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Research Article

Prevalence, Types and Associated Factors of Liver Lesions in Slaughtered Cattle at The Kumasi Abattoir, Kumasi, Ghana

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ABSTRACT

Studies on hepatic pathology in slaughtered animals are few in Ghana. The knowledge of such will aid effective control of some important zoonoses of interest. A cross-sectional abattoir study was conducted from September 2019 to February 2020 on cattle slaughtered at the Kumasi Abattoir to determine major liver pathologies, the types and associated risk factors. Post-mortem inspection procedures were followed throughout the study and liver pathologies observed were recorded. A total of 2712 slaughtered cattle were examined at post-mortem. Out of 2712 slaughtered cattle liver examined, 140 livers were pathologic giving a prevalence rate of 5.16% with 2.06% and 3.10% prevalence rate in the rainy and dry seasons respectively. The major liver pathologies observed in cattle were abscess (47.02%), telangiectasis (20.54%), fascioliasis (18.92%), fibrosis (4.86%), cirrhosis (2.162%), multiple cysts (1.62%), traumatic peritonitis (1.62%), congestion (1.08%), necrosis (1.08%), cysticercosis (0.54%) and adhesion of spleen to liver (0.5%). Liver lesions were more in bulls (91.4%) as well as in the younger cattle (< 2 years old) (70.71%). The Zebu cattle recorded more liver lesions (53.75%) and cattle with moderate body condition score recorded more liver lesions (88.72%). Seasonally, more (60%) of the liver lesions were recorded in the dry season. Risk factors identified include season and age ($p<0.05$) whilst, sex, body condition score and breed of cattle had no statistical significance ($p>0.05$). To this end, there should be an enhanced routine veterinary surveillance and efficient diagnosis of possible etiological factors contributing to pathologies of the liver especially those zoonotic diseases. Further studies are on histological and microbial analysis of liver lesions to help make a definitive diagnosis and further management plans.

Keywords: *Cattle, Liver, Abattoir, Pathology, Risk factors, Ghana*

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INTRODUCTION

Agriculture contributes 21.3% to the national GDP of which the livestock sector account for 1.7% (Ghana statistical service.2013). Livestock provide an important source of protein and ready cash for emergency need (MOFA/DFID, 2002) contributing 7-9% to agriculture GNP (FASDEP, 2002). Animal health has been identified as one of the major constraints to livestock production in Ghana. A number of infections and parasitic diseases pose danger to the livestock industry in Ghana especially cattle production. Cattle potential is not properly exploited due to different factors such as traditional management system, limited genetic potential, lack of appropriate disease control policy due to insufficient information on diseases and their occurrence.

The primary aim of the abattoir is to produce healthy meat, wholesome and clean products which are safe for human consumption (Cadmus and Adesokan, 2009). It is worth mentioning that abattoirs provide information on the epidemiology of diseases on livestock, to know to what extent the public is exposed to certain zoonotic diseases (Jibat *et al*., 2008). Surveillance at the abattoir allows for all animals passing in to human food chain to be examined for unusual signs, lesions or specific animal disease (Alton *et al*., 2008). Several studies have been conducted through abattoir survey to estimate the prevalence of certain diseases associated with organ condemnation in various parts of the country. Findings of such studies have shown that some animals including cattle slaughtered at the Kumasi abattoir might have healthy external appearances but could be harboring an infection in one or multiple organs.

The liver had always been one of the organs of choice or site sites for parasitic infestations, microbial infections and other conditions (Khaniki *et al.*, 2013; Shaibu *et al*., 2017). This phenomenon, however, leads to a lot of liver condemnations and also raises severe public health concerns. In addition to the organ condemnations and the public health significance of liver diseases, the loss of profit due to liver condemnation cannot be underrated (Shaibu *et al*., 2017; Tilahun *et al*., 2017). It is therefore necessary to examine the liver to ascertain the prevalence of liver pathologies, their pattern of occurrence in cattle with respect to the animal factors such as the age, sex and body condition and the non-animal factors such as season. This could be helpful in the

determination of the necessary measures to minimize liver condemnations as well as to promote good quality animal health.

MATERIALS AND METHODS

Study Area: The study location is the Kumasi Abattoir Company Limited. The Kumasi abattoir is one of the largest in Ghana and is located 6°39'36.6"N Latitude and 1°36'15.4"W Longitude in the Kumasi city of Ghana. It was established in 1997 with a grant from the Government of Ghana and the Canadian International Development Agency (CIDA) and commenced operations in 1998 (Frimpong *et al*., 2012). This facility was chosen because of its daily slaughter of averagely 200 cattle from most regions of the country including some West African countries.

