

EVALUATION OF THE RELATIONSHIP BETWEEN SERUM BIOCHEMICAL MARKERS OF LIVER DISORDERS AND BODY CONDITION SCORES IN GOATS

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ABSTRACT

Body condition score (BCS) is an important tool used for the assessment of health status of goats. This study evaluated the relationship between varied body condition scores of goats and the activities and levels of certain serum biochemical markers of liver disorders (SBMLD). The study was a cross sectional survey of slaughter goats in Ikpa abattoir, Nsukka, Enugu state, Nigeria. Each goat was tagged and evaluated for body condition. Prior to slaughter, blood samples were collected and sera obtained for assay of aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, gamma glutamyltransferase activities, and albumin and cholesterol levels. After clinical examination, 114 (94.21 %) of the goats were considered apparently healthy while 7 (5.79 %) were not healthy. Correlation of BCS with SBMLD indicated that cholesterol correlated positively and strongly ($r = 0.861$, $p = 0.028$). The cholesterol values of goats with body condition scores of 2.5 - 4 were significantly ($p < 0.05$) higher than those with body condition scores of 1. It was concluded that the body condition score was directly related to the serum cholesterol values.

Keywords: Biochemical markers of liver disorder; Body condition scores; Nigerian breeds of goats

Body condition scores (BCS) assessment is a very critical tool in evaluating the body conditions of goats. It shows the available fat reserves that can be utilized in time of stress, suboptimal nutrition and high energy demand (Villaquan *et al.*, 2008). Body condition scores assess the extent of fatness or thinness with the use of a scale based on 5-point (Edmondson, *et al.*, 1989). The BCS can be useful in management of feed (Gillund *et al.*, 2001). It affects health, reproduction and production (Dechow *et al.*, 2002).

Nigerian breeds of goats are mainly Red Sokoto goats and relatively smaller proportion of Sahel goats and West African Dwarf goats (Ngere *et al.*, 1984). Goats are veritable source of milk, meat and fur. Ill health occasioned by both infectious and non-infectious agents has been a major challenge in the livestock industry. Some of these ailments may lead to emaciation and changes in body conditions and these will ultimately affect production and reproduction (Heinrich and Isler, 1989).

Serum biochemical markers of liver damage are those parameters assayable from serum and can aid in diagnosis of liver disorders. These analytes include AST, ALT, ALP, GGT, albumin, cholesterol *e.t.c* (Ozer *et al.*, 2008). The parameters such as AST and ALT are enzymes resident in hepatocytes. They ooze out into the circulation upon hepatic injury, and serve as indication of liver damage. In the same vein, enzymes such as ALP and GGT reveal damages to the hepatobiliary system since they (GGT and ALP) are ubiquitous in the epithelial lining cells of hepatobiliary system. Their increased serum activities therefore are a pointer to hepatobiliary disorder (Friedman *et al.*, 2003). However, analytes such as cholesterol and albumin are synthesized by liver. Reductions in their serum levels indicate defective production by hepatocytes (Thapa and Walia, 2007).

There is dearth of information on the possible relationship between the BCS and liver damage in Nigerian breeds of goats. The aim of this study was to evaluate a relationship between these serum biochemical markers of liver disorder and body conditions of the goats and by extension, their health status.

Materials and Methods

Animals

Nigerian breeds of trade goats presented for sale and slaughter at the Ikpa Abbatoir Nsukka, Enugu State, Nigeria were used for the study.

Study design

The study design was a cross sectional survey. Research visits to the Abbatoir were made 2 times a week for period of 12 weeks (January-March, 2019). Before slaughter, the goats were physically examined to determine the body condition score and the health status using the method of Villaquiran *et al.*, (2008).

Sample collection

Blood samples were collected from the jugular veins of the goat at the point of slaughter into clean test tubes devoid of anticoagulant. Sera were harvested by centrifugation at 3, 000 g for 10 mins. Thereafter, the clear supernatants were aspirated with the aid of clean syringe.

Body condition score assessment

The method of Villaquiran *et al.*, (2008) was used to determine the body condition scores of the goats. The method uses a 5-point scale with 0.5 increments. Score of one (1) represents a very thin goat devoid of fat reserves while a score of five (5) shows an overweight goat. The goats were firstly visualized to determine whether they were emaciated or not, strong or weak. The state of the backbone and whether the flank was hollow and the ribs clearly visible or not were all determined. The amount of muscle and fat were determined in the lumbar area by running fingers on the lumbar processes attempting to grasp the fingertips. Attempts were also made to pinch fat covering the sternum, rib cage and the intercostals spaces.

