EFFECT OF FEEDING *BALANITE AEGYPTIACA* ON THE HEAT STRESS ADAPTIVE RESPONSE OF UDA SHEEP

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ABSTRACT
This work was designed to evaluate the use of acute phase protein as biomarker of stress in measuring nutrigenomic effect of balanite on the response of Uda Sheep to heat stress. This research was conducted at the Teaching and Research Farm, Department of Animal Science , Federal University, Gashua. Twelve (12) Uda rams age range between 8-12 months with average initial weight of 17kg were used for this work. Body weight, haematological parameters and biochemical parameters as negative acute phase proteins were measured. Treatments 3 (10 % balanite) and 4 (15 % balanite) reveled significantly ($P < 0.05$) higher body weights than treatments 1 and 2. There were no significant ($p > 0.05$) differences in all serum biochemical parameters measured except in the Urea ($p < 0.05$). Monocytes (MON), Neutrophils (NEU), atypical lymphocytes (ALY) and Basophils (BAS) where there were significant differences ($P < 0.05$). It is therefore, concluded that balanite has nutrigenomic effect and improved the adaptability of Uda and that urea could be used as biomarker of heat of stress.

Keywords:*Balanite aegyptiaca*, heat stress, biomarkers, blood cells

INTRODUCTION

Livestock rearing serves as a major economic activity in the lives and livelihoods of millions of poor and marginal farmers, particularly in developing countries (FAO 2015). As per recent reports, livestock is considered as one of the fastest emerging dominant agricultural subsectors in the world (Thornton, 2010). However, the productivity of the animal is observed to be conserved in a narrow range of environmental conditions (Baumgard and Rhoads 2013). Among the various climatic variables, ambient temperature fluctuations are found to be the most intriguing factor affecting livestock production potential (Sejian *et al.,* 2013). Livestock having superior productive traits may produce poorly when the production environment is not favorable due to negative interaction between their genetic merit and environmental variables (Mpofu *et al*., 2017). High environmental temperature and thermal zone values higher than the critical thresholds level led to lowered feed intake, body weight, and feed conversion efficiency (Sohail *et al.,* 2012). Chronic heat exposure critically affects the meat quality and fat accumulation in broiler chicken, but it is breed dependent (Lu *et al.,* 2007). Heat stress has been reported to have negative effects on health status of chicken leading to changes in physiology, metabolism, hormonal and immune system. At high temperature decreases synthesis of T and B lymphocytes and suppression of phagocytic activity of blood leukocytes (Kadymov and Aleskerov, 1988). Bartlett and Smith (2003) found that lower levels of total circulating antibodies and lower levels of specific IgM and IgG in broiler under heat stress. Nathan *et al.,* (1976) observed that reduced total WBC and activities of leukocytes under heat exposure. Zulkifi *et al.,* (2000) also reported significant decline in animal antibody production under heat stress.This project is therefore, aimed at evaluating the performance response, acute phase proteins and haematological parameters of sheep fed Balanite under heat stress condition.

MATERIALS AND METHODS

This research was carried out in the Department of Animal Science Teaching and Research Farm, Federal University Gashua. Twelve (12) Uda rams aged 8-12 months with average initial weight of 17kg were sourced from the open market, quarantined for two weeks and used for this study. These animals were raised and fed with varying levels of balanite (0%, 5%, 10% and 15% for treatment 1, 2, 3 and 4 respectively) for two months. Three animals were allotted into each treatment of four in completely randomized design (CRD). Ten (10) mL of blood sample were collected in duplicates at

the end of the feeding trial from three rams in each treatment via jugular vein puncture using hypodermic needle for hematology. These samples were used for determination of hematological parameters, total protein, urea nitrogen and creatinine. Blood samples were centrifuged immediately and plasma were decanted into serum vials. The serum samples were stored in a deep freezer (-20 ^{0}C) until required for analysis.

The data collected was subjected to analysis of variance (ANOVA) using the general linear model (GLM) procedure of SAS (2002). Significant differences among means were compared using the Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Body weight and negative acute phase proteins