Study Population, Sample Technique and Sample Size: The study population comprised all the cattle sent for slaughter. Cattle livers were purposively sampled for the presence or absence of liver lesions. All bovine carcasses which were shackled and hoisted on an overhead rail in the slaughter section of the Kumasi Abattoir comprised the cattle which were considered in this study.

Data and Sample Collection: Daily sample collections and recordings on cases of liver pathologies in cattle were carried out at the abattoir through post mortem examination of the liver. Data collection lasted for six months; from September 2019 to February, 2020 at the Kumasi Abattoir. The period of data collection spanned through rainy season (September-December, 2019) and dry season (January- February, 2020).

During the study period, 3,882 cattle were slaughtered. A total of 2,712 cattle livers were sampled at post mortem. The livers were examined grossly by palpation and observation for any abnormalities. Information on the respective age, breed and sex of the cattle were recorded accordingly.

Affected liver tissue samples of all the liver lesions present were taken into an air-tight plastic container; containing 10% neutral buffer formalin. Collected samples were properly sealed and labeled and transported to the laboratory for histopathological examination.

Data Analysis: Data collected in this study were initially stored in Microsoft Office Excel Software (Version 2013). Data was further-on analysed statistically using Statistical Package for Social Sciences (SPSS) Version 20. Descriptive statistics together with Chi-Square analysis were performed to determine the prevalence of liver pathologies in cattle, distribution of liver pathologies with respect to age, breed, sex and season of slaughter of cattle as well as the effect of these parameters on the prevalence of liver pathologies in cattle. Results were displayed using charts and tables. Statistical significance between parameters were tested at 95% confidence interval or 5% significance level.

RESULTS

Number of animals slaughtered and animals inspected: A total of three thousand eight hundred and eighty-two (3,882) animals were slaughtered at the end of data collection of which 2,712 animals were duly inspected. In the rainy season, 1,616 animals were slaughtered of which 1,134 were inspected whiles in the dry season, 2,266 animals were slaughtered and 1,578 animals were duly inspected (Table 1).

Table 1
Number of animals slaughtered and sampled (inspected)

Sampling Season	Number of Animals Slaughtered	Number of Animals Inspected
Rainy Season	1,616	1,134
Dry Season	2,266	1,578
Total	**3,882**	**2,712**

Prevalence of Liver Lesions: The findings are displayed in Table 2 below. The overall prevalence of liver lesions was noted to be 5.16% of which 2.06% prevalence of occurrence of liver lesions was recorded in the rainy season and the remaining 3.10% prevalence rate recorded in the dry season (Table 2).

Table 2.
Prevalence rate of liver lesions and distribution among seasons

Sampling Season	Number of Inspected Livers	Number of Infected Livers	Prevalence Rate (%)
Rainy	1,134	56 (40%)	2.06%
Dry	1,578	84 (60%)	3.10%
Overall	**2,712**	**140 (100%)**	**5.16%**

Type of Liver Lesions and their Occurrences: Fatty degenerations were recorded in all pathological liver samples. Liver abscessation were recorded in 47.02% of the sampled livers. Other lesion recorded were fascioliasis (18.92%), cirrhosis (2.16%), telangiectasis (20.54), cysticercosis (0.54%), multiple cysts (1.62%), scar and fibrosis (4.86%) traumatic peritonitis (stomach attached to liver) (1.62%) (Table 3 and Plate 1).

Table 3.
Type of Liver Lesions Encountered

Type Of Lesion	Number Encountered	Rainy Season	Dry Season
Fascioliasis	35 (18.92%)	5 (14.29%)	30 (85.71%)
Cirrhosis	4 (2.16%)	1 (25%)	3 (75%)
Traumatic peritonitis (stomach+liver)	3 (1.62%)	1 (33.33)	2 (66.67%)
Spleen attached to liver	1 (0.54%)	0 (0%)	1 (100%)
Cysticercosis	1 (0.54%)	1 (100%)	0 (0%)
Multiple cysts	3 (1.62%)	0 (0%)	3 (100%)
Scar and fibrosis	9 (4.86%)	1 (11.11%)	8 (88.89%)
Necrosis	2 (1.08%)	1 (50%)	1 (50%)
Congestion	2 (1.08%)	0 (0%)	2 (100%)
Abscess (caseous and pyogenic)	87 (47.02%)	41 (47.13%)	46 (52.87%)
Telangiectasis	38 (20.54%)	14 (36.84%)	24 (63.16%)
Fat degeneration	All pathologic livers	56 (40%)	84 (60%)

