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Serum Biochemical Changes Observed in Apparently Healthy Cattle and Those with Bovine Fasciolosis in Maiduguri Abattoir" Borno State Nigeria

Munira Ali[1], Haruna Baba Galadima[2*], Hauwa Ibrahim Abdulrahman[3], Jibrin Yerima[2] and Ali Waziri[1]

[1]Department of Veterinary Pathology, Faculty of Veterinary Medicine, University of Maiduguri, Borno State, Nigeria.
[2]Department of Animal Health and Production, College of Agriculture Gujba, Yobe State, Nigeria.
[3]Department of Veterinary Medicine, Faculty of Veterinary Medicine, University of Maiduguri, Borno State, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. Author MA designed the study and performed the statistical analysis. Author HBG managed the literature search, authors HIA and JY wrote the protocol and first draft of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

The objectives of the study was to evaluate some serum biochemical changes in cattle naturally infected with Fasciola species at Maiduguri Abattoir and to determine the association between serum biochemical parameters with breed, sex and body condition score of apparently healthy cattle. A total number of 25 randomly selected cattle were used for this study based on different

**Corresponding author: E-mail: haruna5539@yahoo.com, gamuni9955@gmail.com;*

body condition score and sex groups. The breeds of cattle studied were: Wadara, Red bororo (or Rahaji), Ambala, Sokoto Gudali, Kuri and Arbore. Blood samples from all animals were carefully collected during slaughter in an anticoagulant bottle (EDTA as anticoagulant), labelled and mixed properly. Total plasma protein was determined using the refractometry method. Minerals such as sodium, potassium were determined by flame photometry, while bicarbonate and chloride were determined by titration method using the serum that was centrifuged. The findings of this study showed that there were no differences between the biochemical parameters of healthy cattle and fasciolosis infected cattle. Similarly, there were no differences in biochemical parameters as it relates to breed, sex and body condition score of apparently healthy cattle.

Keywords: Fasciolosis; plasma protein; minerals; cattle.

1. INTRODUCTION

Fasciolosis is a highly pathogenic [1] disease of clinical and veterinary importance caused by *Fasciola hepatica* and *Fasciola gigantica* [2,3,4]. Transmission of the fluke and the presence of its infection in any given population is dependent upon and exacerbated by some factors such as; the presence of a substantial reservoir of water parasite and potential host and the presence of lymneae snail intermediate host. These snail host which commonly measure about 10mm in size, usually occurs in areas with high annual rainfall, large areas of poorly drained pastures and moist soil [5,6].

Fasciolosis is a cosmopolitan infection. Incidence of infection has been reported in many countries including Nigeria, Pakistan, China, United States of America and Iran [7,1]. It is commonly reported in ruminants; cattle, goat and sheep [3,8,4]. Ruminant hosts become infected when forage with metacercarial cyst is ingested. They can also be infected when ingesting cysts suspended in soil and detritus while drinking water. Ingested parasite finds its way to intra hepatic biliary duct or hepatic parenchyma and later to the bile duct where it resides. Some of the significant pathological alterations include hepatic fibrosis, thickening and calcification of the bile ducts [9] which compromises liver function [10]. These changes result in condemnation of affected livers at meat inspection. Infections with these trematodes reduce productivity resulting in serious losses in domestic ruminants [11,12,13]. Although fasciola infected cattle rarely display signs of clinical disease, subclinical infections are recognised as the cause of economically important reductions in animal productivity [14].

Parasitic diseases are usually considered as a major health problem. The consumption of Meat and organ meat (especially liver) is common and is an important source of protein and other nutrient in this region. Fasciolosis leads to liver condemnation and thus causes significant economic loss and reduces its availability in the market. It is an indicator of the poor environmental health of local farm lands. There is a paucity of information on serum biochemical changes in cattle Fasiolosis. As such the objectives of this research are: To evaluate some serum biochemical changes in cattle naturally infected with Fasciola species at Maiduguri Abattoir and to determine the association between serum biochemical parameters with breed, sex and body condition score of apparently healthy cattle.

