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EVALUATION OF SEASONAL TEMPERATURE AND HUMIDITY CHANGES ON BLOOD METABOLITES OF KANO BROWN BUCKS

***[1]Nasir, M., [2]Abduljalal M. Aliyu, [3]Abdulhamid, S. Umar, [3]Sariyyu, S. and [4]Ismail A. Kakudi**

[1]Department of Animal Science, Kano University of Science and Technology, P.M.B 3045, Wudil,
[2]Department of Animal Science, Federal University Dutsin-Ma, Katsina State
[3]Department of Animal Production Technology, Audu Bako College of Agriculture, Dambatta
[4]Department of Animal Health Technology, Audu Bako College of Agriculture, Dambatta.

*Corresponding authors' email: mudassirnasir3@gmail.com

ABSTRACT

Small and large ruminants are often negatively affected by heat stress when the environmental temperature exceeds the upper critical level of 48°C. This condition can lead to decreased production and weight gain in the animals. The aim of this study was to evaluate the effects of seasonal temperature and humidity changes on blood metabolites of Kano Brown bucks. Small and large ruminants are often be affected negatively by heat stress when the environmental temperature exceeds the upper critical level of 48 ^{0}C, it is also result in decrease in production and weight gain of the animals. The study was conducted to evaluate the effect of seasonal temperature and humidity changes on blood metabolites of Kano brown bucks during the periods of dry season (March to June, 2016) in Sudan Savannah region of Nigeria. Sixteen bucks were allotted to four treatments in complete randomized block design with four animals each per treatment. Baseline data was obtained at the end of experiment. The result obtained for Hb, PCV, MCHC, MCH, WBC, lymphocytes and monocytes mean values did not differed statistically ($P > 0.05$) whereas RBC, Neutrophils and Basophils differed significantly ($p < 0.05$). Blood serum chemistry and cortisol hormone differed ($P > 0.05$). The result indicates that temperature between 28^{0}C – 46^{0}C doesn't have any detrimental effect on hematological parameters, blood serum chemistry and cortisol hormone of Kano brown bucks.

Keywords: Blood metabolites, Evaluation, Humidity, Kano brown bucks, Seasonal temperature

INTRODUCTION

In tropical and subtropical environments, small and large ruminants frequently experience heat stress, which can significantly impact their health and productivity. When environmental temperatures exceed the upper critical level of 48°C, animals often exhibit a marked decrease in production and a reduction in weight gain, depending on the species. This physiological stress can lead to compromised growth, reproductive performance, and overall well-being. Furthermore, when temperatures fall outside the comfort zone, other climatic factors, such as humidity, become increasingly important in determining the health and productivity of these animals.

For most tropical farm animals, a mean daily temperature of 28°C is considered the "comfort zone" (Benerjee, 2007). Goats, in particular, represent the most numerous livestock species globally, with a population of approximately 210.5 million compared to 176.8 million sheep and 216.6 million cattle (FAO, 2006). This translates to about 16%, 17%, and 27% of the world populations of these species, respectively. In Nigeria, goats are the predominant livestock, with a population of 38.8 million, in contrast to 21.5 million sheep (FAO, 2012). The primary breeds of goats in Nigeria include the Red Sokoto, West African Dwarf, and Sahelian goats (Adu et al., 1979; Osuga, 2006). Among these, the Kano Brown goat is the most widely utilized and distributed breed in the Northern Savannah belts of the country, with an estimated population of 210.8 million (Lombin, 2007).

Understanding how these environmental factors influence blood biochemistry is crucial for optimizing management practices and improving the productivity of this important breed in a challenging climate. This research seeks to provide insights that can help mitigate the adverse effects of heat stress and enhance the overall health and productivity of Kano Brown bucks in tropical environments. The aim of this study is to evaluate the effects of seasonal temperature and humidity changes on the blood metabolites of Kano Brown bucks.

MATERIALS AND METHODS

Study Area

The study was carried out at the University Teaching and Research Farm and Laboratory of the Department of Animal Science, new site of Bayero University, Kano. Kano is located within the longitude 9^{0}30 and 12^{0}30 North and the latitude 9^{0}30 and 8^{0}42 East in Sudan Savannah region of Nigeria. The annual temperature and relative humidity ranged between 38^{0}C to 43^{0}C and 40 to 51.3%, respectively (Olafin, 2007). The region is characterized by tropical wet and dry climate; wet season (May to September) and dry season (October to April) with annual rainfall that ranges between 787 - 960mm (KNARDA, 2001).