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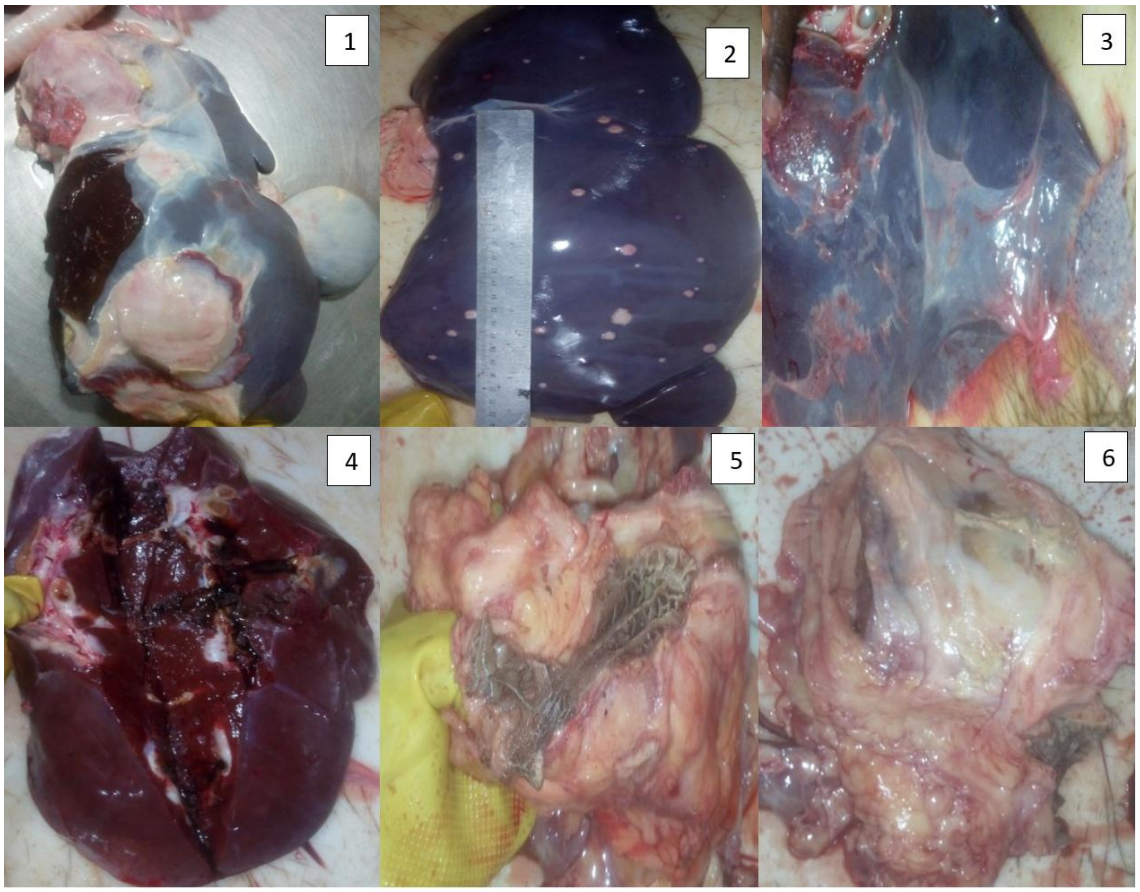

Plate 1
1- Pyogenic abscessed liver, 2-Multifocal liver abscesses with varied sizes, 3-Spleen attached to liver, 4-Fascioliasis with distended bile ducts, 5&6- Traumatic peritonitis.

