

SURVEY OF KETOSIS AND HYPOPROTEINAEMIA IN SLAUGHTERED CATTLE IN THE SAHEL REGION OF NIGERIA

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ABSTRACT

Serum ketone and total protein concentrations of 966 cattle slaughtered at the metropolitan abattoir, Maiduguri, Nigeria, were estimated during the dry and rainy months of the year. None of the sera had a titrable ketone concentration. Serum total protein (STP) concentration of <60.0 g/L, considered as hypoproteinaemia, was more frequent in the dry than rainy period. The prevalence rates of hypoproteinaemia in the dry and rainy periods were 91.1 and 1.7 percents respectively. The mean STP concentration for all the cattle was 59.9 ± 28.9 g/L. Thus, the poor quality of herbage in the dry season may be responsible for undernutrition among the cattle population, reflected by hypoproteinaemia without ketosis.

Keywords: Nigeria, Sahel region, Cattle, Serum ketones, Serum total protein, Undernutrition

INTRODUCTION

In the sahel region of Nigeria, pasture is limited and of low quality during drought lasting for 7 – 9 months every year. Nomadic herdsman with their livestock are engaged in transhumance to areas in the sub-humid zone with abundant pasture. The cattle supplied to the Maiduguri abattoir (Borno State, Nigeria) for slaughter come from the semi-arid localities and, sometimes, from the bordering countries of Niger, Chad and Cameroun, which are in similar climatic belt. Over 20 thousand herds of cattle are slaughtered annually in this abattoir (Igbokwe *et al.*, 2001) and some of them are in poor body conditions because of under-nutrition. Thin, emaciated and unthrifty animals are common in their population, especially during the dry season. Ketosis and hypoproteinaemia occur in cattle feeding on poor quality feedstuff deficient in propionate and protein (Radostiits *et al.*, 1994). In the present study, serum ketone bodies and total proteins of slaughtered cattle in the Maiduguri abattoir were estimated to assess the adequacy of nutrition.

MATERIALS AND METHODS

The blood samples (10 ml) of randomly selected equal numbers of adult male and female cattle

slaughtered in the Maiduguri abattoir (Borno State, Nigeria) from February to August 1999 were collected from the jugular veins into containers without anticoagulant. Each sample was allowed to clot and after centrifugation at 2000g for 5 minutes, serum was harvested. Serum ketone concentration was estimated by the Rothera's test (Dumm and Shipley, 1946). Serum total proteins (STP) concentration was estimated by the Biuret colorimetric method (Silverman *et al.*, 1986). The data were summarized as means \pm standard deviations and comparisons between monthly means were assessed by a one-way analysis of variance (Chatfield, 1983). The bar charts of the frequency distributions of the data were plotted.

RESULTS

Nine hundred and sixty six serum samples (120 – 130 samples per month) had no titrable ketone concentration during a period of 7 months. Thus, there was a zero incidence of ketosis among the cattle.

The mean STP concentrations of cattle during the period was 59.9 ± 28.9 (17.0 - 121.5) g/L. There were significant ($P < 0.05$) variations among the monthly mean STP concentrations, with the higher values in the rainy season than dry season (Table 1).

Table 1: Serum total protein concentrations of cattle slaughtered in Maiduguri abattoir

Month	Number of Samples	Total Proteins, g/l
February	10	28.6±10.1 ^b
March	32	48.4±18.6 ^a
April	10	26.1±6.4 ^b
May	40	41.3±7.6 ^a
June	20	46.8±4.8 ^a
Dry Season	112	41.8±13.6 ^a
July	20	93.8±11.1 ^c
August	38	95.4±16.9 ^c
Rainy Season	58	94.9±15.0 ^c
Total	170	59.9±28.9

Key: ^{a, b, c} Means with different superscripts are significantly different ($P < 0.05$)

The frequency distributions of STP concentrations of the cattle (Figure 1) were unimodal and incompletely symmetrical during the rainy and dry seasons. The mean value in each season was close to the modal class. The lowest STP concentrations were 31.0 g/L and 17.0 g/L in the rainy and dry seasons, respectively. The overlap in frequencies of STP concentrations in both seasons occurred at 60-79 g/L intervals.

The STP concentrations of ≥ 80 g/L observed in the rainy season were not recorded in the dry season. The highest values were 121.5g/L and 77.2g/L in the rainy and dry seasons, respectively. The percentage of cattle having STP concentrations ≥ 60 g/L were 8.9% and 98.3% during the dry and rainy seasons, respectively. Conversely hypoproteinaemia at STP of <60.0 g/L occurred in 91.1% of the cattle during the dry season.

DISCUSSION

Ketosis is biochemically diagnosed by evaluating ketonaemia and ketonuria. Serum ketone levels in bovine ketosis are elevated from the normal values of <10 mg/dl to 10 – 100 mg/dl (Radostits *et al.*, 1994). The Rothera's test detects serum ketone levels of ≥ 10 mg/dl (Dumm and Shipley, 1946). Lack of titrable ketone concentrations in all the serum samples indicated zero incidence of ketosis among the slaughtered cattle.

Ketosis usually occurs when the plasma glucose level is below 2.2 mmol/L in cattle fed on poor quality feedstuff deficient in propionate and protein (Radostits *et al.*, 1994). However, undernourished cattle may be able to maintain blood glucose levels through gluconeogenesis using rumen-derived propionate and amino acids, and catabolism

of muscle proteins (Radostits *et al.*, 1994; McDonald *et al.*, 1995). Absence of ketosis in starved cattle may be due to rapid metabolism of ketone bodies for energy in some tissues of the body, which prevents accumulation of ketones in the blood circulation.