Experimental animals and their management

A total of sixteen (16) Kano Brown bucks with average initial body weight of 15kg aged range between 10 to12 months were purchased at Wudil Market of Kano State were used for this study. The general health status of experimental animals were examined. Animals were quarantined before the commencement of the study. Animals were given antibiotics prophylaxis using 20 % Oxytetracycline (long acting) at the dose rate of 10 mg per kg^{-1} body weight, animal were also dewormed using Albendazole suspension at the dose rate of 7.5 mg per kg^{-1} body weight, they were vaccinated against Pneumo-enteritis Complex/Peste Pestits de ruminant (PPR) using PPR Vaccine at dose rate of 0.5 ml subcutaneously.

Blood sample collection

Ten (10) ml of blood sample were collected for haematological and biochemical analysis. Sample were drawn from the jugular vein after restraining the animals using sterile syringe and needle as described by (Coles, 1986). Three (3) ml of the blood were placed in a sample bottle containing Ethylene Diamine Tetracetic acid (EDTA) for haemothological studies and the remaining 7 ml (without anticoagulant) were used for blood chemistry (serum metabolites) using an Autoanalyzer 2012.

RESULTS AND DISCUSSION

Seasonal and nutritional effect on heamatological parameters of Kano Brown bucks

Heamatological parameters studied shows no significant ($P > 0.05$) difference in Hb, PCV, MCV, MCHV, Lymp, Essinphils and monocytes as studied in Table 1. Significant ($P < 0.05$) difference was observed in RBC, MCH and Neutrophils. Highest mean value of 12.23 Hb was recorded in T_1 while T_3 had the lowest value of 10.16. Similarly, PCV and RBC higher in T_2. Neutrophils was higher in T_2 25.80 and lowest in T_1 20.13 respectively.

Blood serum chemistry of Kano Brown bucks affected by nutrition and seasonal variation

The result of blood serum chemistry of Kano Brown bucks as affected by season and nutritional factors are showed in Table 2. Parameters measured differed significantly ($P < 0.05$) among the treatment studied. Sodium (Na) was higher in T_1 131.33^a and lowest in T_4 115.67, the mean value of potassium (K) did not differed significantly ($P > 0.05$), T3 recorded the highest value of 4.36 T_1, had the lowest value of 3.63. Total protein value was higher in T_2 71.00^a and lowest in T_4 62.00 respectively. The mean value of cortisol hormone did not differed statistically. Highest mean value of 361.00 was obtained in T_4 and lowest value of 183.33 was recorded in T_1 respectively.

Table 1: Seasonal and nutritional effect on heamatological parameters of Kano Brown bucks

Parameters	Treatments				
	T_1	**T_2**	**T_3**	**T_4**	**SEM**
Hb (g/dl)	12.23	11.83	10.16	12.00	0.78
PCV (%)	41.33	42.33	38.00	41.33	2.37
RBC (x10^6/ul)	7.00^b	8.66^b	6.72^a	16.33^a	0.74
MCV (fl)	84.33	67.70	86.00	676.67	7.06
MCHC (pg)	16.00	14.33	40.30	15.67	10.90
MCH (%)	88.33^a	72.70^b	84.66^a	84.33^a	2.35
WBC (%)	19.06	18.83	20.63	21.66	1.18
Neutrophils (%)	20.13^c	20.56^{bc}	25.80^a	24.66a^b	1.06
Lymphocytes (%)	50.23	67.67	51.03	54.33	6.96
Ecsinophil (%)	7.00	6.00	6.00	6.33	0.56
Monocyte (%)	19.33	18.06	21.00	21.00	0.91

^{abc} means within the same rows with different super script are significantly different ($P < 0.05$). SEM standard error of means

Table 2: seasonal and nutritional effect on blood serum chemistry of Kano Brown bucks