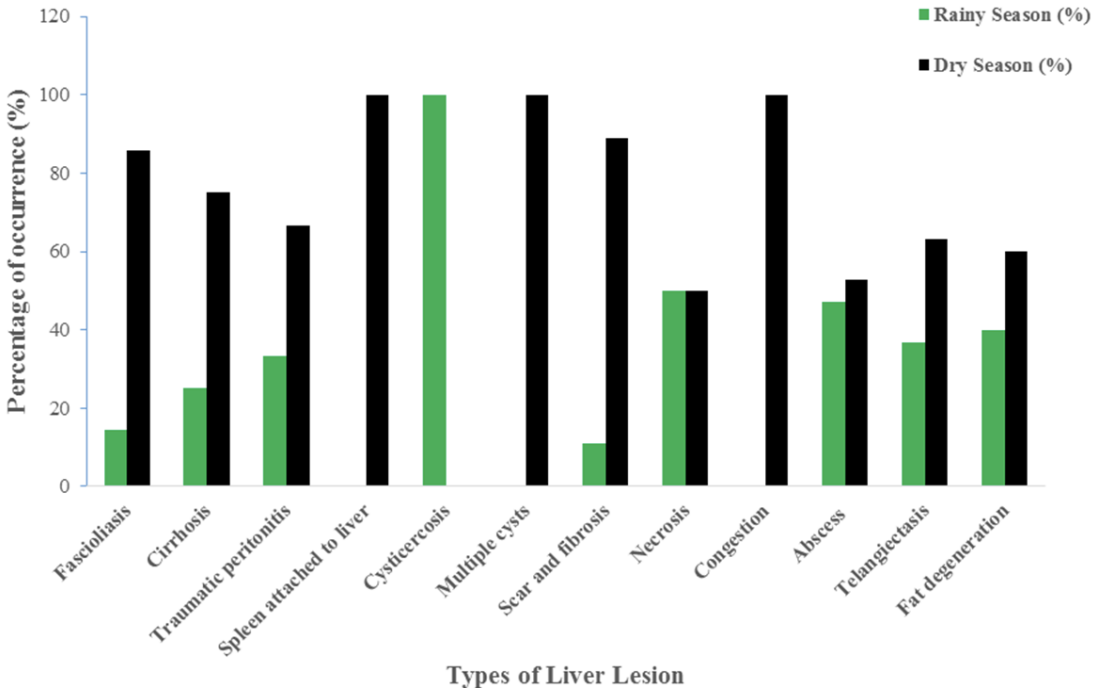

Figure 1
Seasonal distribution of liver lesions in cattle

Gross Morphology of Liver Lesions

Pattern of Seasonal Distribution of Different Liver Pathologies: The seasonality of occurrence of the liver pathologies in cattle was considered in this study. It was observed that the dry season recorded higher percentage of occurrences for all liver lesions except for cysticercosis and fat degeneration as compared to the rainy season as shown in Figure 1 below.

Effects of sex of cattle on occurrence of liver pathologies: Out of the 140 livers that were observed to have different liver pathologies, 128 of them representing 91.4% are from the male cattle (bull) whilst the remaining 12 cases were recorded in the female cattle (cow) representing 8.6% of the liver pathologies recorded. Despite the huge differences in terms of the numbers affected with respect to sex, there was no statistical significance ($p>0.05$). Therefore, sex does not have any significant impact on the occurrence of liver lesions in cattle.

Table 4.
Sex effect on the occurrence of liver pathologies in cattle

Sex of cattle	Frequency of Occurrence	Chi-Square Value	P-value (Significance level)
Male (Bull)	128 (91.4%)	11.452	0.567
Female (Cow)	12 (8.6%)		
Total	**140**		

Effect of breed on occurrence of liver pathologies: Out of the 140 cattle livers that were observed to have different liver pathologies, information on breed was obtained for only 80 of the animals (Table 5). A total of 43 (53.75%) liver pathology cases were recorded in the Zebu breed of cattle followed by the Sanga breed with 22 (27.5%) cases. The West African Short Horn (WASH) and the White Fulani breeds of cattle also recorded 9 (11.25%) and 6 (7.5%) cases of liver lesions respectively. This results shows that the Zebu breed of cattle had relatively higher preponderance to developing liver pathologies. Irrespective of the huge differences in the occurrence of liver lesions between the breed of cattle, the differences were not statistical significant ($p>0.05$).

Table 5.
Breed effect on the occurrence of liver pathologies in cattle

Breed of Cattle	Frequency of Occurrence	Chi-Square Value	P-value (Significance level)
Zebu	43 (53.75%)	21.793	0.630
Sanga	22 (27.5%)		
West African Short Horn	9 (11.25%)		
White Fulani	6 (7.5%)		
Total	**80 (100%)**		

Effects of age on occurrence of liver lesions in cattle: In this study, information on age was obtained for only 99 animals and this was used in the statistical analysis as displayed in Table 6. Out of the 99 animals, 70 of the liver pathology cases; representing 70.71% happened to be from the young cattle whilst the remaining 29 cases were recorded in the adult cattle; representing 29.29% of the liver pathologies recorded. With the marked differences in terms of the frequency of occurrence between the age categories, there was found to be a statistically significant difference ($p<0.05$) between the age categories and the occurrence of liver lesions.

