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Conditions Responsible for Meat Condemnations in Cattle Slaughtered in Bugesera, Gicumbi and Rwamagana districts of Rwanda

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ABSTRACT

Introduction: Records obtained from slaughterhouses on the causes of meat condemnation is vital in contributing to the surveillance of disease prevalence and for promoting food security by protecting the community from consuming infected or unhygienic meat.

Purpose: The objective of this study was to determine the prevalence of conditions that lead to organs and/or carcass condemnation.

Methodology: A retrospective study design was used to collect data by using a structured questionnaire. The study reviewed three years (October 2018 to October 2021) postmortem inspection records of cattle slaughtered at abattoirs located in Bugesera, Gicumbi, and Rwamagana districts of Rwanda.

Findings: Of the 9256 cattle slaughtered, 26.3% had at least one condition leading to total condemnation of organs or carcasses. The results of the study also revealed that the fasciolosis was the main cause of the liver (41.1%, 90.0%, and 65.5%) condemnation in the three districts respectively, while the kidney (4.7%, 0.8%, and 6.4%) was condemned due to urinary calculi. The leading causes of condemnation of lungs and intestine were insufficient bleeding (50.1%) and pimply gut (0.7%), respectively. In decreasing order of probability of being more prevalent, the top four conditions were: fasciolosis (9.2%), insufficient bleeding (3.2%), urinary calculi (0.9%), and hydronephrosis (0.6%).

Recommendations: These results highlight the need for improved meat inspection practices at abattoirs, awareness of stakeholders involved in cattle trading value chain, and implementing control and prevention measures against these conditions. This will help improving meat safety at abattoirs while ensuring food security and profitability of meat value chain.

Keywords: *Condemnation, Meat inspection, Organs, Post-mortem, Slaughterhouses.*

1. INTRODUCTION

Meat inspection is a tool used to determine and control meat borne diseases by using vision, palpation, and incision of the carcass and offals to deliver safe meat for human consumption (EFSA, 2013; Blagojevic & Antic, 2014; Stärk *et al*.,2014). Based on post mortem inspection findings; any carcass/organ or portion of carcass/organ that (i) has sign (s) of disease, (ii) is abnormal, (iii) is affected with condition that may present a hazard to human health or (iv) that may be nauseating to consumer is partially (rejection of affected parts and passing unaffected ones) or totally (disposal of the whole carcass) condemned (FAO, 2011; Dupuy *et al.*, 2013; EFSA, 2013). Various studies have reported different causes of condemnation. The study of Fuseini (2012) in South Wales reported that conditions responsible for total condemnation of carcasses were tuberculosis (34.2%), pyemia (24.9%), septicemia (19.8%), oedema (18.3%), tumours (1.2%), severe trauma/bruising (0.9%), and uraemia/abnormal Odour (0.6%). Other conditions responsible for meat rejection at post mortem inspection were fascioliasis, kidney and lung lesions that respectively represented 50.2%, 12.2% and 79.3% of total conditions (Fuseini, 2012). Mohammed and Maky (2020) reported that out of 126 686 animals slaughtered from January 2017 to December 2019 in Alexandria; 0.02% (n=20) were totally condemned due to various causes comprising in decreasing order: icterus, fever, tuberculosis, ill bleeding and emaciation. Similarly, a retrospective study conducted by Yesihak and Webb (2015) based on records from abattoirs in Ethiopia showed that 170 out of 62,917 carcasses were totally condemned due to poor bleeding (0.11%), abscess (0.06%), adhesion (0.04%), tuberculosis (0.03%), pneumonia (0.01%), *Cysticercus bovis* (0.01%), and bruising (0.01%).

In contrast, major causes of partial condemnations recorded were bruising, poor bleeding, contamination, adhesion, abscess and calcification of cysts respectively representing 34.1%, 25.6%, 12.6%, 9.4%, 1.6% and 0.1% of the cattle slaughtered (Yesihak & Webb, 2015). The reported causes of organ condemnation are tuberculosis, congestion, parasitic cyst and pneumonia for lungs; cysticercosis and traumatic pericarditis for heat; abscess and Fasciola for liver, hydronephrosis, renal fibrosis and abscesses for kidney; splenomegaly and congestion for the spleen, congestion and emergency slaughter for intestines (Mungube *et al.,* 2006; Mellau *et al.*, 2010; Mohammed & Maky, 2020; Clement *et al.*, 2020; Kheder & Mohamed, 2021). These reports demonstrate the lack of a proper herd health program necessary for the promotion of animal health at farm level.