Assay of biochemical parameters

The serum aspartate aminotransferase activity was determined by the Reitman-Frankel spectrophotometric method (Reitman and Frankel, 1957; Colville, 2002). The serum alanine aminotransferase activity was determined by the Reitman-Frankel spectrophotometric method (Reitman and Frankel, 1957; Colville, 2002). The serum alkaline phosphatase activity was determined by the phenolphthalein monophosphate method (Klein *et al.*, 1960; Colville, 2002). Gamma glutamyltransferase (GGT) activity was done following a Spectrophotometric method according to Theodorsen and Strømme, 1976 and Colville, 2002. The serum albumin was determined by the bromocresol green method (Dumas *et al.*, 1971; Colville, 2002). The serum cholesterol was determined by cholesterol oxidase-peroxidase method (Allain *et al.*, 1974; Colville, 2002). The AST:ALT ratio (De Ritis ratio) was calculated by dividing the AST activity with the corresponding ALT activity.

Data analyses

One-way analysis of variance (ANOVA) was used to compare data on the serum biochemical markers of liver disorders of the goats with varied BCS. Duncan's Multiple Range post hoc test was used to separate the variant Means. Spearman Rank correlation was used to correlate the BCS and the serum biochemical markers of liver disorders. Probability levels were set at $p < 0.05$. Results were presented in tables and charts as means \pm standard error of the mean.

Results

Table 1: Serum biochemistry parameters of goats with varied body condition scores

PARAMETERS	BODY CONDITION SCORES					
	1 (N=9)	2 (N=31)	2.5(N=17)	3(N=31)	3.5(N=20)	4 (N=13)
AST(U/L)	77.26 ± 7.71 ^b	57.84 ± 4.30 ^a	52.079 ± 4.46 ^b	63.56 ± 5.01 ^{ab}	56.15 ± 5.33 ^a	69.38 ± 9.27 ^{ab}
ALT (U/L)	14.07 ± 2.13 ^a	11.59 ± 1.40 ^a	10.65 ± 0.95 ^a	13.83 ± 2.04 ^a	11.58 ± 1.17 ^a	19.35 ± 8.02 ^a
AST:ALT	6.13 ± 0.76 ^a	5.73 ± 0.36 ^a	5.36 ± 0.99 ^a	5.29 ± 0.36 ^a	4.88 ± 0.27 ^a	5.11 ± 0.47 ^a
ALP (U/L)	59.48 ± 23.98 ^a	75.27 ± 16.28 ^a	75.93 ± 30.61 ^a	30.40 ± 4.24 ^a	72.49 ± 13.99 ^a	75.07 ± 22.63 ^a
GGT (U/L)	33.38 ± 9.7 ^b	17.37 ± 1.90 ^a	26.15 ± 5.31 ^{ab}	18.11 ± 1.88 ^a	19.80 ± 2.44 ^a	18.34 ± 2.38 ^a
ALB (g/dl)	3.13 ± 0.21 ^a	3.217 ± 0.07 ^a	3.22 ± 0.09 ^a	3.42 ± 0.07 ^a	3.44 ± 0.07 ^a	3.30 ± 0.09 ^a
CHOLESES (mg/dl)	64.57 ± 3.88 ^a	73.71 ± 2.63 ^{ab}	75.92 ± 2.61 ^b	90.38 ± 3.13 ^c	84.07 ± 2.53 ^{bc}	90.47 ± 4.99 ^c

Different superscripts a, b, c across the same row indicates significant difference at P< 0.05.

Persistent and significant increases were observed in cholesterol values as the body condition scores improved from thin to obese while specified trends were not observed in other parameters measured.

Key: AST=Aspartate aminotransferase; ALT= Alanine aminotransferase; AST:ALT= Ratio of AST to ALT; ALP=Alkaline phosphatase; GGT=Gamma glutamyl transferase; ALB=Albumin; CHOL=Cholesterol. 1-Emaciated, 2=Thin, 3-Moderate, 4-Fat, 5-Obese

DISCUSSION

Gamma glutamyltransferase activities and cholesterol levels showed significant differences (P<0.05) in relation to body condition scores. Cholesterol showed consistent and significant increases as the body condition scores improved. The goats that were rated 4 and 3 (Normal) had significantly higher cholesterol levels compared with those rated 1, 2 (thin) and 2.5 (normal). Similar results had earlier been reported in a study by Roche *et al.*, (2009) and Duricic *et al.*(2017). However, the results of this study are at variance

with those of Barbosa *et al.*, (2009). Body condition score has been accepted as an effective, simple and reliable method to help assess reproductive efficiency (Duricic *et al.*, 2017). Some researchers have noted that breed, age, sex, nutrition and environmental condition are among the key factors that affect body condition scores (Aktas *et al.*, 2011; Samardzija and Vince, 2013). The effect of GGT revealed that the goat with score of 1 (thin goats) had a statistically higher activity of GGT. There is dearth of information on the relationship between body condition scores and the level of activity of GGT. GGT is a marker enzyme for hepatobiliary dysfunction (Thapa and Walia, 2007). It is thought that probably the goats with body score of 1 (thin or emaciated) may probably have some level of hepatobiliary dysfunction.

CONCLUSION

The results of this study showed that goats with high body condition score indices had higher serum cholesterol levels compared to the thin goats implying that the body condition score in goats could give a rough estimate of cholesterol levels.

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