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Bacteriological and biochemical examination of liver lesions of slaughtered goats (*Capra hircus*) in and around Guwahati, Assam

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Abstract
The present investigation was conducted to study the bacteriological and biochemical examination of the pathological lesions found in the livers of goats in and around Guwahati. Liver samples were collected from goats slaughtered for human consumption from different slaughter places and meat shops. For this purpose, 1,031 livers of slaughtered goats were examined. A total of 167 (16.19 per cent) goat livers were found to be affected with various pathological conditions on gross and histopathological examination. Out of these livers, thirty seven (37) liver samples were found with the presence of abscess and necrotic lesions which were then subjected to bacterial isolation**.** Bacterial identification was done on the basis of colony morphology, cultural characteristics and biochemical tests. The bacteria isolated from hepatic abscess and necrosis were *Staphylococcus aureus*, *Streptococcus spp.*, *E. coli*, *Salmonella spp*. and mixed culture of *Staphylococcus*, *Streptococcus*, *E. coli* and *E. coli*, *Salmonella spp.*, *Staphylococcus aureus*. Gram positive cocci were found to be dominant among the isolates. Serum enzymes like ALT, LDH and GGT were estimated and statistically compared between goats with liver lesions and without liver lesions. These Serum enzymes were found to be significantly higher in goats with liver lesions.

Keywords: bacteriological, biochemical, goat, Guwahati, lesions, liver

Introduction
Assam has a goat population of 6.17 million (Livestock census, 2012) [1], i.e. 4.56% share of the country; and stands second in terms of population next to cattle. Goat constitute as one of the major sources of food and income generation leading to the improvement of socio-economic status of the farmers of Assam. They make a critical contribution to economies for households by providing meat, milk, hide, manure etc. Goat meat i.e. Chevon, is one of the preferable meat by all sections of people in the state.

Liver is the principal organ of metabolism for many endogenous and exogenous substances and is one of the most frequently damaged organ in the body. The liver is first organ of the body that undergoes pathological changes when an animal suffers from an acute infection and the last organ to assume normalcy. The liver is susceptible to various parasites and disease conditions which affect the total health status of the animal. It may harbour pathogens which is dangerous for human consumption when passed with localized or mild infection. Liver has a larger capacity to regenerate in response to injury and as a result, liver of clinically healthy animal also showed a wide spectrum of disease conditions at slaughter period. Slaughter houses are valuable sources for information about epidemiology of food borne and zoonotic diseases, actual losses in meat production and the economic impacts for condemnation (Tahir *et al.*, 1985) [7]. Despite the fact that the goat is one of the predominant domesticated animals, very little published information is available on the bacteriological and biochemical examination of the pathological lesions found in the livers of goats. So, keeping in view of these, the present study was done to investigate the bacteriological and biochemical examination of liver lesions of slaughtered goats (*capra hircus*) in and around Guwahati, Assam.

Materials and Methods
The present study was conducted to study the bacteriological and biochemical examination of liver lesions of slaughtered goat (*capra hircus*) in and around Guwahati, Assam. Liver samples were collected from goats slaughtered for human consumption from different slaughter places

and meat shops in and around Guwahati. For this purpose, 1,031 livers of slaughtered goats were examined. Samples from livers affected with abscess and necrotic lesions were taken up for bacteriological examination. The specimens were taken aseptically in sterile bags without any preservatives and transported to the microbiological laboratory where isolation and identification of bacteria was performed. Different types of culture media (nutrient agar, blood agar, MacConkey agar, mannitol salt agar, Brilliant Green agar and eosin methylene blue agar) were used in this study together with biochemical test reagents (catalase, coagulase, IMViC test and TSI test) for primary isolation and identification of bacteria. For biochemical test, blood samples were collected during ante mortem and livers of the same animals were appropriately inspected for the presence of gross lesions after slaughter. Then the animals were categorized into two groups based on the absence or presence of visible liver lesions as (Group A) and (Group B). Serum was separated and stored at -20^{o} C for biochemical estimations using appropriate methods (IFCC SZASZ method, IFCC SZASZ method and UV kinetic method using clinical spectrophotometer). Lastly, the data obtained by the investigation were arranged and statistically analysed by using SAS9.3 software.