Total and/or partial condemnation of carcasses may represent a source of nutrient losses needed for good health and wellbeing of human (FAO, 2019; Ishangulyyev *et al.*, 2019; Chen *et al.*, 2020). This is because ruminant meat is the source of protein (28-36 g/100 g in cooked red meat), polyunsaturated fatty acids (0.448 g/100 g of edible portion of lean meats of beef), energy (498 kj/100g), minerals, and vitamins needed for good health and wellbeing of the community (Williams, 2007; Wyness *et al.*, 2011; Tieland *et al.*, 2012; Wyness, 2016). This implies that meat is an animal derived product essential to provide nutrients that are necessary to meet nutritional requirements for human. Also, condemnation of meat reduces quantity of meat available at market, thus decreasing supply to the consumers (Jaja *et al.*, 2018). In Rwanda, Habarugira *et al.* (2014) reported that Bovine Tuberculosis caused a rejection of 1683.5 kg of meat. The condemnation of meat was also associated with economic losses. The highest ($ 383,063) economic losses was reported in Alexandria (Mohammed & Maky, 2020) and the lowest ($ 4 810) was observed in Rwanda (Habarugira *et al.*, 2014).

The per capita annual meat consumption in Rwanda stands at 7.9 kg equivalent to an average daily intake of 21.6 g which is very low compared to meat consumption threshold of 160 g

recommended by WHO (Shapiro, 2017; WHO, 2019). This demonstrates that there is still gap to fulfill to achieve recommended quantity of meat consumed in Rwanda. But this gap could be worsening by abattoir condemnations in ruminants especially cattle due to different pathological conditions. Thus, abattoirs are vital in the detection and surveillance of animal diseases and abattoir records have been recognized as a valuable syndromic surveillance tool for the detection of emerging diseases (Dupuy *et al*., 2013). The practical implications of this is that the abattoir records can help in tracing an infected carcass back to the farm from which it originated. Also, abattoirs aid in diagnosing infections during post-mortem examination, which may have gone unnoticed during ante-mortem examination. Consequently, findings based on abattoir records are useful in assessing the risk of human exposure to zoonotic and non-zoonotic diseases. Therefore, there is a need for detailed documentation of various causes of meat condemnations in Rwanda.

Despite the available abattoir records in other countries (Fuseini,2012; Mohammed & Maky, 2020; Yesihak & Webb, 2015; Kheder & Mohamed, 2021), the empirical evidence of major causes of meat condemnations in cattle slaughtered in Rwanda is lacking and as to which ones of them pose high risks for meat condemnations. Such evidence is useful epidemiological data for the evaluation of conditions/diseases at cow- and farm-levels to verify the efficacy of prophylactic and therapeutic practices, to prevent the spread of diseases, and to promote food security. This study was designed to assess the causes of meat condemnations in cattle slaughtered in abattoirs located in Bugesera, Gicumbi, and Rwamagana districts of Rwanda.

2. METHODOLOGY

2.1 Study area

This study was conducted in Bugesera and Rwamagana districts of Eastern Province and Gicumbi district of Northern Province of Rwanda. The average high temperature in study districts is 20-21^{o}C recorded in Eastern Plateau and the average low temperature is 15-17^{o}C measured in Northern highlands (Warner *et al*., 2015; USAID, 2019). The average annual rainfall ranges from 700 to 950 mm in warmer and drier districts of the Eastern region and 1,400 to 1,600 mm in the coolest and wettest districts of the Northern region (Warner *et al*., 2015; USAID, 2019). The study districts experience two dry and rainy seasons. A short dry season (average temperature (°C): 21, min-max: 15-26) starts in December to February, a long rainy season (average temperature (°C): 20, min-max: 15-25) starts in March to May, a long dry season (average temperature (°C): 22, min-max: 15-27) starts in June to September, and a short rainy season (average temperature (°C): 21, min-max: 15-26) starts in October to November. At least 67.8% and 74.1 % of households own livestock in districts of Eastern and Northern provinces, respectively (EICV, 2015).

2.2 Data collection procedure

A retrospective study design was used to collect information from records of routine meat inspection procedures at slaughterhouses/abattoirs and reports of Sector Animal Resources Officers reported at district level for the period from October 2018 to October 2021 to identify conditions that lead to organs or carcasses condemnations. Routine meat inspection was conducted by qualified veterinarians. The collected data included the number of cattle slaughtered, seasons, the type and number of condemned organs, and causes for each condemnation. For quality control of data, all incomplete data and ambiguous records were excluded from the analysis.