The serum biochemical parameters of Uda rams *Balanite aegyptiaca for* 10 week of experiment are presented in Table 1. There were no significant ($p > 0.05$) differences in all serum biochemical parameters measured except for Urea ($p < 0.05$). Urea values in T3 at 10% was higher when compared with other treatments (T1, T2 and T4).There were no significant ($p > 0.05$) differences in the body weights. This report disagreed with the findings of Bamikole and Babayemi, 2004 and Okpara, et al., 2014 who emphasized the negative or no effect of high level of browse leaves in Uda' diets. It is more profitable to feed browse leaves as supplements at a reduced level of inclusion in livestock diets. This finding is similar to the reports of Nagalakshmi *et al.* (2010) observed that complete diets increased nutrient utilization, increased acceptability and reduced cost of feeding in ruminants. Serum biochemical indices had been used to determine the level of heart attack, liver damage and also to evaluate protein quality and amino acid requirements in animals (Harper *et al*., 1979). The result revealed that feeding balanite affected the urea amount in the Uda. The increases in urea level improve the ammonia concentration used for microflora (bacteria and protozoa) to synthesize protein as reported by Zarcada *et al.* (1997) that stated that urea is an important source for protein supplement. This could bring about adaptation in the animal during period of heat when they are deprived from feeding due to environmental factor (Marai *et al*., 2007). Protein deficiency may cause growth retardation, muscles wasting, abnormal swelling of the belly or fluids in the body.

Table 1: Body weight and negative acute phase protein of uda breed of sheep fed graded level of *Balanite aegyptiaca.*

Biochemical parameters	T1 (0%)	T2 (5%)	T3 (10%)	T4 (15%)
Body weight (kg)	18.67^{bc}±1.85	17.00^{c}±5.567	22.00^{ab}±7.33	23.50^{a}±1.527
Urea (umol/L)	7.033^{b}±1.414	7.700^{b}±0.0577	9.20^{a}±0.0577	6.433^{b}±0.317
Total protein (g/L)	58.667±1.452	59.00±0.577	57.00±0.577	59.667±3.756
Albumin(g/L)	29.333±1.2018	29.00±0.577	27.00±0.577	29.33±0.666

$^{a, b, c}$, means in the same row with different superscript differ significantly ($P<0.05$).

Haematology

The means (±SE) of heamatological parameters of Uda breed of sheep fed graded level of Balanite aegyptiaca at 10weeks of experiment as presented in table 2. There were no any significant differences ($p>0.05$) in all of the heamatological parameters measured except in Monocytes (MON), Neutrophils (NEU), atypical lymphocytes (ALY) and Basophils (BAS) where there were significant differences ($P > 0.05$). The result presented revealed that feeding *Balanite* to sheep affected the Monocytes, Neutrophils, Atypical lymphocytes and Basophils concentration of Uda breed of sheep. No report was available on the effect of *Balanite* on haematological parameters. However, Daramola *et al.* (2005) reported that Guna affected monocyte and neutrophils in sheep. Heamatological values could serve as baseline information for comparison in conditions of nutrient deficiency, physiology and health status of farm animals (Daramola *et al.*, 2005). This may account for variation in age, sex, breed or strain, sampling techniques, and testing methodology.

Table 2: The results of mean ± SE of hematology of uda breed of sheep fed graded level of *Balanite aegyptiaca.*

	T1 (0%)	T2 (5%)	T3 (10%)	T4 (15%)
LYM	54.03^{a}±8.85	40.80^{ab}±0.46	37.00^{b}±0.58	55.50^{a}±7.28
MON	2.85^{b}±0.65	6.80^{ab}±0.46	2.90^{b}±0.58	9.03^{a}±2.75
NEU	40.90^{ab}±8.10	50.40^{ab}±0.10	58.10^{a}±0.58	31.90^{b}±11.31
EOS	0.10±0.00	0.20±0.06	0.20±0.01	1.60±1.35
BAS	0.40^{b}±0.10	1.90^{a}±0.06	0.90^{ab}±0.01	1.97^{a}±0.73
ALY	1.30^{b}±0.20	4.80^{a}±0.01	3.10^{ab}±0.58	4.00^{a}±1.24
IMM	0.05 ±0.05	0.10±0.01	0.10±0.58	0.03±0.03
RBC	1.42±0.45	1.28±0.01	1.563±0.01	1.34±0.10
HGB	9.95±2.05	9.40±0.06	10.80±0.10	10.37±0.61
HCT	6.75±2.15	6.10±0.06	7.50±0.06	6.43±0.63
MCV	47.65±0.15	47.50±0.12	48.00±0.06	47.80±1.55

$^{a, b, c}$, means in the same row with different superscript differ significantly (P<0.05); LYM= Lymphocytes (%), MON= Monocytes (%), NEU= Neutrophils (%), EOS= Eosinophils (%), BAS= Basophils (%), MCV= Mean corpuscular volume, RBC= Red blood cell, HGB= Haemoglobin., ALY= Atypical lymphocytes, IMM=Immune mediated myositis, HCT=hematocrit.

CONCLUSION

It is revealed in this study that Uda breeds fed 10% and 15% balanite showed better performance in body weight. Therefore, it is conclude that balanite has nutrigenomic effect on body weight and improved adaptability of Uda breed and that urea could used as biomarker of stress.