Table 6.
Age effect on the occurrence of liver pathologies in cattle

Age of Animal	Frequency of Occurrence	Chi-Square Value	P-value (Significance level)
Young	70 (70.71%)	41.509	0.008*
Adult	29 (29.29%)		
Total	**99 (100%)**		

** = p-value is significant ($P \leq 0.05$) at 95% confidence interval or 5% significant level.*

Effects of body condition score on occurrences of liver pathologies: The findings on the body score condition effect on occurrence of liver pathologies in cattle in this study showed no statistically significant difference ($p>0.05$) as 118 cases representing 88.72% occurred in cattle with moderate body condition score, 9 cases representing 6.77% occurred in cattle with good body condition score whilst 6 cases representing 4.51% of the liver lesions occurred in cattle with poor body condition as shown in Table 7 below.

Table 7
Body score effect on the occurrence of liver pathologies in cattle

Body Score	Frequency of Occurrence	Chi-Square Value	P-value (Significance level)
Good	9 (6.77%)	15.99	0.939
Moderate	118 (88.72%)		
Poor	6 (4.51%)		
Total	**133 (100%)**		

Effects of season on the occurrence of liver pathologies in cattle: The prevalence of occurrence of liver lesions based on season showed that 56 cases representing 40% of the liver lesions in cattle were recorded in the rainy season and 84 cases representing 60% of the liver lesions were recorded in the dry season. This indicates that a higher number of liver pathologies occur in the dry season and this differences between seasonal occurrence of liver lesions were statistically significant ($p<0.05$) as indicated in Table 8 below.

Table 8.
Seasonal effect on the occurrence of liver pathologies in cattle

Season	Frequency of Occurrence	Chi-Square Value	P-value (Significance level)
Rainy	56 (40%)	30.86	0.000*
Dry	84 (60%)		
Total	**140 (100%)**		

** = p-value is significant (P ≤ 0.05) at 95% confidence interval or 5% significant level.*

DISCUSSION

The overall prevalence liver anomalies in this study was 5.16%. Most of the lesions recorded had greater prevalence in the dry season compared to the rainy season. Studies by Chinonyerem & Kalu (2019**)** had 63.9% as the prevalence of liver lesion in their study from January, 2019 to April, 2019 in Nigeria which is slightly lower than the prevalence of liver lesions (60%) this study saw in the dry season (January to February, 2020). Also, at the end of the research the risk factors, season and age, were statistically significant ($p<0.05$) which means age and season are predisposing factors to liver pathology in Ghana whilst the sex of animals, body condition score and breed of cattle do not influence the development and prevalence of liver lesions in cattle ($p>0.05$).

This study showed abscess prevalence of 47.03% and tends to be more prevalent in the dry season (52.87%) compared to the rainy season (47.13%). Studies conducted by Shaibu *et al*. (2017) in a retrospective survey recorded liver pathology prevalence of 49.4% which is more than the value obtained in this study. That obtained by Opoku *et al.* (2019) was 29.77% of abscessations of liver and the lungs. The disparities may be attributed to the origin, breed and management system of cattle sent for slaughter at the different times. Though the causative organisms of the abscessations in this study were not determined, it has been established by Sohair *et al*. (2009) that a greater percentage of liver abscesses are caused by *Fusobacterium necroforum* alone and in some instances combined with other organisms such as *Corynebacterium pyogenes*. This usually happens when there is an ulceration or corrosion in the rumen where the above-mentioned microbes invade the blood stream and are carried to the liver through the hepatic portal vein. In certain instances, tuberculous abscesses come about as a result of generalized tuberculosis. In such abscesses, the lesion looks nodular and may have a caseous exudate which could be dried and calcified.