2.3 Data analysis

Collected data were entered, stored, validated, and analyzed using Statistical Packages for Social Science (SPSS) software (Version 20.0). Descriptive statistics were used to calculate the proportion of organs and/or carcasses rejected for human consumption. The prevalence of conditions was seasonally as well as annually. The overall prevalence for the three years (October 2018- October 2021) was also determined. To determine the prevalence of conditions causing meat condemnations in ruminants slaughtered in abattoirs, the following formula was used (Mohamed, 2021).

$$P = \frac{NC}{N} x\ 100$$

Where **P** = prevalence, **NC**= number of cases observed and **N =** the total number of cows slaughtered in the specific period of time (October 2018- October 2021).

3. RESULTS

Table 1 indicates the causes of condemnations and number (%) of condemned organs during the three years between October 2018 and October 2021. Of the 9256 cattle slaughtered during that period, 26.3% (2437) had at least one condition leading to total condemnation of organs or carcasses. Retrospective study revealed that the fasciolosis was the main cause of the liver (41.1%, 90.0%, and 65.5%) condemnation in the three districts (Rwamagana, Gicumbi, and Bugesera) respectively, while the kidney (4.7%, 0.8%, and 6.4%) was condemned due to urinary calculi. Furthermore, the leading causes of condemnation of lungs and intestine were insufficient bleeding (50.1%) and pimply gut (0.7%), respectively. In general, the main causes of liver condemnation were fasciolosis (65.5%), liver abscess (3.1%), and cysticercosis (0.9%). In contrast, insufficient bleeding (50.1%) was the leading cause of lung condemnation, followed by pulmonary abscess (2.4%), pneumonia (1.9%), tuberculosis (1.4%), and lung worms (0.5%). Similarly, urinary calculi (4.0%) and hydronephrosis (2.9%) were major causes of condemnation of kidneys, whereas the main cause for intestines was pimply gut (0.7%). During the same period of the study, total carcass condemnation was only observed in Gicumbi district, mainly due to tuberculosis (0.2%, 8/4104).

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Table 1. Causes of condemnations and number (%) of condemned organs during the three years between October 2018 and October 2021

