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INFLUENCE OF BREEDS, PHYSIOLOGICAL STATUS AND DIFFERENT FEEDS ON BIOCHEMICAL PARAMETERS OF GOATS IN BALI, TARABA STATE

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ABSTRACT

The study evaluated the influence of breeds, physiological status and diets on biochemical parameters of West Africa Dwarf (WAD) and Sahel goats at the Teaching and Research farm of the Federal Polytechnic Bali, Taraba State. A total of twenty-four does and their corresponding progenies of the two breeds were used for this study. Blood samples were collected from each animal to evaluate the biochemical parameters, which lasted for 12 calendar months. The animals were fed feeds components of Gmelina and cassava peel meal, Gmelina and cowpea husk, Ficus and cassava peal meal and, Ficus and cowpea husk as treatments (T_1-T_4 respectively).The parameters considered were, calcium, potassium, phosphorus, chlorine, creatinine, albumin, protein, alanine aminotransferase and aspartate aminotransferase. The data obtained was subjected to analysis of variance (ANOVA), using (Statistix, version 8.0, 2009) statistical package. The overall results of biochemical parameters by breed, physiological status and diet were 2.044, 103.88, 5.498, 139.84mmol/l, 3.415, 33.053mg/dl, 31.327mmol/l, 45.654g/dl, 8.500, 25.0iu/l and, 51.010g/dl, for Ca, Cl, K, Na, Urea, CRT, P04, ALB, ALT, AST, and TP respectively. Base on the present findings therefore, it is concluded that, Biochemical parameters are useful measures of physiological statuses are quite variable. The study has provided useful body of information/knowledge on the reproductive biology of the two goat breeds of the study area, which hitherto was not available. These indices should therefore be used with caution for any rigorous interpretation.

Key words: Feed, biochemical, goats, progenies, does.

INTRODUCTION

The animal protein consumption of the average Nigerian was only 6.08g/day (Ibe, 1999) out of 35g recommended by F.A.O (Shaib *et al*., 1997). Inadequate protein intake results in retarded growth, kwashiorkor and infant mortality, other human diseases, and short live span (Oyenuga, 1975). Low animal protein availability is partly due to low level of animal production because of subsisting neglect of the livestock subsector in the context of national policies, dated back to the colonial era (Ozo, 2004). Increase supply of animal products could be easily achieved by higher ruminant population as suggested by Devendra and McLeroy (1982). However, an attempt at increasing cattle number has not been successful due to the high maintenance requirements and low productivity of local breeds. Substituting the local with the exotic breed has also resulted in failures due to inability to adapt to tropical environments, poor quality forages, pests and diseases, which affect growth and reproductive performance (Cunningham and Syrstad, 1987). However, some reports have shown that goat population and meat and milk production have risen continuously over the last three decades, with major increases occurring in Nigeria and other developing tropical countries (Devendra, 1979; Wilson, 1988). Increase in population and productivity of small ruminants in general and goats in particular would meet some of the demands for animal products. Goat's

ability to thrive in harsh environments is due to morphological features suited for feed selection and adaptation (Brumby, 1984). Selective grazing/browsing in goats is in parts genetically determined or due to prior experience or conditioning by prevailing nutritional, physiological and environmental circumstances including the availability of various plants from which the choices are made (Malechek and Provenza, 1983).

Allen and Voster, (2017), determined the effect of type of feeding on blood biochemistry of goats in South Africa. Serum urea in tethered goats was reported to be higher than in their grazed counter parts (Allen and Voster, 2017), but the latter had better nutrient flow especially energy (Pambu-Gollah *et al.,* 2000). These urea concentrations are within the normal range of 3.57-7.14 mmol/L for healthy goats (Kaneko *et al*., 2008). Allen and Voster (2017) further reported that the higher urea in tethered than herded goats was due to increase production of rumen ammonia (Rumosa Gwaze *et al*.,2010),from the degradation of ingested acacia leaves as the goats were largely tied to the thorny bushes. Herded goats in addition had lower serum urea because they were able to select different forage species. They also had higher DM intake, TP, TDN, and thus were more efficient in nitrogen utilization (Nonaka *et al*., 2008).

