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Haematological and Serum Biochemical Changes in *Bunaji* Work Bulls after Farmland Ridging Exercise in Kaduna State, Nigeria

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Abstract: Thirty-six *Bunaji* work bulls aged 4 to 6 years old, belonging to 18 agropastoral farmers in Kaduna State, Nigeria were used to investigate changes in haematological and serum biochemical parameters before and immediately after farmland ridging exercise. Significant ($p<0.01$) elevations in Packed Cell Volume (PCV), Red Blood Cell (RBC), Haemoglobin (Hb) and total White Blood Cells (WBC) were observed immediately after ridging exercise. Insignificant ($p>0.05$) decreases were observed in Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC). Neutrophilia, lymphocytopenia and eosinopenia were demonstrated indicating stress. There were also significant ($p<0.01$) increases in chloride, Blood Urea Nitrogen (BUN), creatinine and total protein, while bicarbonate levels decreased immediately after work.

Key words: Bunaji work bulls, ridging, haematology, serum biochemistry, Nigeria

INTRODUCTION

The blood picture of *Bunaji* work bulls under Northern Nigerian traditional mixed farming systems is of interest in view of their seasonal use to provide mobile work energy for cultivation and transportation of farm produce (Thomas *et al*., 1990) and also being the most numerous breed and most widely used by farmers for traction in the zone (Otchere *et al*., 1986). Haematological and serum biochemical values of many breeds of cattle in Nigeria have been determined (Akerejola *et al*., 1980; Gbodi and Chechet, 1981; Gbodi *et al*., 1989; Oyedipe *et al*., 1984; Rekwot *et al*., 1997; Rekwot *et al*., 1989). Many of these parameters are influenced by many factors like age, breed, sex, seasonal variations, lactation, pregnancy, health and nutritional status (Rekwot *et al*., 1989; Schalm *et al*., 1975). Few studies however, have been carried out on the haemogram and serum biochemical levels of working *Bunaji* bulls to establish the effects of exercise and work. These parameters are important in order to determine normal values and thus detect any deviations suggestive of disease or abnormal conditions. The purpose of this research was to document baseline values for haematological and serum biochemical changes occurring in *Bunaji* work bulls before and after ridging of farmlands.

MATERIALS AND METHODS

Work bulls: Thirty-six *Bunaji* work bulls aged 4 to 6 years old with a mean weight of 381.8±60.1 kg belonging to 18 cooperating agropastoral farmers distributed within Giwa and Soba Local Government Areas of Kaduna State, Northern Nigeria were used for this study. The bulls were all entire (not castrates) and used in pairs for ploughing farmlands for cropping at the beginning of the rainy season (May to July). The farmers used ox-drawn ridgers weighing 35.4±4.5 kg hitched to yokes of 12.8±1.5 kg weights. The bulls worked an average of 4.5±0.8 h per day. Some of the bulls were returned to cattle herds to serve as breeding bulls after the cropping season.

Examination of the bulls: The bulls were clinically examined for work fitness before the start of the trials. Rectal temperatures, pulse, heart and respiratory rates were taken. Blood and faecal samples were examined for parasites. Each bull was then dewormed with Nilzan(R) bolus (*2g d, 1-tetramisole and 1.4 oxyclozanide*) according to body weight and vaccinated against Contagious Bovine Pleuro-Pneumonia and Blackquarter. They were also sprayed weekly with steladone(R) 300EC (300 g *chlorfenvinphos* per litre) for ectoparasite control during the rainy season when tick population was highest.

Sample collection: Blood samples were collected from the bulls weekly from the month of May when farm preparations using work bulls start to July when farm preparations ends. Two blood samples were collected on each occasion; the first was taken at the bulls shed to obtain resting values while the post ridging exercise sampling was done within 10 min after work in their

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respective farms. In each case, about 20 mL of blood were collected through jugular venipuncture, care being taken not to excite the bulls. Three mililitre were put in bijou bottles containing disodium salt of Ethylene Diamine Tetra Acetic Acid (EDTA) for haematological analysis. Three mililitre were put in fluoride oxalate tubes for blood glucose estimation and the remainder in plain sterile universal tubes (without anticoagulant) for serum extraction. Samples for haematology and glucose determination were transported to the laboratory on ice packs. The serum was harvested soon after clot formation to minimize the movement of potassium and inorganic phosphate ions across the cell membrane. The serum was frozen at 20°C until used for biochemical determinations.