REFERENCES

Bamikole, M. A.and Babayemi, O. J.(2004). Feeding goats with Guinea grass-verano stylo and nitrogen

Bartlett, J.R. and Smith, M.O. (2003). Effects of different levels of zinc on the performance and immunocompetence of broilers under heat stress. *Poult. Sci.,* 82: 1580–1588.

Daramola, J. O., Adeloye, A. A., Fatoba, T. A., & Soladoye, A. O. (2005). Haematological and biochemical parameters of West African Dwarf goats. Livestock Research for Rural Development, 17(8), 95. Retrieved January 22, 2014, from http://www.lrrd.org/lrrd17/8/dara17095.htm

FAO (2015). Climate change and food systems: global assessments and implications for food security and trade. Food Agriculture Organization of the United Nations (FAO). Available in: http://www.fao.org/3/a-i4332e.pdf -fertilized grass with energy concentrate.*Archivosde Zootecnea* 53:13-23

Harper, H. a; Rodwell, V. W and Mayer, P. A. 91977) review of Physiological Chemistry 6th Edn. California Lange Medical Publishers. Pp 559-598. Retrieved fromhttp//en.wikipedia.org/wiki/cholesterol on 23/10/2012.

Kadymov, R.A. and Aleskerov, Z.A. (1988). Immunological reactivity of poultry organism under high temperature conditions. Dokl. Vses. Akad. S-Kh. Nauk Im. V. I. Lenina 5: 33–35

Lu, Q., Wen, J. and Zhang, H. (2007). Effect of chronic heat exposure on fat deposition and meat quality in two genetic types of chicken. *Poult. Sci.,* 86: 1059–1064.

Marai IFM, El-Darawany AA, Fadiel A, Abdel-Hafez MAM (2007). Physiological traits as affected by heat stress in sheepd: A review. *Small Ruminant Research* 71(1):1e12.

Mpofu TJ, Ginindza MM, Siwendu NA, Nephawe, KA, Mtileni, BJ (2017) Effect of agro ecological zone, season of birth and sex on preweaning performance of Nguni calves in Limpopo Province, South Africa. *Tropical Animal Health and Production,*49:187-194.

Nagalakshmi, D., Nalini Kumari,N. and Srinivasa,R.D. (2010). Feed Processing: Effect on nutrientavailability. In Proceedings of Animal Nutrition Strategies for Environment Protection andPoverty Alleviation, College of Veterinary Science and Animal Husbandry, Bhubaneswar, India.(1) 76- 83.

Nathan, D.B., Heller, E.D. and Perek, M. (1976). The effect of short heat stress upon leucocyte count, plasma corticosterone level, plasma and leukocyte ascorbic acid content. *Br. Poult. Sci.* 17: 481–485.

Okpara, O., Akporhuarho, P. O. and O k a g b a r e , G . O . (2 0 1 4) . Determination of Browse Intake and Nutrient Digestibility of Grazing West African Dwarf (WAD) Goats Fed Varying Levels of Gmelina arborea Leaves as Supplements in Delta State Nigeria. *International Journal of Animal and Veterinary Advances* 6(2): 52-57.

SAS (2002). Statistical analysis system multiple incorporation. Users' Guide Statistical version Cary, NC. USA.

Sejian V, Indu S, Naqvi SMK (2013) Impact of short term exposure to different environmentaltemperature on the blood biochemical and endocrine responses of Malpura ewes under semi-arid tropical environment. *Indian Journal of Animal Science* 83:1155-1160.

Sohail, M.U., Hume, M.E., Byrd, J.A., Nisbet, D.J., Ijaz, A., Sohail, A., Shabbir, M.Z. and Rehman, H. (2012). Effect of supplementation of prebiotic mannan-oligosaccharides and probiotic mixture on growth performance of broilers subjected to chronic heat stress. *Poult. Sci.,* 91: 2235–2240.

Thornton, P.K. (2010) Livestock production: recent trends, future prospects. Philosophical transactions of the Royal Society of susceptibility to thermal stress in goat kids. *Small Ruminant Research,* 145:20-27.

Zarkada,C.G., Voldeng, H.D. and Vu, U.K. (1997). Determination of the protein Quality of three new Northern Adapted Cultivars of Soya beans by Amino acid Analysis. *Journal for Agriculture and Food Chemistry*, 45:1161-1168.

Zulkifi, I., Norma, M.T., Israf, D.A. and Omar. A.R. (2000). The effect of early age feed restriction on subsequent response to high environmental temperatures in female broiler chickens. *Poult. Sci.,* 79:1401–1407.