Condemnation rate during from 2018 to 2021														
Organ condemned	Causes of condemnation	Rwamagana				Gicumbi				Bugesera				Overall average (%)
		2019	2020	2021	Average (%)	2019	2020	2021	Average (%)	2019	2020	2021	Average (%)	
		% (n)	% (n)	% (n)		% (n)	% (n)	% (n)		% (n)	% (n)	% (n)		
Liver	Fasciolosis	40.9(233)	40.7(321)	41.3(245)	41.0	84.9(73)	92.1(58)	93.2 (41)	90.0	69.4(100)	73.6(67)	53.4(31)	65.5	65.5
	Liver abscess	3.2(18)	1.3(10)	0.2 (1)	1.5	4.7 (4)	7.9(5)	0.0 (0)	4.2	2.8(4)	4.4(4)	3.4(2)	3.5	3.1
	Cysticercosis	0.0(0)	0.0 (0)	0.0 (0)	0.0	0.0 (0)	0.0(0)	0.0 (0)	0.0	0.0(0)	7.7(7)	0.0(0)	2.6	0.9
Lung	*Sub Total*	*44.1(251)*	*42.0(331)*	*41.5(246)*	42.5	*89.5(77)*	*100.0(63)*	*93.2 (41)*	94.2	*72.2(104)*	*85.7(78)*	*56.9(33)*	71.6	69.5
	Pulmonary abscess	1.4 (8)	1.3 (10)	1.3 (8)	1.3	0.0 (0)	0.0(0)	0.0 (0)	0.0	0.7(1)	0.0(0)	17.2(10)	6.0	2.4
	Lung worms	4.2 (24)	0.0 (0)	0.0 (0)	1.4	0.0 (0)	0.0(0)	0.0 (0)	0.0	0.0(0)	0.0(0)	0.0(0)	0.0	0.5
	Pneumonia	0.0 (0)	0.0 (0)	0.0 (0)	0.0	0.0 (0)	0.0(0)	0.0 (0)	0.0	1.4(2)	5.5(5)	10.3(6)	5.7	1.9
	Tuberculosis	0.0 (0)	0.0 (0)	0.0 (0)	0.0	5.8 (5)	0.0 (0)	6.8 (3)	4.2	0.0(0)	0.0(0)	0.0(0)	0.0	1.4
	Insufficient bleeding	44.6(254)	53.0(418)	52.6(312)	50.1	0.0 (0)	0.0 (0)	0.0 (0)	0.0	0.0(0)	0.0(0)	0.0(0)	0.0	50.1
Kidney	*Sub Total*	*50.3(286)*	*54.2(428)*	*54.0(320)*	52.8	*5.8 (5)*	*0.0 (0)*	*6.8 (3)*	4.2	*2.1(3.)*	*5.5(5)*	*27.6(16)*	11.7	22.9
	Urinary calculi	5.6(32)	3.8 (30)	4.6(27)	4.7	2.3 (2)	0.0 (0)	0.0 (0)	0.8	9.7(14)	4.4(4)	5.2(3)	6.4	4.0
	Hydro-nephrosis	0.0 (0)	0.0 (0)	0.0 (0)	0.0	2.3 (2)	0.0 (0)	0.0 (0)	0.8	14.6(21)	4.4(4)	5.2(3)	8.1	2.9
Intestine	*Sub Total*	*5.6(32)*	*3.8(30)*	*4.6(27)*	4.7	*4.7 (4)*	*0.0 (0)*	*0.0 (0)*	1.6	*24.3(35)*	*8.8(8)*	*10.3(6)*	14.5	6.9
	Pimply gut	0.0 (0)	0.0 (0)	0.0 (0)	0.0	0.0 (0)	0.0 (0)	0.0 (0)	0.0	1.4(2)	0.0(0)	5.2(3)	2.2	**0.7**
	Subtotal	*0.0 (0)*	*0.0 (0)*	*0.0 (0)*	0.0	*0.0 (0)*	*0.0 (0)*	*0.0 (0)*	0.0	*1.4(2)*	*0.0(0)*	*5.2(3)*	2.2	0.7
Total condemned		**64.0 (569)**	**47.6 (789)**	**44.9 (593)**		**5.5 (86)**	**4.8 (63)**	**3.6 (44)**		**24.0(144)**	**29.4(91)**	**15.5(58)**	**22.9**	**26.6**
Number of slaughtered cattle		**889**	**1656**	**1322**		**1557**	**1318**	**1229**		**601**	**310**	**374**		

Prevalent conditions encountered in the various organs in the period from October 2018 to October 2021 are shown in Table 2. The top two conditions recorded in Rwamagana district were insufficient bleeding (9.7%) and fasciolosis (8.9%), whereas fasciolosis (3.3%) and tuberculosis (0.2%) were the commonest disease conditions recorded in Gicumbi district. Also, fasciolosis (8.3%) and pulmonary abscess (2.7%) were the top disease conditions encountered in Bugesera district. Overall, in decreasing order, the condition leading to condemnation of organs was as follows: fasciolosis (9.2%), insufficient bleeding (3.2%), urinary calculi (0.9%), hydronephrosis (0.6%), liver abscess (0.6%), pulmonary abscess (0.4%), pneumonia (0.4%), lung worms (0.3%), cysticercosis (0.3%), pimply gut and tuberculosis (0.1% each).

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Table 2. Annual prevalence of causes of organs condemnation (2018-2021)