1. Bacteriological Examination

In the present study different bacteriological agent like *Staphylococcus aureus*, *Streptococcus spp*., *E. coli*, *Salmonella spp*. were isolated singly and in mixed cultures from livers with abscess and necrotic lesions. The bacteria were isolated using different media, cultural characteristics and biochemical tests and the following results have been found. The bacterial isolates and their relative abundance are presented on Table 1 and the laboratory identification of isolates show cultural and staining characteristics of the bacteria isolated from the liver lesions are presented in Table 2. Gram positive cocci were dominant among the isolates. The second dominant bacterium was E.coli. Other species were isolated at relatively lower rates. The Staphylococcus aurous produced a gray white or yellow colony on nutrient agar, white to golden colored colony on blood agar and yellow colour colonies on mannitol salt agar (Fig. 1). All isolates of staphylococcus aurous were gram positive (Fig. 2), arranged in clusters, coagulase and catalase positive. Streptococcus spp. produced small, circular and convex colonies on nutrient agar, pinpoint colonies surround by clear zones of hemolysis on blood agar. The isolated streptococcus species were gram positive (Fig. 3) and arrange in chains or pairs. Streptococci were catalase negative and coagulase negative. E .coli were Gram-negative bacilli (Fig. 4) occurred singly or in pairs produced circular, smooth colonies on nutrient agar, white to brown colonies on blood agar, pink colonies on macconkey agar and produces black metallic sheen on EMB agar (Fig 5). Salmonella were rod shaped gram negative bacilli produced larger, circular and smooth colonies on nutrient agar, non haemolytic smooth white colonies on blood agar, pale colonies on macconkey agar and pink colonies on BGA (Fig. 6). These finding received support from the study of Hodzic *et al*. (2013) [2] and Madhav *et al.* (2015) [4] where similar kind of observations were observed.

Table 1: Bacterial Isolates and Their Relative Roportion from Liver Lesions

Lesions / Isolates	Abscess (n=20)	Necrosis (n=17)	Total
Staphylococcus aureus	8 (14%)	2 (11.77%)	10 (27.03%)
Streptococcus spp.	4 (20%)	3 (17.65%)	7 (18.92%)
E. coli	3 (15%)	5 (29.41%)	8 (21.62%)
Salmonella spp.	-	2 (11.76%)	2 (5.41%)
S. aureus + Streptococcus spp.+ E. coli	5 (25%)	2 (11.76%)	7 (18.92%)
E. coli + Salmonella spp. + Staphylococcus aureus	-	3 (17.65%)	3 (8.1%)

Table 2: Cultural Colony Characteristics and Grams Staining Reaction of the Bacteria Isolated From Liver Lesions

Morphology			Colony Characteristics						Biochemical test				Identified organism
Shape	Arrangement	Germ stain reaction	Nutrient agar	Blood agar	MSA	Mac Conkey agar	EMB	BGA	Catalase	Coagulase	IMViC	TSI	
Cocci	Cluster	Gr + ve	White or Yellowish colony	White to golden, yellow colonies B hemolysis	yellow colonies	No growth			+	+			*S. aureus*
Small cocci	Chain or Pairs	Gr + ve	White colony	Pin point colonies with β hemolysis	No growth	No growth			-	-			*Streptococcus spp.*
Bacilli	Singly and in Pairs	Gr - ve	Circular smooth surface	White colonies to brown, no hemolysis	No growth	Pink colonie	Black colonies with metallic sheen				++--	A/A/-ve H_2S/gas	*E. Coli*
Bacilli	Rod Shaped	Gr - ve	Colonies are larger in diameter, circular and smooth	Smooyh white colonies, no hemolysis		Pale colonie		Pink colonies			-+-+	K/A/+ve H_2S/gas	*Salmonella Spp.*

Note: IMViC = Indol Production, Methyl Red, Voges-Proskauer and Citrate Utilization, TSI = Triple Sugar Iron TEST

2. Biochemical Examination

Serum biochemical parameters (ALT, LDH and GGT) were compared among the animals with no visible lesion (Group A) and presence of visible lesions (Group B).