2. MATERIALS AND METHODS

2.1 Study Area

Maiduguri Metropolis, a major city in the North-eastern part of Nigeria. It is located between latitudes 11°04'N and 11°44'N; and between longitudes 13°04'E and 13°44'E. It covers a total land area of 543 km2, which makes it the largest city in the North-eastern region of Nigeria [15,16].

Maiduguri city now extends to four Local Government Areas: Maiduguri Metropolitan, Jere, Konduga and to a smaller extent part of Mafa local government areas [17]. The climate of Maiduguri is characterised by a long dry season with high evaporation rate from October to May and a short Wet season for the remaining part of the year [16]. There are four identified seasons in the area which include the Rainy Season, (June to September) Harvest Season (September to November), Harmattan or Cool Season (December to February) and Hot Season (March to May) [17].

It has a population estimated at 1.275 million people according to the 2006 census [18]. With an annual growth rate of about 3.5% and a

density of 1145 persons per square km which makes it the most densely populated city in North Eastern Nigeria [19,16]. Crop production and livestock farming are the predominant occupation of the people in the study area [20].

2.2 The Animal Breeds

The breeds of cattle studied were: Wadara, Red bororo (or Rahaji), Ambala, Sokoto Gudali, Kuri and Arbore. The sex, breeds and number of animals slaughtered were obtained through observation, counting and tallying at the main entrance as the animals were being led into the slaughter hall.

2.3 Study Population

A total number of 25 randomly selected cattle were used for this study based on different body condition score and sex groups. The cattle were brought for slaughter at the Maiduguri Abattoir.

2.4 Body Condition Score Estimation

Body condition scoring (BSC) describes the systematic process of assessing the degree of fatness of an animal [21]. The areas such as back, tail head, pins, hooks, ribs and brisket are used to determine BSC.

BSC 1 (Poor): Indicates low level of musculature, no evidence of any fat. Skeletal structure is very prominent.

BSC2 (Backward): Light tissue covering over the skeleton. The backbone remains clearly distinguishable as are the rear ribs.

BSC 3 (Moderate): Animal has a fair degree of muscling. No prominent backbone and ribs-tubacoxa remains prominent.

BSC 4 (Forward): animal are evenly and well covered in muscle and fat. Skeletal protuberances are all smoothly rounded.

BSC 5 (Fat): has obvious substantial level of fat. Skeletal definition is lost.
Among the 25 cattle selected, presence of fasciola infection was confirm at post mortem inspection.

2.5 Sampling Processing

Blood samples from all animals were carefully collected during slaughter in an anticoagulant bottle (EDTA as anticoagulant) and mixed properly. Each blood sample was clearly labelled with the animal's data based on breed, sex, body condition score and the date the sample was collected. The samples were transported to the laboratory in an ice pack for analysis. Total plasma protein was determined using the refractometry method. Minerals such sodium, potassium were determined by flame photometry, while bicarbonate and chloride were determined by titration method using the serum that was centrifuged.

2.5.1 Plasma protein

Blood sample was drawn into the capillary tube with capillary action to about two-third to three-quarter full ant the tube end was sealed using plaster seal. The capillary tube was placed in a centrifuge machine, centrifuged at 15000rpm for 5 minutes. After centrifuging, the capillary showed three layers. The top layer is of plasma; the middle layer is thin and creamy white known as the buffy coat; the last layer is that of the red blood cell.

To obtain the top layer which contains the plasma, the capillary tube was gently broken at the point above the buffy coat. A drop of plasma was placed on the glass plate of the refractometer and the cover closed. The glass cover was pressed gently in order to spread the liquid over the plate with no air bubbles. Holding the plastic cover in place, the refractometer was pointed towards a light source. When viewed through the piece; there are three scales and the scale for the protein is on the far left separating the horizontal line between the bright and dark area on the scale indicates the value for the plasma protein in gram per decilitre (g/dL).

2.5.2 Bicarbonate

The blood sample was centrifuged in a macro haematocrit machine to separate the serum and the red blood cell (RBC). The serum was gently harvested into a clean plain bottle. 2mL of deionised water was added unto 20µL of the sample. 2 drops of methylene red as an indicator was added and gently mixed. 0.001 NaOH in a biuret was allowed to flow onto the sample; gently shaking it; noting the colour change. At this point, the reading was taken on the calibration of the biuret.