Analysis of blood and sera: Packed Cell Volume (PCV) was determined using a Hawksley microhaematocrit centrifuge. Total erythrocytes (RBC) and leukocytes (WBC) were determined using a Coulter Counter and the Haemoglobin concentration (Hb) by coulter haemoglobin-o-meter (*Coulter Counter electronics Inc. Hialeah, Florida*). Differential WBC counts were carried out on Giemsa-stained thin smears by direct microscopic counting of not less than 100 leukocytes. The Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC) and Mean Corpuscular Volume (MCV) values were calculated from the PCV, Hb and RBC values as described by Coles (1980). The sera were analyzed for sodium, potassium, chloride, inorganic phosphate, bicarbonate, urea, creatinine, total protein and albumin contents using the SMA 12/60 Auto analyser (*Technicon, Ireland Ltd, Dublin*). Blood glucose was estimated as described by Coles (1980).

Statistical analysis: The means and standard deviation of each blood parameter at rest (before ridging exercise) and within 10 min after ridging were calculated. The paired t-test method was used to determine level of significance between the resting values and those within 10 min after ridging exercise (Dixon and Massey, 1985; Steel and Torrie, 1980).

RESULTS

The 36 *Bunaji* work bulls sampled were clinically normal. Their rectal temperature, pulse, heart and respiratory rate were within the normal range for clinically normal cattle. The results of haematological and serum biochemical changes are presented in Table 1 and 2, respectively. There were significant increases ($p< 0.01$) in RBC, Hb, PCV, WBC and neutrophils. Decreases in MCV, MCH and MCHC were insignificant ($p>0.05$). Lymphocytes and eosinophils were slightly reduced ($p>0.05$) while monocytes were slightly increased ($p<0.05$). Significant increases ($p<0.01$) in the level of chloride, BUN, creatinine and total protein occurred immediately after ridging exercise (Table 2). Whereas the bicarbonate and potassium levels were decreased insignificantly

Table 1: Mean haematological values of 36 work bulls before and after farmland ridging exercise in Kaduna State, Nigeria

Parameter	Resting values before ridging	Within 10 min. after ridging	p-value*
RBC $x10^{12}$ L^{-1}	6.71±0.98	7.21±0.98	p<0.01
Hb g L^{-1}	90.69±2.11	110.40±1.95	p<0.01
PCV %	24.15±6.45	33.22±6.45	p<0.01
MCV fl	56.16±6.58	45.31±6.44	p>0.05
MCH pg	15.19±1.78	11.86±1.67	p>0.05
MCHC g L^{-1}	34.66±2.79	34.51±2.49	p>0.05
WBC x 10^{9} L^{-1}	10.69±2.65	13.03±2.65	p<0.01
Neutrophils%	20.82±6.06	28.52±6.87	p<0.01
Lymphocytes%	69.85±5.11	54.93±5.21	p>0.05
Monocytes%	0.87±2.17	0.96±1.43	p>0.05
Eosinophils%	10.85±2.96	7.32±2.80	p>0.05

*Significant at p<0.01

Table 2:Mean serum biochemical values in 36 work bulls before and after farmland ridging exercise in Kaduna State, Nigeria