Allen and Voster (2017), also observed that the creatinine concentrations for herded and tethered goats were below the normal range of 88.40 to 159µmol (Kaneko *et al* .,2008). The low creatinine concentrations indicated that the goats had lean muscles (Damptey *et al*., 2014)

The total serum protein concentration for tethered goats were within the normal range of 64 to 70 g/L (Kaneko *et al*., 2008), whilst, herded goats had slightly lower than the optimum range. Plasma protein concentration is normally maintained at optimum concentration and only falls when dietary protein is low (Pambu-Gollah *et al.,* 2000). Globulin was also reported in this series of studies to be higher in tethered goats.

The serum albumin concentration obtained for the herded, tethered and floor type treatments were below the expected normal range of 27 to 39 g/L (Kaneko *et al*., 2008; Solaiman *et al*. (2010). Low albumin concentration is usually ascribed to protein deficiency and parasitism (Ndlovu, *et al.*2009; Mapiye *et al*., 2010).

Olafadehan, (2011) and Mapiye *et al.* (2010) have also reported low albumin value of 28.03 g/L in goats fed grass with low protein (9.2% on DM basis) as compared to 34.80 g/L in those offered a denser protein (16% on DM basis) browse species.

Usually, the ratio of albumin to globulinis such that increase in one result is decrease in the other and vice versa (Mapiye *et al*., 2020). Ndlovu *et al*., (2009), stated that high globulin to low albumen ratio is an indication of in efficiency of an immune system in fighting disease. Aspartate transaminase did not vary between diets such as 72.68± 1.91(Ikhimioye and Immamsuen, 2007). Similarly the values of AST were not significantly different among animals fed experimental diets. However, those of ALT varied ($P<0.05$), ranging from 9.90 to 12.95m/l (Oni *et al*., 2012). The concentrations of serum transaminase (ALT and AST) in the blood are reliable test for liver damage (Oni *et al.,* 2012).

The mean glucose concentrations for herded, tethered and floor type treatments were found to be within the normal range of 2.78 to 4.16mmols/L for goats (Kaneko *et al*., 2008). These values indicate that there was adequate glucose for life processes at cell level in the goats (Damptey *et al*., 2014).

Oni *et al.* (2012) reported on WAD goats fed graded levels of dried cassava leaves to WAD goats and found that glucose levels in the blood ranged from 40.1to 56.0mg/dl and showed significant ($P<0.05$) linear trend. The TP and albumin values ranged from 56.0 to 68.5 and

30.6 to 38.4g/dl respectively and showed significant ($p<0.05$) linear quadratic and cubic trend. They further stated that at 0, 20 and 40% levels there were an increase in glucose but reduced at the 60% of inclusion. Serum glucose level is an indication of carbohydrate metabolism in high energy diets (Coles, 1986). Low level is an indication of hypoglyceamia (Olurumnisomo and Fayomi, 2012).The total protein (TP) increased ($p<0.05$) across the dietary treatment, while urea showed a slight reduction at 40%.

Serum parameters have been reported to be important in the proper maintenance of the osmatic pressure between the circulatory fluids and the fluid in the tissue space so that the exchange of materials between the blood and the cell could be facilitated (Isidahoman *et al* 2012) IKhimioye and Immansuen (2007) also found that serum proteins are important in osmotic regulation, immunity and transport of essential substance in the body. The studies of Ikhimioye and Immansuen (2007) indicated that sodium and potassium bicarbonate in the blood did not vary with diet.

Wada *et al* (2014) however reported that, Sodium (1330-173mnol/), and potassium value range from 3.9 to 5.5mnol/l in blood of small ruminant fed *Zizyphus mucronata* and *Parkia biglobosa* leaves. Similarly, chloride level ranged from 128 to 95mnol/L. Urea level also ranged from 7.65 to 11.7mnol/l.

Aims and objectives

The main purpose of this study was to determine reference baseline data regarding biochemical values of WAD and Sahel breeds.