2.5.3 Chloride

A drop of potassium chromate was added to the sample as an indicator. The sample was titrated

using silver nitrate. Readings was taken at the point where there was a colour change.

2.5.4 Flame photometry for sodium and potassium

10mL of deionised water was added into the serum sample and gently shaked. Using the deionised water, the flame photometer was set at zero. The knob of the filter was adjusted depending on either sodium or potassium. The sample was added and the peak reading was recorded.

2.6 Sample Analysis

Data were expressed as mean ± SD and statistically analysed using student t-test and one-way analysis of variance (ANOVA) with Graph pad Prism version 7.0. A p value of $p<0.05$ was considered as significant.

3. RESULTS

3.1 The Study Group

A total of 25 samples were analysed. Table 1.1 below shows the distribution base on different bread categorised into infected and non-infected.

3.2 Infected and Non-infected Cattle

Table 1.2 below shows the mean of variables between infected and non-infected group which shows variation. There were no differences ($p>0.05$) among all the parameters evaluated between the infected and non-infected groups.

3.3 Breed

The breed of apparently healthy cattle of the study group analysed were: red bororo (n=8); wadara (n=5); ambala (n=3) and others (n=4). The mean ±SD of serum biochemical parameters are shown below (Table 1.3). One-way ANOVA was used to analyse the means of the group (breeds). Hence, a null hypothesis was formulated.

$H_{0:}$ There is no significant difference in means of serum biochemical parameters and breeds of cattle. At $p<0.05$, the null hypothesis was accepted. We therefore, conclude that there is no significant difference in means of serum biochemical parameters and breeds of cattle.

3.4 Gender

The study sample of apparently healthy cattle was categorised based on gender where 50% (n=10) were male and 50% (n=10) were female. Their means of serum biochemical parameter was analysed (Table 1.4). Further analysis using t-test ($p<0.05$) was carried out to establish whether a relationship between means of serum biochemical parameters exists. It was, therefore, concluded that there is no significant difference of means of serum biochemical parameters between male and female of apparently healthy cattle.

Table 1.1. Shows the distribution of infected and non-infected cattle base on breed

s/n	Breed	Infected	Non-infected	Total bread
1.	Red bororo	1	8	9
2.	Wadara	3	5	8
3.	Ambala	-	3	3
4.	Others	1	4	5
	Total(n=)	5	20	25

Others include: Abore, Kuri and Sokoto Gudali.

Table 1.2. Shows the mean ± SD of serum biochemical values between Fasciolosis infected and non-infected cattle presented for slaughter at the metropolitan abattoir, Maiduguri

Variables	Infected (n=5)	Non infected (n=20)
BCS	4.00^{a}± 0.71	3.85^{b} ± 0.88
Plasma Protein	9.96 ± 0.73	9.63± 0.92
Na^{+}	98.80 ± 5.07	100.70 ± 2.87
$HCO3^{+}$	24.20 ± 1.64	23.65 ± 1.39
K^{+}	5.44 ± 0.36	5.46 ± 0.65
CL^{-}	119.6 ± 18.73	119.55 ± 7.33

BSC= Body Condition Score. ^{a,b} means with different subscript are significantly different at p< 0.05.

Table 1.3. Mean ± SD of serum biochemical values of different breed of apparently healthy breed of cattle

Variables	Red bororo (n=8)	Wadara (n=5)	Ambala (n=3)	Others (n=4)
Body Condition Score	3.2 ± 0.7	4.2 ± 0.8	4.0 ± 1.0	4.5 ± 0.5
Plasma Protein	9.8 ± 0.7	9.1 ± 1.2	10.0 ± 0.6	9.5 ± 0. 9
Na^+	101.0 ± 2.9	102.2 ± 1.7	97.3 ± 2.5	100.7 ± 2.8
$HCO3^+$	24.2 ± 1.2	22.8 ± 1.7	23.6 ± 0.5	23.5 ± 1.2
K^+	5.4 ± 0.3	5.9 ± 0.8	4.7 ± 0.4	5.2 ± 0.5
CL^-	116.8 ± 5.3	122.6 ± 9.4	121.3 ± 10.2	119.7 ± 6.9