Parameter	Resting values before ridging	Within 10 min. after ridging	p-value*
Na^{2+} mmol L^{-1}	144.97±2.42	145.67±1.84	p>0.05
K^{+} mmol L^{-1}	4.61±0.66	4.94± 0.59	p>0.05
Cl^{-} mmol L^{-1}	96.59±2.57	99.51±1.66	p<0.01
$P0_{4}$ mmol L^{-1}	1.72±0.26	1.79±0.21	p>0.05
HCO_{3} mmol L^{-1}	33.44±5.80	31.59±6.56	p>0.01
BUN mmol L^{-1}	2.94±1.16	6.30±0.70	p<0.01
Creatinineμ mol L^{-1}	64.52±12.32	84.39±9.08	p<0.01
Total Protein g L^{-1}	87.75±6.05	91.06±6.24	p<0.01
Albumin g L^{-1}	43.22±5.78	44.25±4.23	p<0.05
Glucose mmol L^{-1}	2.30±3.24	2.04±2.89	p>0.05

* Significant at p<0.01

($p>0.05$), the levels of sodium, phosphate and albumin were slightly increased ($p<0.05$). Blood glucose level, however, decreased insignificantly ($p>0.05$).

DISCUSSION

The results of this study indicated significant elevations in RBC, Hb, PCV and WBC immediately after farmland ridging exercise. Similar changes have been reported in draught cattle following stressful exercise (Anil and Thomas, 1994; Bhatnagar and Upadhyay, 1991). The increase in RBC, Hb and PCV may be due to haemo concentration caused by dehydration due to exercise and thermoregulation, in addition to increased adrenaline output causing splenic contraction and release of erythrocytes into the peripheral circulation(Coles, 1980). However, since bovine erythrocytes mature in the bone marrow before reaching circulation, it is not likely that there would be release of immature erythrocytes into the circulation following excitement, stress, or exercise (Pearson and Archibald, 1989).

Muscular exercise influences total and differential leukocytes counts (Kaneko, 1989). This also applies to cattle where a leukocytosis is expected with increased severity of the stressful work. In this study a significant leukocytosis was observed immediately after work with neutrophils dominating ($p<0.01$). Vigorous exercise in working bulls is reported to provoke the release of endogenous glucocorticoids particularly cortisol and adrenaline (Bush, 1994) which produce a response of temporary leukocytosis with neutrophilia, lymphopenia and eosinopenia similar to what was observed in race horses (Rossdale *et al*., 1982) indicating stressful conditions (Tietz, 1976). The insignificant increases in sodium and chloride levels following work may suggest the release of aldosterone during exercise which causes retention of these elements (Narinder *et al*., 1980) resulting in little or no marked losses in sweat.

The increase in the levels of blood urea nitrogen and creatinine and inorganic phosphate may be due to the breakdown of creatinine phosphate, a major source of energy to creatinine and phosphate which is consistent with changes that occur during strenuous exercise in such animals (Lording and Friend, 1991). Also, under such conditions, the increase production of these serum constituents may be attributed to reduced hepatic and renal perfusion, as a result of redistribution of blood flow to active muscles (Murphy and Henry, 1979). The changes in total protein value may reflect the effect of haemoconcentration caused by sweating and not an indicator of nutritive status of the bulls (Bush, 1994; Oyedipe *et al*., 1984). The decrease in bicarbonate levels may be related to the buffering of the lactic acid produced during exercise and also to the sustained loss of carbon dioxide in respiration, about 95% of which is contributed by bicarbonate (Narinder *et al*., 1980). Blood glucose levels may have decreased because exercise is reported to cause a relatively fast decrease in blood glucose concentration and an increase in lactic acid concentration (Bhatnagar and Upadhyay, 1991).

CONCLUSION

The observed changes in blood parameters following farmland ridging exercise in *Bunaji* work bulls are important reference material in order to determine physiological limits and thus detect any deviations suggestive of disease or abnormal conditions.

REFERENCES

Akerejola, O.O., N.N. Umunna and S.M. Denis, 1980. Serum biochemical levels of cattle in Northern Nigeria. Nigeria Vet. J., 9: 26-31.

Anil, K.S. and C.K. Thomas, 1994. Draught performance of buffaloes compared to cattle. Draught Anim. News, 20: 12.

Bhatnagar, S.P. and R.C. Upadhyay, 1991. Mild exercise induced physiological changes in cows. Draught Animal News, 14: 14.

