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Chemical Analysis of Urinary Constituents in Cattle Presented for Slaughter at Zaria Abattoir

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Abstract: In a study to determine the occurrence evidences of impairment of kidney function in cattle, urine specimens were collected from 135 emaciated cattle, made up of 70 bulls and 65 cows and analyzed chemically for urinary constituents using reagents strip. Results obtained indicated that abnormal values of pH, glucose, bilirubin, specific gravity, erythrocyte, protein, Urobilinogen, nitrite, leukocyte and ketones occurred at prevalence rates of 10.4, 3.7, 15.6, 27.4, 11.1, 30.4, 1.5, 14.1, 13.3 and 20%, respectively. Abnormal values of these parameters were found to occur more in the males than in females except for values of glucose, specific gravity and ketones in which the reverse was the case. It was recommended from this study, that since the abnormal values of most of the constituents evaluated in the urine of these animals were suggestive of the existence of disorders that could impair with renal function, an in-depth study to identify the specific disorders and their aetiologic factors be conducted so that effective control and preventive measures could be designed and effected to curtail the menace of the diseases in cattle livestock.

Key words: Cattle, urinary constituents, kidney function, chemical analysis, slaughter

INTRODUCTION

Animal protein intake in Nigeria has been put, on average, at 4.82g day^{-1} (Tewe, 1999). This value, when compared with the minimum (35 g day^{-1}) recommended by FAO (1992), seems to suggest that most Nigerians suffer from malnutrition. Today, there is little if any improvement on the average animal protein intake when the ever-skyrocketing unemployment rate and the exponential growth in population are taken into cognizance.

Bridging the gap between the extant animal protein intake in Nigeria and that recommended by FAO requires a concerted effort by both the government and private sector that will be tailored towards boosting livestock production. Conversely, disease constraints and high feeding costs of animals have continued to be limiting factors to this much-desired improved livestock production (Tarawali *et al*., 1999; Adegbola, 2002). Low productivity of livestock has been attributed to such factors as diseases and poor nutrition.

In Nigeria and, perhaps, most African countries, cattle are the most dominant source of animal protein (Adedeji *et al*., 2006). These species of animals are the cheapest to produce owing to their feeding habit. Cattle production can be significantly increased through improved breeding practices and efforts that will be targeted at combating such constraints as diseases and poor nutrition. Economic losses due to diseases in livestock production are what inadvertently culminate in the exorbitant cost of the animals with attendant lack of affordability of their meat to low income earners. Curtailing the menacing effects of diseases in cattle requires a multidimensional approach that will encompass among other things efforts that will be directed at identifying specific diseases that affect essential organs in the body of these animals.

Kidney is one of the indispensable organs in the body and functions to maintain constancy in the internal environment. Urine, which is the byproduct of the regulatory activities of the kidneys, is not only altered by diseases occurring in the organs, but many extra renal conditions produce changes that may be of diagnostic significance. Analysis of urine could therefore reveal alterations typical of diseases of these organs in addition to providing valuable information concerning alterations in other physiologic processes in the body (Sirois, 1995). It suffices to note that in spite of the huge body of research conducted on various diseases of cattle in Nigeria, there is dearth of information on specific diseases that affect kidney function in these species of animals. This study was therefore, carried out to identify any evidences of impairment of kidney function in cattle presented for slaughter at Zaria abattoir through analysis of chemical composition of urine. The study

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was conceived to be a prelude to studies that would be targeted at diagnosing specific diseases responsible for the impairment of kidney function, if any.

MATERIALS AND METHODS

Study animals: White Fulani cattle showing evidences of loss of weight, such as deep para lumber fossa and prominence of shoulder and pelvic bones, presented for slaughter at Zaria abattoir were selected for study. Emaciated animals were selected so as to increase the probability of sampling from diseased ones.

