

Comparative Study of Liver Pathological Changes with Bacterial and Parasitic Infection in Cattle at Jimma and Agaro Municipal Abattoir, Ethiopia

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Abstract

Pathological affections of liver may be attributable to a variety of causes including parasites, viruses, mycoses and bacteria, resulting in great economic losses either directly through condemnation of affected liver at slaughter houses or indirectly by effect on animal production and reproduction. Abattoir based cross sectional study was conducted from January 2016 to March 2017 to identify the common bacterial and parasitic causes of the liver pathological lesions in cattle slaughtered at Jimma and Agaro municipal abattoir. From the total 384 slaughtered animals 32% (n=123) was found with liver damages. 8.6% (n=33) and 7.3% (n=28) liver were found with hemorrhagic necrosis because of presence of fasciola and yellow to brown discoloration of the liver respectively. Abscess, Presence of cyticercus cyst and hepatomegaly were also the gross pathologic lesions detected during the study period. Statistically there was no significant difference in liver damage within sources of the animals ($P>0.05$), but the prevalence of liver damages is significantly different between good and medium body condition of the animals ($P<0.05$). Bacteria were also isolated from the liver pathological lesions. From the total liver samples 27% (n=104) were the number of livers with different bacterial infection. *Proteus* and *Salmonella* species were found in highest percentages, which account 9.1% and 8.6% respectively. Statistically bacterial identification has significance difference among the different categories of pathological lesions of the liver. Proteous species and salmonella were the bacteria foremost isolated from the liver damages. Therefore, it is recommended that: furthermore, molecular characterization and antimicrobial susceptibility testing of the bacteria circulating in the area is mandatory and deworming should be given regularly in the study area for liver parasitic cases.

Keywords: Abattoir; Cattle; Infection; Hepatocytes

Introduction

Liver is the largest gland in the body, characterized by multiple functions categorized broadly as synthetic, catabolic, detoxifying, secretory and excretory. Pathological affections of liver may be attributable to a variety of causes including parasites, viruses, mycoses and bacteria, resulting in great economic losses either directly through condemnation of affected liver at slaughter houses or indirectly by effect on animal production and reproduction [1].

Liver abscess has been considered the major economic problem responsible of contaminating liver which are associated with less feed intake, weight gain, and dressing percentage. Also, they increase trimming and as a consequence damage the profitability of feedlot producers and slaughter plant owners [2].

Fasciolosis in adult cattle may predispose animals to *Salmonella* dublin infection. Fasciolosis also lowers the resistance of animals and predispose them to other infection [3]. Pathogenesis of Fasciolosis varies according to the phase of parasitic development in the liver and species of host involved, essentially the pathogenesis is twofold; the first phase occurs during migration in the liver parenchyma and is

associated with liver damage and hemorrhage. Early infection, during fluke migration, there is hyperproteinemia, hyperglobulinemia, and hypo-albuminemia. The second phase occurs when the parasite is in the bile ducts, and results from the hematophagic activity of the adult flukes and from the damage to the mucosa, by their cuticular spines [4].

Fusobacterium necrophorum, a member of the ruminal anaerobic bacterial flora, is the primary etiologic agent for liver abscess. *Actinomyces pyogenes* is the second most frequently isolated pathogen [5].

Liver examination at slaughterhouse has considered being the most direct, reliable and cost-effective technique for the diagnosis of liver affections [1]. Thus, the present study was attempted with objective:

- To identify the common bacterial and parasitic causes of the liver pathological lesions in cattle slaughtered in Jimma and Agaro municipal abattoir.

Materials and Methods

Study area and study population

The study was conducted in Jimma zone municipal abattoirs. It includes Jimma and Agaro municipal abattoir. These are purposively included in the study. Jimma zone is about South West of Ethiopia, at a distance of about 352 km from Addis Ababa. Geographically, Jimma is located at 7013' and 8056' N latitude and 35052' and 37037 E longitude. The area has an altitude ranging between 1720 to 2110 m above sea level having an annual rain fall ranging between 1200 to 2000 mm. The annual mean temperature ranges from about 12.1°C to 28°C. Jimma zone has a livestock population of about 2,016,823 cattle, 942,908 Sheep, 288,411 Goats, 74,574 Horses, 49,489 Donkeys, 28,371 Mules and 1,139,735 Poultry [6].

Cattles were the species of animals included in the study population. These populations of animals were delivered to the Jimma zone municipal abattoir from different areas around jimma. During the study, liver of the slaughtered animals was inspected for presence of parasitic infestation and any types of liver pathological changes were identified grossly.

Study design and sample size determination

A cross-sectional study was conducted on randomly selected local breeds of apparently healthy cattle destined for slaughter so as to identify parasitic, bacterial and pathological changes occurred in the liver. The study was conducted from January 2016 to March 2017.