Bush, B.M., 1994. Interpretation of laboratory results for small animal clinicians. Blackwell Scientific Publications Ltd, Oxford.

Coles, E.H., 1980. Veterinary clinical pathology. (3rd Edn.), W.B. Saunders Company. Philadelphia.

Dixon, W.J and F.J. Massey, 1985. Introduction to statistical analysis. (4th Edn.), McGraw-Hill Book Company. Auckland, London, Tokyo.

Gbodi, T.A. and J.I. Chechet, 1981. Some biochemical values in serum from normal and *Dermatophilus congolensis* (Cutaneous streptothricosis) infected Friesian cattle. Nig. Vet. J., 10: 56-61.

Gbodi, T.A, S.E. Atawodi and D. Salifu, 1989. Normal serum mineral levels of N'dama and Muturu Breeds of cattle in the Jos Plateau of Nigeria. Zariya Vet., 4: 41-46.

Kaneko, J.J., 1989. *Clinical biochemistry of domestic animals*. (4th Edn.), Academic Press, San Diego., USA.

Lording, P.M. and C.E. Friend, 1991. Data Analysis Guide: Interpretation of laboratory results. Aus. Vet. Practitioner, 21: 186-195.

Murphy, J.E. and J.B. Henry, 1979. Evaluation of Renal Function and Water, Electrolyte and Acid Base Balance. In: John Bernad Henry (Ed.), Clinical Diagnosis and Management by Laboratory Methods. (16th Edn.), WB Saunders Company. Philadelphia.

Narinder, S., O.P. Nangia and P.K. Dwaraknath, 1980. Effect of exercise on biochemical constitutuents of blood in entire, castrated and vasectomised Buffalo-males. Ind. J. Dairy Sci., 3: 299-303.

Otchere, E.O., H.U. Ahmed, S.A.S. Olorunju and M.S. Kallah, 1986. Utilization and management of work oxen in a guinea savanna environment in Nigeria: Initial result. In: Paul Starkey and Fadel Ndame (Eds). Animal power in farming systems. Proceedings of the second West Africa Animal Traction Networkshop. Freetown, Sierra Leone., pp: 233-237.

Oyedipe, E.O., D.I. Saror, D.I.K. Osori and O.O. Akerejola, 1984. Haematological parameters of zebu cattle on different protein levels and their relation to rate of gain. Bull. Anim. Health Prod. Africa, 32: 129-136.

Pearson, R.A. and R.F. Archibald, 1989. Biochemical and haematological changes associated with short periods of work in draught oxen. Anim. Prod., 48: 375-384.

Rekwot, P.I., J. Kumi-Diaka, O.O. Akerejola and E.O. Oyedipe, 1997. Haematological values of Bunaji and Friesian X Bunaji bulls fed two levels of protein diets. Nigerian Vet. J., 18: 63-72.

Rekwot, P.I., E.O. Oyedipe, O.O Akerejola and P.M. Dawuda, 1989. Serum biochemistry of zebu bulls and their Friesian crosses fed two planes of protein. British Vet. J., 145: 85-88.

Rossdale, P.D, P.M. Burgeut and R.S.G. Cash, 1982. Hemolytic anemia in the horse associated with Heinz body formation. Equine Vet. J., 14: 293.

Schalm, O.W., N.C. Jain and E.J. Carroll, 1975. Veterinary haematology. (3rd Edn.), Lea and Febiger, Philadelphia.

Steel, R.D.G and J.H. Torrie, 1980. *Principles and procedures of statistics*. (2nd Edn.), McGraw-Hill Book Company. Toronto, London.

Thomas, T., C. Oram and G. Tembo, 1990. Research on Diversified Uses of Work Animals. Needs, Experiences and Methods. In: Lawrence P.R, K. Lawrence, J.T. Dijkman and P.H. Starkey (Eds.), Research for Development of Animal Traction in West Africa. West Africa Animal Traction Network and ILCA, Addis Ababa, Ethiopia.

Tietz, N.W., 1976. Fundamentals of clinical chemistry. W.B. Saunders Company, Philadelphia.