Annual prevalence of causes of organs condemnation														
Organ condemned	Cause of condemnation	Rwamagana			Average (%)	Gicumbi			Average (%)	Bugesera			Average (%)	Overall average
		2019 (N=889)	2020 (N = 1656)	2021 (N = 1322)		2019 (N = 1557)	2020 (N = 1318)	2021 (N = 1229)		2019 (N = 601)	2020 (N = 310)	2021 (N = 374)		
		% (n)	% (n)	% (n)		% (n)	% (n)	% (n)		% (n)	% (n)	% (n)		
Liver	Fasciolosis	26.2(233)	0.2 (321)	0.2(245)	8.9	4.7(73)	4.4 (58)	3.3 (41)	3.1	16.6 (100)	21.6 (67)	8.3 (31)	15.5	9.2
	Liver abscess	2.0(18)	0.0 (10)	0.0 (1)	0.7	0.3 (4)	0.4 (5)	0.0 (0)	0.2	0.7 (4)	1.3 (4)	0.5 (2)	0.8	0.6
Lungs	Cysticercosis	0.0(0)	0.0 (0)	0.0 (0)	0.0	0.0 (0)	0.0 (0)	0.0 (0)	0.0	0.0 (0)	2.3 (7)	0.0 (0)	0.8	0.3
	Pulmonary abscess	0.9(8)	0.0 (10)	0.0 (8)	0.3	0.0 (0)	0.0 (0)	0.0 (0)	0.0	0.2 (1)	0.0 (0)	2.7 (10)	0.9	0.4
	Lung worms	2.7(24)	0.0 (0)	0.0 (0)	0.9	0.0 (0)	0.0 (0)	0.0 (0)	0.0	0.0 (0)	0.0 (0)	0.0 (0)	0.0	0.3
	Pneumonia	0.0(0)	0.0 (0)	0.0 (0)	0.0	0.0 (0)	0.0 (0)	0.0 (0)	0.0	0.3 (2)	1.6 (5)	1.6 (6)	1.2	0.4
	Tuberculosis	0.0(0)	0.0 (0)	0.0 (0)	0.0	0.3(5)	0.0 (0)	0.2 (3)	0.1	0.0 (0)	0.0 (0)	0.0 (0)	0.0	0.0
Kidneys	Insufficient bleeding	28.6(254)	0.3(418)	0.2(312)	9.7	0.0 (0)	0.0 (0)	0.0 (0)	0.0	0.0 (0)	0.0 (0)	0.0 (0)	0.0	3.2
	Urinary calculi	3.6(32)	0.0 (30)	0.0(27)	1.2	0.1 (2)	0.0 (0)	0.0 (0)	0.0	2.3 (14)	1.3 (4)	0.8 (3)	1.5	0.9
	Hydro-nephrosis	0.0(0)	0.0 (0)	0.0 (0)	0.0	0.1 (2)	0.0 (0)	0.0 (0)	0.0	3.5 (21)	1.3 (4)	0.8 (3)	1.9	0.6
Intestines	Pimply gut	0.0(0)	0.0 (0)	0.0 (0)	0.0	0.0 (0)	0.0 (0)	0.0 (0)	0.0	0.3 (2)	0.0 (0)	0.8 (0.8)	0.4	0.1

N = Total number of cattle slaughtered

n = Number of conditions recording in post-mortem inspection

% = Annual prevalence of causes of organs condemnation

Figure 1 shows the seasonality trend (prevalence) of major conditions that lead to organs condemnation in the study area. The seasonal distribution of these conditions as also noted to be significant at specific period of the season. The prevalence of fasciolosis was highest (30.8%) in long dry season (June to September) while the prevalence of liver abscess (2.3%) and urinary calculi (4.2%) in long rainy season (March to May). On the other hand, condemnation of lung due to insufficient bleeding was observed to be more prevalent (30.0%) in short dry season (December to February).