Collection of urine specimens: Urine specimens were collected from a total number of 135 cattle made up of 70 bulls and 65 cows over a period of 2 months. Urine specimens were collected into clean test tubes as the animals were voluntarily voiding while waiting to be checked into the slaughter area. Only midstream urine specimens were collected so as to minimize contamination.

Chemical analysis: Urine specimens were analysed for leukocyte, nitrite, urobilinogen, protein, blood, specific gravity, ketones, bilirubin, glucose and pH using multistix dip technique (Bayer Reagents Strip, Germany). This was done by first dipping the strip into the fresh urine for about a second. The strip was then drawn across the rim of the test tube to remove excess urine. After about 30- 60 sec, the reagent areas on the strip were compared with the colour scale and results were read and recorded.

Determination of abnormal values: The corresponding values against each of the following parameters were considered to be abnormal based on similar studies conducted on normal healthy cattle (unpublished):

Leukocyte	=	Values greater than or equal to 5 leukocytes per microlitre of urine
Nitrite	=	Values greater than or equal to 0.05 mg per deciliter of urine
Urobilinogen	=	Values greater than or equal to 3.2 mg per deciliter of urine
Protein	=	Values greater than or equal to 30 mg per deciliter of urine
Blood	=	Values greater than or equal to 5 Erythrocytes per microlitre of urine
Specific gravity	=	Values less than 1.015
Ketones	=	Values greater than or equal to 25 mg (+) per deciliter of urine
Bilirubin	=	Values greater than or equal to 1 mg (+) per deciliter of urine
Glucose	=	Values greater than or equal to 50 mg per deciliter of urine
pH	=	Values less than 7.4

Statistical analysis: Abnormal values of individual parameters analyzed in the urine were identified and percent occurrence of each was calculated in all animals, females and males.

RESULTS AND DISCUSSION

Results obtained were as presented in Table 1. It is evident from these results that except for glucose, specific gravity and ketones, occurrence of abnormal values of the various parameters was higher among the males than in the female animals.

The revelation from this study clearly shows that with the exception of abnormal values of urobilinogen, bilirubin and ketones, all the others are good indicators of renal dysfunction or, at least, presence of pathological conditions in the urogenital tract. Thus, it could be inferred from these findings that a significant proportion of emaciated cattle in Zaria are being afflicted by a variety of pathological conditions that may have effects either directly or indirectly on kidney function.

Presence of abnormal leukocyte counts, pyouria, in 13.3% of the animals sampled suggests that there was inflammation or tissue necrosis in the urogenital tract (Coles, 1974; Bush, 1993). This is because normal urine, especially with the method of urine collection employed in this study, could only contain a few leukocytes (less than 5 per microlitre). Since urine specimens were collected during micturition, the most likely site of the inflammation or necrosis and therefore the source of these leukocytes, is the urogenital tract. In ascending infections, however, involvement of the urinary bladder, ureter or even the kidney may not be precluded (Finco, 1980). Conditions like pyelonephritis, renal abscesses, renal tubular damage and infected renal cysts are possible causes of pyouria (Bush, 1993).

Presence of nitrites in urine indicates bacterial infection. Detection of nitrites in the urine of 14.1% of the animals sampled in this study is an evidence of the existence of infection in the urogenital tract of these animals. Existence of the infection is supported by the abnormal leukocytes content of the urine of some of these animals (Finco, 1980; Carnfield, 1986).

Detection of protein in urine is considered pathologic except in certain physiological states like at the time of parturition, during the first few days of life, following strenuous exercise or during estrus (Coles, 1974). Thus, results obtained from this study could be said to be suggestive of either inability of the renal tubules to reabsorb the protein as may occur in renal disorders or that there were some exudative inflammations of the urogenital tracts of animals showing this proteinuria (Meyer and Harvey, 1998).