Alanine transaminase (ALT)

The serum level of ALT in group B was significantly higher than the group A. The mean ±SE in group A and group B was 36.53±3.78 IU/L and 76.62±5.85 IU/L respectively (Table 3).

Lactate dehydrogenase (LDH)

The serum level of LDH in group B was significantly higher than the group A. The mean ±SE in group A and group B was 199.64±9.97 IU/L and 285.21±10.57 IU/L respectively (Table 3).

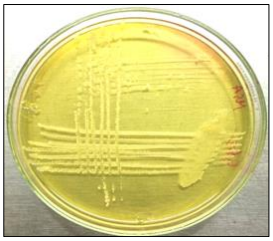

Fig 1: Staphylococci Produdicing Yellow Colonies in Msa

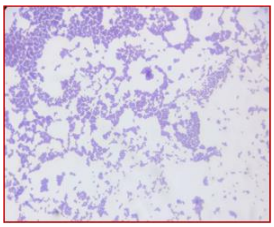

Fig 2: Staphylococci Organisms on Grams Stain

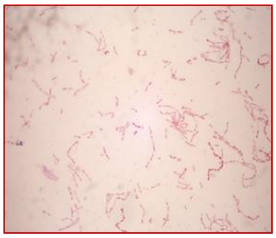

Fig 3: Streptococci Organisms in Gram Staining

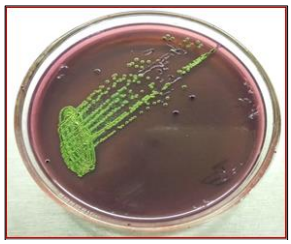

Fig 4: E. *coli* producing black metallic shean on emb agar

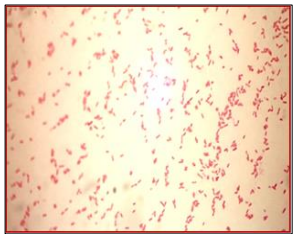

Fig 5: *E. coli* Organisms on Grams Stain

Fig 6: Salmonella Produces Pink Colour Colonies in Bga Agar

Gamma glutamyltransferase (GGT)

The serum level of GGT in group B was significantly higher than the group A. The mean ±SE in group A and group B was 35.37±2.91 IU/L and 57.64±4.40 IU/L respectively (Table 3).

Similar observations were made by previous workers like Kitila *et al.* (2014) [3] and Pandya *et al.* (2015) [5]. They observed significant increase in the mean values of serum enzymes in various hepatic diseases. The increase in serum enzyme in the present study might be due to hepatocellular necrosis and degenerative changes produced by migrating flukes and other pathological conditions encountered. According to Hodzic *et al.* (2013) [2], plasma concentration of ALT increases with hepatocellular damage/ necrosis or degeneration and hepatocyte proliferation. Increase circulating GGT activity can arise from impaired bile flow and biliary epithelial necrosis (Madhav *et al.*, 2015) [4]. Serum GGT is commonly used indicator of hepatobilliary disease in cattle, sheep, goat and horse (Saeed and Hussain, 2006) [6].

Table 3: Comparison of Alt, Ldh and Ggt Between Group A (No Visible Lesio) And Group B (Visible Lesion)

Groups Enzymes	(A) No visible lesion (n=20)	(B) Visible lesion (n=20)		
	Mean ± SE	Mean ± SE	t-value	p-value
ALT	36.53±3.78	76.62±5.85*	5.76	<.0001
LDH	199.64±9.97	285.21±10.57*	5.89	<.0001
GGT	35.37±2.91	57.64±4.40*	4.22	0.0001

Note: *Highly significant (P<0.01)

Conclusion

From the study it was found that Gram positive cocci bacteria were found to be dominant among the isolates from abscess and necrotic livers. The serum ALT, LDH & GGT were found to be significantly (P<0.01) higher in animals with liver lesions. Various liver diseases affect the structural and functional integrity of the organ and render it partly or wholly unfit for human consumption causing considerable losses. This loss can be minimized by the identification of the diseases and undertaking preventive and therapeutic measures. The results of this study do not represent the total goat population in Assam region. So, further study could be undertaken on the basis of different geographical location.

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