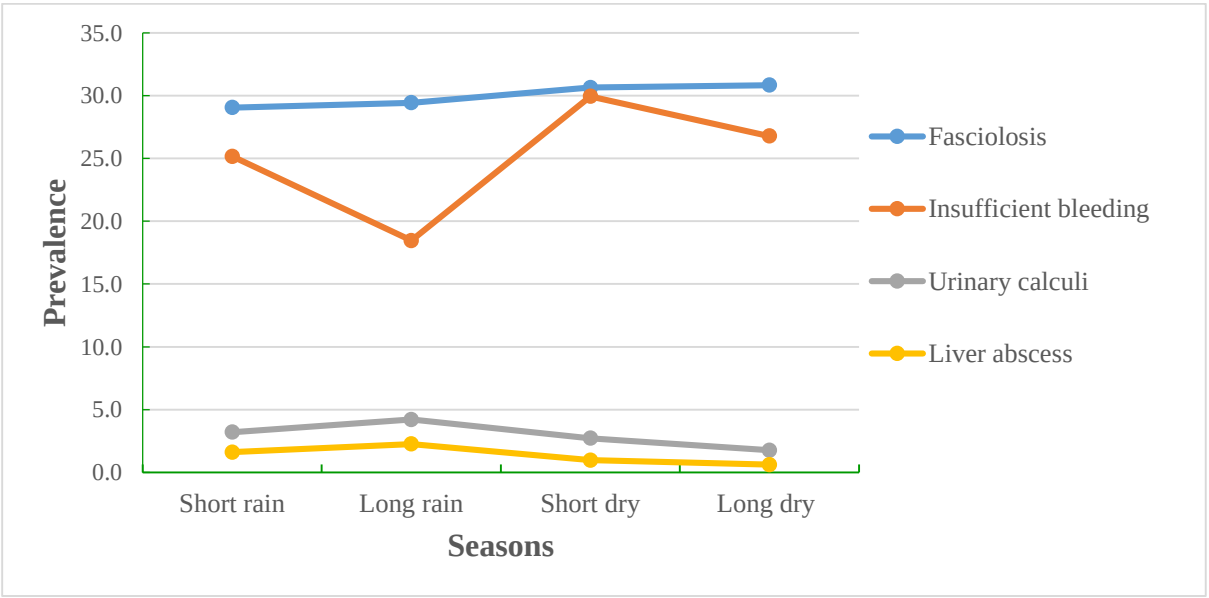

Figure 1. Seasonal trend and prevalence of the major conditions that led to the condemnation of organs

4. DISCUSSION

Livestock contributes 3% of the GDP (MINAGRI, 2020) and plays a crucial role in poverty alleviation and ensuring food security although the sector is constrained by numerous factors including but not limited to animal diseases, poor farm management practices and post-harvest losses (Gustavsson *et al.*, 2011; Ndaka *et al.*, 2012; OECD-FAO, 2016; MINAGRI, 2020). The importance of the present study is to characterize conditions that are commonly responsible for meat rejection at post-mortem inspection and recommend appropriate farm management practices and accurate handling of cattle during slaughtering exercise to ensure good animal health and welfare, minimize post-mortem losses and reduce food insecurity.

The present study revealed that the conditions responsible for meat condemnations in cattle slaughtered were *Fascioliasis* (9.2%), insufficient bleeding (3.2%), urinary calculi (0.9%), and liver abscess (0.6%). Liver is a nutritionally important organ (Li *et al*., 2014; Biel *et al.,* 2019) but mostly rejected during routine meat inspection due to Fascioliasis to prevent occurrence of human Fascioliasis due to ingestion of raw cooked livers infected by immature flukes (Mas-Coma et *al*, 2018; Kheder & Mohamed, 2021). The highest prevalence of Fascioliasis was 15.5% and 8.9% observed respectively in Bugesera and Rwamagana districts and the lowest prevalence of 3.1% was recorded in Gicumbi district. Highest prevalence observed was lower compared to the findings from study conducted in Uganda and Ethiopia in which 65.7% and 39.9% of livers inspected were positive to Fascioliasis, respectively (Aregay *et al.*, 2013; Opio *et al.*, 2021). The prevalence of Fascioliasis tends to be high (30.8%) in long dry season compared to short dry and rainy seasons. This implies that the prevalence of Fascioliasis increases with prolonged dry season and varies due to climatic conditions.

Results from this study agreed with findings of Ardo *et al*. (2013) who reported high (25.9%) prevalence of Fascioliasis in dry season than in rainy season (18.2%). This study contrast finding of Opio *et al. (*2021) in which high prevalence of Fascioliasis was observed in rainy season than in dry season. Seasonal variability and difference in prevalence of Fascioliasis observed in study districts might be linked to availability of feeds which are scarce in warmer and drier areas and in long dry season. Thus, forcing farmers to use pasture from wetland and probably containing snail intermediate host and shaded metacercariae which are the infective stage of Fascioliasis (Nzalawahe & Komba, 2013; Boray & Love, 2017; Girma & Delelegn, 2019). Following their ingestion along with feed; metacercariae encyst in the small intestine and the released immature flukes penetrate the intestinal wall into the abdominal cavity and end up by penetrating the liver (Boray & Love, 2017). In cattle, the resultant Fascioliasis lowers feed conversion and growth rates and reduces milk production in quantity and quality (Boray & Love, 2017).

