines (FAO, 2007). Carcass condemnation causes were diagnosed based on gross inspection, disease conditions, traits and organs pathological lesions that were judged in accordance with the traditional manual of poultry meat inspection (Herenda et al., 1994; Gracey et al., 1999).

Assessment of direct financial loss

The total financial loss due to carcass condemnation was computed based on the average meat yield per carcass number of carcasses condemned by year, average local market prices of each carcass. The annual economic losses due to poultry carcass condemnation were calculated using following formula:

DFL= C × P × W

Where: DFL= Direct Financial Losses; C = Estimated number of chicken slaughtered annually; P= Rate of condemnation; W=Average poultry carcass Price

Data management and analysis

Data generated during the active abattoir survey was entered in to Microsoft excel spread sheet and summarized by descriptive statistical methods like mean, percentage and proportion was utilized to summarize the data. Then the data was further analyzed by using Software program for Social Science (SPSS) version

20.00 software. Descriptive statistics was used to determine the level of carcass condemnation rates defined as proportion of condemned carcass to the total number of carcasses was examined.

RESULTS

Abattoir survey

Out of the 400 poultry examined during postmortem, 35(8.75%) chickens were totally condemned while 42 (10.5%) chickens were partially rejected (Table 1).

Assessment of direct financial loss

The financial loss of carcass condemnation was analyzed based on the average number of chicken slaughtered annually at the slaughterhouse that was estimated to be 96000 and obtained from the records of the slaughterhouse. The average price of chicken meat obtained from supermarkets and retailers was 80ETB. The average rate of total condemnation computed during this study was 0.086 (35/400). Thus, the estimated annual financial loss of poultry carcass condemnation during the study period was ETB 660,480 (C*P*W= 96000*80*0.086) or USD 19,144.34.

DISCUSSION

Monitoring and revealing the major cause of carcass condemnation at the slaughterhouse can help the producers and scientists for determination of fault management at production and slaughtering operations. Every year extensive research on the causes of poultry carcasses condemnation is performed all over the world that plays an important role in the prevention of diseases and the reduction of financial losses (Ferreira et al., 2012). Therefore, the present study was conducted to investigate the causes of carcass condemnations and their associated financial losses in chickens slaughtered

at the poultry slaughterhouse. Active abattoir survey, which includes observation of checklists, ante mortem inspection of live broilers for determination of age groups, species and dead and live chicken and PM inspection of slaughtered chicken carcass were done to identify the major abnormalities or lesions that cause carcass condemnation and financial losses.

In the present study, of the total 400 PM examined carcass, 35(8.75%) chickens were totally condemned while 42 (10.5%) chickens were partially rejected. Bruise, machine damage, septicemia, arthritis, poor bleeding and fracture were the most common reason for carcass condemnation at poultry slaughterhouse. The result of PM inspections of carcasses and internal organs showed that the total number of condemnation and the causes of condemnation are varied in different countries, which seems reasonable as a result of different ecologic conditions, epidemiologic aspects, management practice and health status in each country (Ansari-Lari and Rezagholi, 2007).

Bruises were most important lesion that causes partial condemnation at the current poultry slaughterhouse. Thigh muscle, breast muscle and wings were the most common affected parts at the slaughterhouse. The overall prevalence of bruises at the present poultry slaughterhouse was 7.25%. This finding is also reported in other countries by Santana et al. (2008) from State of Goias, Brazil and by Ghanie et al. (2016) from West Azerbaijan Province (North West of Iran) with prevalence of 0.47 and 10.3% respectively. However, there are no further studies were reported in Ethiopia for poultry slaughterhouse. Fracture of bone with (2%) and Arthritis (1%) of prevalence also the pathological conditions that are cause partial condemnation of carcass.

The numbers of machine damage and poor bleeding were higher in this slaughterhouse as the cause of total condemnation with 4.5 and 2.5% prevalence respectively. Emaciation/cachexia were also indicated as a cause of condemnation in this survey with (1.25%).

In different study Azizpour (2011) mentioned that septicemia and ascytes was main cause for condemnation of carcass in Namin province within 2009, also one year of experiment conducted by Gholamian et al. (2008) revealed that septicemia is main cause of carcass condemnation at industrial slaughtery in Gonbadkavous, this finding was also considered as the cause of carcasses rejection in the present study with the prevalence of (0.5%).

This study has revealed that a number of conditions result in the condemnation of carcasses, and thus have great financial implications. In addition to the economic losses as aresult of the fact that carcasses could not be packaged and marketed due to quality issues (Alves, 2006). Factors such as the method of harvesting, transport time, waiting time, type of transportation boxes, density per cage, harvesting period, age, sex and temperature were reported by Santana et al. (2008) as parameters that influence poultry lesions.

CONCLUSION AND RECOMMENDATIONS

The most common reasons for carcass condemnation at the slaughterhouse were bruises, machine damage, poor bleeding, bone fracture, emaciation, arthritis, and septicemia, according to this study. The main reasons for partial and entire carcass condemnation were bruising and machine damage, respectively. The annual direct financial loss incurred as a result of organ condemnation was projected to be around 660,480 ETB. To reduce losses caused by bruises and fractures, better harvesting and transportation management should be done, as well as sophisticated equipment adjustment at slaughterhouses to reduce machine damage and poor bleeding. This research paves the way for a more in-depth investigation of the causes of organ condemnation (pathogens involved, public health issues).

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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