The sample size is determined by the formula described by Thrusfield [7], at 95% confidence level. The expected prevalence was 56.16% [8].

$$N = \frac{[1.96^2 p_{exp} - (1 - p_{exp})]}{D^2}$$

Thus, the total sample size was 384.

Sample collection

Liver tissue sample collections were done from the randomly selected cattle slaughtered in the abattoir. This is just to identify presence of parasite or bacteria in the damaged liver that could be suspected as the causal agents for the liver damages. Accordingly, about 384 liver samples were collected from different animals and different bacteria were isolated.

Tissue sampling procedure

During the post mortem examination liver of bovine was collected and ordered according to the animal code. Then the livers were examined for presence of any parasitic infestation and for presence any gross pathological changes according to procedure of West. Those parasites that appeared in the liver tissue were collected and recorded. At the same time presence of any pathological changes were noted and recorded carefully.

Laboratory examination

Bacterial identification: All bacteriological examination procedures were done according to Quinn et al. [9]. For bacteriological isolation

and identification tissue were minced with sterile scissors and forceps and inoculated to brain heart infusion broth and aerobically incubated at 37°C for 24 hrs. After 24 hrs aerobic incubation a loopful of bacterial growth were streaked on 7% sheep blood agar and incubated aerobically at 37°C for another 24 hrs. The plates then checked for presence of growth and colonies examined for colony morphology, size, shape, and presence or absence of haemolysis. For primary identification catalase test, oxidase test, oxidation fermentation test, motility test and gram stain were conducted, and suspected genera were additionally checked with selective media. Selective medium and differential medium used were includes EMB, XLD and salmonella shigella agar. After 24 hrs incubation characteristic growth on selective medium were registered.

Data management and analysis

Data were entered into Microsoft excel and analyzed by SPSS version 20. Prevalence differences of study variables were analyzed by chi-square and descriptive statistics. $P \leq 0.05$ is considered as statistically significant at 95% CI.

Results

From the total 384 slaughtered animals 32% (n=123) was found with liver damages. During the study period identification of different pathological alterations in the liver with respect to bacterial isolation from the liver was done. 8.6% (n=33) and 7.3% (n=28) liver samples were with hemorrhagic necrosis because of presence of fasciola and yellow to brown discoloration of the liver respectively. Grossly yellow to brown discoloration was seen on some parts of the liver, at the same time increased size of the liver was detected (Table 1).

Gross lesions of the liver	Number of examined animals	Number of positive animals	Positive animals in percentage
Hemorrhagic necrosis because of presence of fasciola	384	33	8.6
Yellow to brown discoloration of the liver	384	28	7.3
Abscess	384	22	5.7
Presence of cyticercus cyst	384	23	6
Increased size of liver	384	17	4.4
Total	384	123	32

Table 1: Gross pathological lesion detected in the liver.

During the study period body conditions and sources of the animals (where animals were slaughtered) were considered as variables. The samples were collected from two different abattoirs namely Jimma and Agaro municipal abattoir. Statistically there was no significant difference in liver damage within two sources of the animals ($P > 0.05$), but the prevalence of liver damages is significantly different between good and medium body condition of the animals ($P < 0.05$) (Tables 2 and 3).

Variables	Category (with in the variables)	No. Examined animals	Liver Lesions (in number and percentages)						χ ²	P-value
			Yellow discoloration	Presence of fasciola	abscess	Presence of cyst	Liver enlargement	Total		
Body conditions of the animals	Medium	142	6 (4.2)	4 (2.8)	1 (0.7)	5 (3.5)	4 (2.8)	20 (14)	36	0
	Good	242	22 (9.1)	29 (12)	21 (8.7)	18 (7.4)	13 (5.4)	103 (43)		
Sources of the animals	Jimma	301	21(7)	24 (8)	17 (5.6)	19 (6.3)	16 (5.3)	97	4.3	0.53
	Agaro	83	7 (8.4)	9 (10.5)	5 (6)	4 (4.8)	1(1.2)	26		

Table 2: Pathological lesion in the liver with respect to different variables.

Isolated bacteria	Total number of examined animals	Positive (In number)	Percentages
<i>Proteus</i> spp.	384	35	9.1
<i>Salmonella</i>	384	33	8.6
<i>E. coli</i>	384	15	3.9
<i>Shigella</i>	384	13	3.4
<i>Pseudomonas</i> spp	384	8	2.1
Total	384	104	27.1

During the study period different types of bacteria were also isolated from the pathological lesions of liver. 27% (n=104) were the total number of livers found with different bacterial infection. *Proteus* and *Salmonella* species were found in highest percentages, which accounts 9.1% and 8.6% respectively (Table 3).