In this study, 18.92% prevalence was recorded for fascioliasis. This prevalence is similar to that reported by other workers. Raji *et al*. (2010) recorded a prevalence of 23.41% in Zaria, Nigeria, and Freeman *et al*. (2013) also recorded a prevalence of 22.5% in Buffalos slaughtered in Bangladesh while Shaikh *et al*. (2004) reported a prevalence of 14.8% in buffalo slaughtered at the main abattoir in Hyderabad City. These disparities in prevalence may be attributed to the system of rearing and also grazing fields of the cattle. It was observed that the occurrence of fascioliasis in the dry season was higher than in the rainy season. Chinonyerem & Kalu (2019**)** in the year 2019 recorded a prevalence of 58.0% in the months of January to April which also corresponds to the dry season in this study where fascioliasis prevalence of 52.87% was obtained. The increase in prevalence in dry season compared to rainy season may be due to the increasing exposure of cattle to environments where there is a higher possiblity of fasciola infestations. Such environments include, streams, gutters, sewages and ponds where animals tend to obtain drinking water due to scarcity and insufficiencies during the dry season. Most samples were obtained from cattle brought from communities such as Asewasa, Adukrom, Asokore-Mampong, Aboabo, Asebi, and Sewaba which had a higher chance of fasciola infestation. These communities have large gutters and drainages with bushes from which the cattle from such communities are allowed to graze and drink. A further study is suggested to ascertain the presence of snails associated with fasciola transmission in these communities.

In this study, there was a general prevalence of 4.86% of hepatic fibrosis resulting from healed inflammatory processes. Tilahun *et al*., (2017) recorded higher liver fibrosis prevalence of 10.3% which could be as a result of feed disparities. High grain feed cattle are prone to ruminal ulcerations which in turn puts the liver at a high risk of infection. Most of the cattle slaughtered at the Kumasi Abattoir are brought from regions where there is strictly extensive system of cattle production and hence may not be fed with high concentrate feed. The prevalence of fibrosis is higher than those reported by Jaja *et al*. (2017) (1.7%, 10.5%, and 9.2%) in 2010, 2011, and 2012 from three different abattoirs in the Eastern Cape Province of South Africa.

Liver cirrhosis is the end-stage of liver damage when there are nodules of different sizes with fibrotic boundaries. The entire organ can be cirrhotic or a localized region of the liver could be cirrhotic. Either of the two was observed in this study. Raji *et al*. (2010) recorded a prevalence of 10.41% whilst Freeman *et al*. (2013) recorded 31.25% in slaughtered buffaloes. These were all higher than what this current study reports, 2.16%. The reason for these large differences may be due to difference in geographic location.

Atasever *et al*. (2002) reported telangiectasis prevalence of 2.3% in their study which is far less than that obtained in this current study (20.54%). The difference may be due to grazing pattern and exposure to toxic plants and also a possible microbial induced vascular inflammation. Further investigations should therefore be done to ascertain the possible causes of telangiectasis cases recorded.

This current research recorded a prevalence of 1.1% for liver congestion and 100% prevalence of fatty degeneration of which majority (60%) occurred in the dry season. All such lesions found were smaller in sizes and were either locally defused or regionally distributed with a maximum diameter of about 2cm or lesser. The presence of fat granules in the hepatocytes may have resulted from malnutrition where fat stored in the body are mobilized and metabolized in the liver to generate energy.

Cysticercosis is a helminthiasis caused by *Cysticercus bovis* and it has some public health consequences. Shaibu *et al*. (2017) reports *Cysticercus bovis* prevalence of 2.95% from

a retrospective study which is higher than 0.54% recorded by this current research.

This presence study recorded 1.62% of cases where the hardware headed towards the right side of the abdomen and ended up piercing the left lobe of the liver presenting with abscessations and fibrosis. The liver lies in the right abdomen and extends caudally to relate to the caudal face of the diaphragm. It also borders with organs such as the reticulum, gall bladder, pancreas, omasum, duodenum and atrium ruminis on its visceral surface as stated by Dyce *et al.* (2010). Due to this association with the reticulum, it is therefore likely for hardware to pierce through the reticulum to the liver and cause an inflammatory reaction which ends up becoming an abscess and a resultant fibrosis.

In this study, a bovine liver pathology prevalence of 5.16% was obtained. Several liver pathologies were observed of which liver abscessation was predominant. The predisposing factors are seasonality and age. Based on the findings, it was recommended that routine deworming programs should be developed and adhered to. Cattle raised in communities should be prevented from getting access to water from drains, stagnant waters and all sewages. The feed of the cattle should contain more fiber and a little less concentrate or grains to reduce their predisposition to liver pathologies. There should be an enhanced routine veterinary surveillance in areas where cattle are reared to enable quick and efficient diagnosis and management of possible etiological factors contributing to pathologies of the liver. Further studies are on histological and microbial analysis of liver lesions to help make a definitive diagnosis for further management plans.

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