Table 1.4. Mean ± SD of serum biochemical values of male and female in apparently healthy cattle

	Male (n=10)	Female (n=10)
Body Condition Score	4.50 ± 0.53	3.20 ± 0.63
Plasma Protein	9.75 ± 0.90	9.51 ± 0.98
Na^+	100.90 ± 3.14	100.50 ± 2.72
$HCO3^+$	23.30 ± 1.42	24.00 ± 1.33
K^+	5.49 ± 0.63	5.42 ± 0.71
CL^-	120.60 ± 7.04	118.50 ± 7.84

Table 1.5. Mean ± SD of serum biochemical values in various body condition score of apparently healthy cattle

Variables	BCS 3 (n=6)	BCS 4 (n = 8)	BCS (n =6)
Plasma Protein	9.72 ± 0.85	9.55 ± 1.22	9.856 ± 0.67
Na^+	100.00 ± 3.47	101.25 ± 2.87	100.60 ± 2.88
$HCO3^+$	24.00 ± 1.67	23.75 ± 0.89	23.20 ± 1.92
K^+	5.57 ± 0.87	5.55 ± 0.61	5.12 ± 0.48
CL^-	120.00 ± 9.49	118.00 ± 7.46	120.40 ± 6.50

3.5 Body Condition Score

Based on the body condition score, the apparently healthy cattle were categorised into 3, 4 and 5. Table 1.5 shows the means ± SD of body condition score 3, 4 and 5. One-way ANOVA ($p<0.05$) was used to establish whether a relationship between means of serum biochemical parameters and different body condition score exist. It was concluded that there is no significant difference of means of serum biochemical parameters and body condition scores 3, 4 and 5 of apparently healthy cattle.

4. DISCUSSION

The results of the study showed that the mean of serum biochemical parameters of apparently healthy cattle revealed a high value as compared to the reference range established by Coles [22], Esievo and Moore [23] and Latimer et al. [24]. The mean values of all parameters did not concur with studies of Oduye and Fasanmi [25], Olayemi [26], Bademkiran et al. [27] and Akinrinmade and Akinrinde [28].

The study revealed that the mean plasma protein in infected and non-infected group were not different. This is in accordance with Udeani [29] and Ahmed et al. [30] although the later study subject was in sheep. The destruction of the hepatic tissue during the migration of larval flukes and the presence of adult flukes in the bile ducts results in changes to the levels of serum proteins. Proteins either increase or decrease during infection, causing hypoalbuminaemia or hyperglobulinaemia, which are the most common features in liver fluke infections [31] and are due to plasma leakage through bile ducts [32].

Mean serum sodium level, potassium and chlorine were almost at the same level between the two groups. This doesn't agree with the findings of Ahmed et al. [30].

The mean biocarbonate and body condition score in infected group was comparable to the non- infected. The intensity of infection and the effect of fasciolosis are greater in cattle with poor body condition score. Many studies on the relationship between body condition score and

fasciolosis has shown that there is a positive association between fasciolosis and cattle weight [33,34,35,36]. Ahmed et al. [37] and Bitew et al. [38] also reported a lower body condition score among infected group. This contradicts with the findings of this study. The study showed that that there was no significant differences in serum biochemical values between the different breeds of apparently healthy cattle. This finding is not in line with Olayemi and Oyewale [39], who reported a significant difference between their study breeds.

There was no significant difference between mean of serum biochemical values and gender. The mean value of chlorine was high in males than females. This concurs with Bademkiran et al. [27].

Bademkiran et al. [27] reported a lower plasma protein in males than female cattle while the present study does not agree with it. In the present study, biocarbonate was comparable between male and female animals. Mean body condition score was higher in male than female cattle. No significant difference between the biochemical parameters of cattle with body condition score 3, 4 and 5 were noted.

5. CONCLUSION

The findings of this study showed that there were no differences between the biochemical parameters of healthy cattle and fasciolosis infected cattle. Similarly, there were no differences in biochemical parameters as it relates to breed, sex and body condition score.

CONSENT

It is not applicable.

ETHICAL APPROVAL

As per international standard or university standard written ethical permission has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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