Poor nutrition of the slaughtered cattle was suggested by low STP concentrations. This was more frequently encountered in the dry than the rainy season. The STP values ranged from 17.0 - 121.5 g/L as compared to 68.0-80.0 g/L of plasma total proteins reported as normal values for temperate cattle breeds (Schalm *et al.*, 1975). The mean plasma total protein concentrations reported in intensively managed ruminant flocks in Maiduguri were 68.0 ± 7.8 g/L (Igbokwe and Ajuzieogu, 1991) and 72.9 ± 5.3 g/L (Igbokwe *et al.*, 2003) in sheep and 67.4 ± 6.3 to 75.0 ± 9.2 g/L (Mohammed *et al.*, 1993) in goats.

Majority (98.3%) of the cattle slaughtered in the rainy season had high serum total proteins. Only one of them (1.7%) was hypoproteinaemic with STP value of 31.0 g/L which was an outlier. The lowest class interval for STP in the rainy season was 60 – 64 g/L. The high STP was presumed to be due to adequate nutrition with high quality pasture in the rainy season. Highly digestible immature herbage with high contents of crude proteins, non-protein nitrogen, soluble carbohydrates and metabolizable energy (McDonald *et al.*, 1995) is the hallmark of early rainy season (July – August).

Hypoproteinaemia (STP of <60.0 g/L) was commonly encountered in the dry season (91.1% of 112 cattle) and STP value as low as 17.0 g/L was observed. Because of low colloidal osmotic pressure of blood of hypoproteinaemic animals, oedematous areas may occur in parts of the body and such occurrence is frequent in emaciated animals (Thornton and Gracey, 1974). Therefore, watery poor quality beef may be one of the outcomes of drought periods when the lower quantities of pastures available to the grazing animals have high fibre and low nutritive contents. The meat of emaciated animals has more water and less protein contents, and increased water-to-protein ratio than the lean meat of healthy animals (Thornton and Gracey, 1974).

In the late dry season, pasture plants are usually tall, spindly and sparsely distributed (McDonald *et al.*, 1995), and grazing cattle trek long distances to reach limited dead pasture. Moreover, voluntary feed intake of the animals is likely to be often depressed by high environmental temperatures from March or April to June ($39 - 43$ °C), inadequate water supply for drinking (Igbokwe, 1997) and untreated chronic infections often diagnosed at

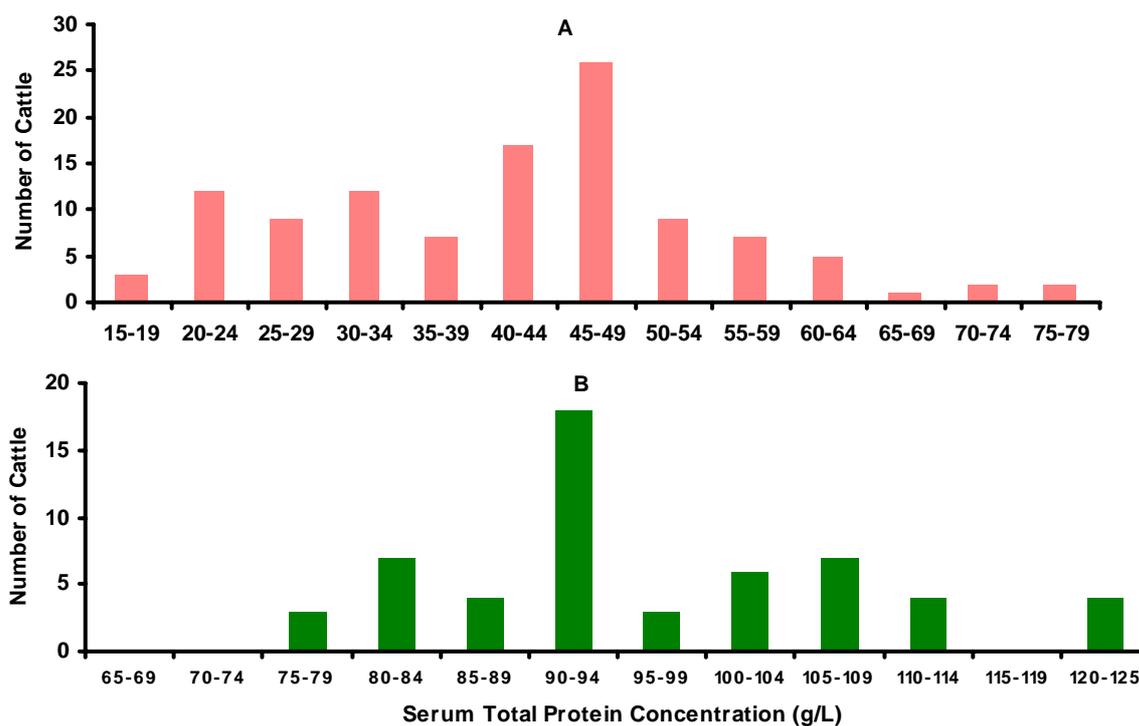


Figure 1: Frequency distribution of the serum total protein concentrations of cattle in Maiduguri, Nigeria, in dry (A) and rainy (B) seasons

slaughter such as tuberculosis, contagious bovine pleuropneumonia, fascioliasis and helminthiasis (Nwosu and Srivastava, 1993; Ameh *et al.*, 1998; Igbokwe *et al.*, 2001).

In conclusion, the survey had revealed that ketosis was not epidemiologically important, but frequent occurrence of hypoproteinaemia among the cattle was a notable indication of poor quality feeding of our cattle during the dry season.

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