Liver abscess was also recorded to cause rejection of the liver in study area. The condition is more prevalent in Bugesera (0.6%) and Rwamagana (0.7%) districts compared to Gicumbi district (0.2%). This might be linked to the availability of maize; a predisposing factor to acidosis that is highly cultivated in Eastern Province of Rwanda and mostly used as a basal diet in animal feeding (NISR, 2021). The present study agreed with findings of the study conducted in Ethiopia where the prevalence of liver abscess was 0.6% (Edo *et al*., 2014). Prevalence of liver abscess observed in this study is low compared to findings observed in the study conducted by Jaja *et al. (*2017) in which the prevalence of liver abscess was 1.1%, 2.9% and 1.5% recorded in 2010, 2011, and 2012, respectively. The prevalence of liver abscess revealed from this study disagree with the study conducted by Kheder and Mohamed (2021) where the prevalence of liver abscess at post mortem inspection were 7.6%, 8.0% and 6.3% recorded in 2009, 2010, and

2011, respectively. The present study revealed a seasonal variation in prevalence of liver abscess with highest prevalence of 2.3% obtained in long rain season and lowest prevalence recorded in long dry season. Findings from this study contrast findings from a study conducted in Sudan where there was no seasonal variability in prevalence of liver abscess observed (Kheder & Mohamed, 2021). This divergence could result from difference in rearing practices where in Soudan livestock production industry is dominated by traditional pastoral systems which does not necessitate inclusion of commercial feeds predisposing cattle to acidosis (Babiker, 2015).

Liver abscess might result from invasion of the portal vein with *Fusobacterium necrophorum* which under normal conditions inhabits the rumen of cattle (Tadepalli *et al.*, 2009). Ruminal lesions resulting from acidosis generally provide a portal of entry to *Fusobacterium necrophorum* into blood stream and predispose cattle to liver abscesses (Tadepalli *et al.*, 2009; Rezac *et al.*, 2014). Liver abscess in beef industry poses economic losses associated with condemnation of liver at post mortem inspection, reduced animal performance, and carcass yield due to reduced feed intake and feed efficiency (Nagaraja & Chengappa 1998; Ty, 2020). The seasonal variability observed might be correlated to maize growing season which starts in short and long rain seasons to harvest in short and long dry seasons, respectively (Mumo *et al.*, 2018). Thus, making maize and maize by-products available for inclusion in feeding regimen of cattle which in turn predisposes cattle to acidosis when not properly managed. Therefore, change of forage to concentrate in cattle's diet should be increased progressively to allow a period of adaptation (Jaramillo-López *et al.*, 2017).

Lung was also mostly condemned at post mortem meat inspection mainly due to insufficient bleeding. The present study revealed that in the study district, insufficient bleeding caused a rejection of lungs in 50.1% of slaughtered cattle. This indicates a huge meat rejection and associated financial loss. Results from this study are higher compared to findings from study conducted by Syaghuswa *et al*. (2020) in Democratic Republic of Congo where out of 20 755 cattle slaughtered insufficient bleeding was responsible for 5.4% condemnation of lungs.

Insufficient bleeding might be due to aspiration of blood during phase of agony which in turn result from method of slaughter. Those malpractices leading to insufficient bleeding include slaughtering animals in conscious state due to lack of stunning methods and incomplete severe of carotid artery and jugular vein during bleeding phase (Heinz & Srisuvan, 2001: Kane *et al.*, 2005; Syaghuswa *et al.*, 2020).

The most common condition observed to be responsible for the rejection of kidney in study area was urinary calculi that caused condemnation of 0.9% of slaughtered cattle. Results from the present study disagree with the study conducted by Sheferaw and Abdu (2017) in which the condemnation of kidneys due to urinary calculi in cattle was 1.6%. This condition might be due to calcium-phosphorus imbalance which leads to urinary excretion of high phosphate; which in turn results in formation of phosphate calculi (Unmack, 1963; Makhdoomi & Gazi, 2013; Abbott, 2018). This might be linked to rearing practices of including black salt (containing 0.9% of phosphorous) in drinking water for livestock (Stergiou et *al.*, 2016). To prevent formation of urinary calculi, management practices aiming to increases water intake and balance calcium-phosphorous intake to 2:1 should be encouraged (Makhdoomi & Gazi, 2013).

5. CONCLUSION

Post-mortem meat inspection records show the type of conditions diagnosed at meat inspection and they probably indicate the types of disease occurring in cattle farming system. Fasciolosis, insufficient bleeding, urinary calculi, and hydronephrosis were recorded as the most prevalent conditions that lead to organs and/or carcass condemnation. Although, most of these conditions cannot be diagnosed on ante-mortem examination, they impact negatively food security and income from meat value chain.

6. RECOMMENDATIONS

This study recommends awareness creation of stakeholders involved in meat value chain on applying control and prevention measures against the observed conditions. It is also strongly recommended for future research to carry out an epidemiosurveillance of diseases conditions that are common in cattle in the study area.

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