Parameters	Treatments				
	T_1	**T_2**	**T_3**	**T_4**	**SEM**
Urea (mmol/L)	6.00^a	5.63^a	4.67^a	6.00^a	0.6
Na (mmol/L)	131.33^a	125.33a^b	128.33^{ab}	115.67^b	3.25
K (mmol/L)	3.63^a	4.03^a	4.36^a	4.10^a	0.2
Hc_{03} (mmol/L)	21.67^a	31.33^a	27.00^a	26.67^a	1.15
CL (mmol/L)	103.33^a	100.67^a	98.33^a	92.67^a	2.68
Creatinine (mmol/L)	74.67^{ab}	54.33^c	83.33^a	62.33^{bc}	3.38
Glucose (mmol/L)	4.73^a	3.22^b	4.09^{ab}	4.10^{ab}	0.27
Total cholesterol (mmol/L)	1.29^b	3.66^a	4.09^a	3.63^a	0.21
HDL (mmol/L)	0.20	0.89^a	1.12^a	1.35^a	0.14
TRIG	0.24^b	1.55^a	1.62^a	1.71^a	0.20
IDL (mmol/L)	3.94^a	2.45^a	3.25^a	1.99^a	1.47
Alkaline phosphate (u/L)	26.33^a	30.33^a	24.33^a	24.66^a	2.14
Alanineamintransferase (u/L)	36.00^a	27.00^b	32.00^{ab}	30.33^{ab}	1.86
Aspartaaminotransferase (u/L)	101.33^a	111.55^a	107.00^a	101.43^a	3.92
Bilirubin: total (g/l)	1.80^a	1.36^a	1.139	1.50^a	0.16
Bilirubin: direct (g/l)	0.80^b	5.00^a	0.90^b	1.03^a	0.26
Total Protein (g/l)	68.66^a	71.00^a	69.00^a	62.00^a	5.06
Globulin (g/l)	48.33a	35.00^b	28.67^b	30.33^b	1.66
Calcium (mmol/L)	2.19^a	2.09^a	2.14^a	2.11^a	0.05
Inorganic Phosphate (mmol/L)	1.26^b	1.26^b	1.80^a	1.40^a	0.16
Cortisol (mmol/L)	183.33^a	329.67^a	339.00^a	361.00^a	44.37

^{abc} means within the same rows with different super script are significantly different ($P < 0.05$). Na = Sodium, K = Potassium, Hc_{03} = Hydrogen carbonate, CL = Chloride, HDL = High density lipoprotein, TRIG = Triglyceride lactate dehydrogenase, LDL = Low density lipoprotein, SEM = standard error of means.

Discussion

Heamatological parameters of Kano brown bucks studied found to be different among the treatment groups observed. The values obtained for PCV, Hb, RBC were within the reference values reported by Duncan *et al.* (1994) reference values for goat in tropical region while MCV observed in this study were higher compared to earlier report. The values observed for Neutrophils, Lymphocytes, Basophils and eosinophils were within the reference value reported by Duncan *et al.* (1994) tropical haematological reference values for tropical goat. This could probably be attributed to animals' health, this indicates that, the body of animals is not fighting any diseases. This report was supported by the findings of Tambuwal *et al.* (2012) in red Sokoto goat. High mean values of white blood cell differentials indicates disease condition while lowered mean values signifies low immunity. Contrary opinion was reported by Azab and Abdel-Maksoud, (1999) in Sahelial goat.

Blood chemistry studied includes urea electrolytes, liver test function, blood glucose, total protein among other parameters of Kano brown bucks. Though no significant difference was noted in blood urea, potassium, HCO3, CL, IDL, Alkaline phosphate and total bilirubin are found to be within the reference value of Boyd (1984) goat reference value for medical diagnostic. Simiraks *et al.* (2004) reported higher values of blood urea above the reference values reported earlier, potassium and alkaline phosphate in West African dwarf goat. Clinical diagnostic division (1990) reported (3.0 - 5.8) mean value for blood glucose while the values obtained in the present study were within that range. Hyper and hypoglycemia causes' death in animals, El-Shabrawy, (2006) supported the value obtained in this study. Nutritional and seasonal effect on cortisol hormone were judiciously studied and values obtained in this study were supported by the findings of Daramola and Adeloye, (2010) Daramola *et al.* (2011). This is probably due to the facts that animals were not exposed to danger of stress of high ambient temperature of 46^0C as well as nutritional factors.

CONCLUSION

Based on the result of this findings it can be concluded that seasonal temperature of 26 – 42^0C and relative humidity of 10 – 22 shows no significant effect on haematological parameters, blood serum chemistry and cortisol hormone of Kano brown bucks.

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