Table 1: Results of chemical analyses of urine of cattle (n = 135)

Parameter	RVO	NAV	NFA	NMA
PH	5-8	14(10.4)	3(4.6)	11(15.7)
Glucose (mg dL^{-1})	Norm.-500	5(3.7)	3 (4.6)	2(2.9)
Bilirubin (mg dL^{-1})	1-2	21(15.6)	10(15.4)	11(15.7)
S. Gravity	1.008-1.030	37(27.4)	22(33.8)	15(21.4)
Blood (Ery μL^{-1})	Neg-50	5(11.1)	4(6.1)	11(15.7)
Protein (mg dL^{-1})	Neg-500	41(30.4)	11(16.9)	30(42.9)
Urobilinogen (mg dL^{-1})	Norm.-8	2(1.5)	0(0.0)	2(2.9)
Nitrite (mg dL^{-1})	Neg.-Pos	19(14.1)	8(13.8)	11(15.7)
Leukocyte (Leu/μL)	Neg.-10	18(13.3)	4(6.1)	14(20.0)
Ketones (mg dL^{-1})	Neg.-100	27(20.0)	22(33.8)	5(7.1)

Key: RVO = Range of Values Obtained, NAV = Number of Abnormal Values, NFA = Number of Female Animals Affected, NMA= Number of Male Animals affected, Norm= Normal, Neg =Negative, Pos =Positive, The figures in parentheses represent the percentage of the animals affected for each parameter determined

The presence of blood in the urine of 11.1% of animals sampled is of clinical significance since haematuria is encountered mostly in association with diseases of the urogenital tract (Carnfield, 1986). A few systemic diseases may, however be accompanied by haematuria. Diseases that result in haematuria include pyelonephritis, ureteritis, cystitis, urolithiasis, pyelitis, prostatitis and neoplasms of the kidney, bladder and prostate, among others (Bush, 1993).

Although determination of specific gravity was done only once in these animals, the finding that 27.4% of the animals sampled had low values of this parameter may suggest presence of disease conditions that affect renal function (Bush, 1993).

Bilirubin and urobilinogen tests are not indicators of renal function. The former is normally carried out to assist in the differential diagnosis of icterus.

Urobilinogen in urine is of value in ascertaining the patency of bile duct in animals showing clinical icterus. Abnormally high values of this parameter indicate excessive bilirubin metabolism by the intestinal microbes (Coles, 1974).

Like bilirubin and urobilinogen, determination of ketones in urine is not a test for kidney function. Excretion of these products in urine, ketonuria, occurs when carbohydrate metabolism does not keep up with the body's need. Lack of sufficient feed intake is the commonest cause of ketonuria in cattle (Coles, 1974; Meyer and Harvey, 1998). Result of ketone bodies analysis in this study therefore suggests that a significant proportion of our cattle are malnourished.

Excretion of glucose in urine suggests inability of the renal tubules to reabsorb it since normal urine tests negative for glucose

Normal urine of cattle has alkaline $_{p}$H. Finding lower values of this parameter in 10.4% of the animals sampled most probably suggests some nutritional problems such as starvation with associated accumulation of ketones bodies in blood. Other causes of decreased urinary acidity include respiratory acidosis, severe vomiting and diarrhoea, increased protein breakdown and severe azotaemia (Bush, 1993).

Reasons for the occurrence of abnormal values of the parameters at higher prevalence rates in the males than in the female animals have not been determined in this study. However, a comprehensive study to identify the specific aetiologies of these abnormal findings could provide explanation on the discrepancies between the two groups of animals.

CONCLUSION

This study has revealed that a good proportion of emaciated cattle have abnormal values of urinary constituents. These features were most probably the result of disorders that affect renal function and could impact negatively on the health of these animals and ultimately contribute to the high economic losses incurred in livestock industry due to diseases. It becomes imperative, therefore, to initiate studies with the primary objective of identifying the specific disorders and their causative factors with the view to designing and effecting concrete control and preventive measures against them. This would, ultimately, help in improving the health status of our cattle and, in the long run, reduce economic losses due to such diseases.

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