Statistically bacterial identification has significance difference among the different categories of pathological lesions of the liver. The number of proteous bacteria isolated from the liver abscess is more than the rest of the bacteria (Table 4).

Table 3: Isolated bacteria.

Variables	Category (lesion)	Positive Bacteria (in number and percentages with in lesions)						χ ²	P-value
		<i>Salmonella</i>	<i>Proteus</i>	<i>E. coli</i>	<i>Shigella</i>	<i>Pseudomonas</i>	Total		
Types of Lesions in the liver	Yellow discoloration	7 (25)	10 (35.7)	4 (14.3)	5 (17.9)	0	26	121.4	0
	Hemorrhagic necrosis (fasciola)	13 (39.4)	7 (21.2)	3 (9.1)	6 (18.2)	4 (12.1)	33		
	Abscess	6 (27.3)	7 (31.8)	3 (13.6)	1 (4.5)	4 (18.2)	21		
	Presence of hydatid cyst	2 (8.7)	6 (26.1)	0	0	0	8		
	Liver enlargement	5 (29.4)	5 (29.4)	5 (29.4)	1 (5.9)	0	16		

Table 4: Isolated bacteria in association with different pathological lesions.

Discussion

The present studies detect both parasitic and bacterial causes of liver damages. Fasciolosis and cysticercosis were the common cause of liver damages detected, whereas *proteus*, *salmonella*, *E. coli*, *shigella*, and *pseudomonas* were the bacterial causes isolated from pathological lesions of liver. The overall liver damages found in this study were 32% which is different from 56.16% reports from Hawassa municipal abattoir, Ethiopia [8].

During the study period liver hemorrhagic necrosis, because of presence of fasciola was accounted 8.6%. This was similar with 13.1% prevalence, reported in Eastern Cape Province of South Africa. But the present study result was different from the reports from Mekelle municipal abattoir, Ethiopia (39.9%). This result was also lower than

the results of the study conducted in Elfora abattoir (50.65%) [10] and study conducted in Andassa livestock research center, in North West Ethiopia which was 60.42% [3]. These differences were occurring because of the in agro ecological difference of the study area.

Fasciolosis lowers the resistance of animals and predispose them to other infection [11]. During the present study period different bacteria was isolated from livers that has liver fluke. The percentages of these bacteria were 21.2%, 12.1%, 9.1%, and for *Proteous* spp., *Pseudomonas* spp. and *Escherichia coli*, respectively. Similarly, Ahmed and Mohammed [3] were isolated, *Pseudomonas* spp. (7%) from liver of bovines in Omdurman slaughter-house, Saudia Arabia. But the percentages of *Escherichia coli* (19.5%) and *Proteous* spp. (4.5%) were different from the present study results. Different results were also reported by Sohair and Eman [12], from Dokki, Giza which were

43.6% *E. coli* and 7.7% *Proteus spp* that were also accompanied with liver fluke infestation.

Diet is an important factor influencing the prevalence of liver abscess. Grain digestion, particularly gelatinization of the starch granules promoted the rate of ruminal fermentation of the starch, so it increased the probability of acidosis and liver abscesses [2]. Ruminal lesions resulting from acidosis generally are accepted as the predisposing factors for liver abscesses [5]. The result of liver abscess during this study was found to be 5.7%, this was in line with the results (0.7%) reported by Hussein [13] in Asella, Ethiopia. At the same time the present study concerning liver abscess was similar with the study conducted in Eastern Cape Province of south Africa (8.7%). Study conducted in Karbala province of Iraq also shows the prevalence of liver abscess to be 32% [2].

6% (n=23) was the percentages of cysticercosis detected in liver by the present study. This result is analogous with 2.4%, reports from South Africa. Salmonella was the second most types of bacteria encountered during the study period. 8.6% (n=33) was the prevalence of salmonella during the study period. This study was in line with 5.7% (n=2) which was reported by Abe, [14] from Addis Ababa abattoir enterprise, Ethiopia.

The present studies indicate isolation of *Escherichia coli* from liver with different pathological changes. *E. coli* was found to be 3.9% (n=15), but this result is in contrary with 20% (n=5) results from slaughtered at abattoirs in Cairo, Giza and Kalubia [1].

Conclusion

The present study shows the presence of different pathological lesions in the liver of cattle slaughtered in Jimma and Agaro municipal abattoir. Hemorrhagic necrosis and yellow discoloration of the liver is the major gross lesion finding. Proteous species and salmonella were the bacteria foremost isolated from the liver damages. In reference to the present study it is recommended that: furthermore, molecular characterization and antimicrobial susceptibility testing of the bacteria circulating in the area is mandatory to decrease the economic loss from liver condemnation and deworming should be given regularly in the study area for parasitic cases.

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