Materials and Methods

Experimental Site, Animal and Management

The study was conducted at the Teaching and Research farm, Federal Polytechnic Bali, Taraba State, Nigeria. Bali Local Government Area (LGA) is located between the latitude $7^0$12' and $9^0$00'N of the equator, longitudes $10^0$00' and, $12^0$00'E of the Greenwich Meridian, and at an altitude of 4500 to 5000 metres above sea level (Adebayo and Bashir, 2005).

Twenty-four does were made up of 12 each of West African Dwarf and Sahel, between the ages of 16-18 months old and weighing 28-29 kg. also their progenies, were weighed and used for the study. The animals were obtained from small holder subsistence farmers and some pastoralists, who reared them extensively on natural pastures with little or no supplementations and also took them to local livestock markets in and around Bali town.

The ages of the animals were determined using the dentition estimation method, by counting the number of permanent incisors that have erupted on the lower jaw as described by Sastry and Thomas (1980) and Matika *et al.* (1992).

The animals were managed semi-intensively. In the night, they were kept in a cross ventilated pen of $2x5m^2$ within the animal house made up of concrete blocks, cemented floor and wall, and zinc roofing. Mineral licks were provided periodically. Routine health care: vaccination, medication, deworming and regular acaricidal application were carried out. Clean fresh water was provided *ad- libitum*. The animals were acclimatized for two weeks before the commencement of the experiment.

Experimental rations were offered in the morning between 8 and10 am before the animals were release to graze natural pasture of different grasses and leguminous plants, under the supervision of an attendant until 5:00pm. The pen (housing) was cleaned on weekly basis, while feeding/ water troughs were usually cleaned before serving the day's provision on daily basis.

Experimental Diet and Procedure

Four experimental diets; T1 (Gmelina + Cassava peel meal [Gm+Cpm], T2 (Gmelina+ Cowpea husk [Gm+Cph], T3 (Ficus + cassava peels meal [Fs+Cpm] and T4 (Ficus+ cowpea husk [Fs+Cph] were constituted and fed to the

animals. The animals were randomly allotted to the four treatment in a factorial design of 2x4x4 according to breed, physiological status and treatments, such that there were three does and a buck per treatment i.e. ratio of 3:1 and replicated four times.

The leaves of browse were fed at 1.5 kg per animal/day by hanging, using a rope and allowed to the floor of the pen. Likewise, the supplements (cassava peel meal and cowpea) were fed (1.5 kg) per animal per day. This is for desired biochemical parameters at a specified quantity of feeds. Half of the quantities of browse and supplement were served in the morning (8-10 am and before release to graze natural pasture under the supervision of an attendant until on return in the evening at 5.00pm when the remaining was fed.

Blood Collection

Approximately 5 milliliters of blood were collected from each animal at the different physiological stages into sample bottles. The blood samples were allowed to clot. Serum was collected after two hours and transferred to 2 milliliter cryovials bottles. The samples were racked inside a cooler with ice and transported to Biochemical and Haematological Laboratory University of Maiduguri Teaching Hospital, Maiduguri for analysis using a commercially available kit.

Biochemical Analysis

It is a random access, high-speed fully automated clinical Chemistry analyzer, with intelligent multitasking software, automated calibration, bar coding and innovative cuvettes washing station. Its photometric trough output is 300 tests per hour. There was variation in name of procedure for each parameter based on the chemical used e.g. cresolpthalein for calcium Bromocresol green for albumin (Randox lab, 2009), Sodium hydroxide for protein (Weicselbaum, 1978; Tietz, 1995). Generally, however three test tubes containing sample, standard solution in each case and blank were assembled. Each of them was mixed thoroughly and three incubated in the analyzer for each parameter e.g.

(1) Calcium, incubation was for 5 minutes at 37^{o}c and absorbance of sample and standard read against the blank at 578nm.

(2) Protein incubation was for 30 minutes at 20-25^{o}c and absorbance of sample and standard read against blank also at 546nm.

(3) Albumin, incubation was for 10 minutes at 37^{0}c and absorbance of sample and standard read against blank at 546nm.

Sample value in each was calculated as: Absorbance of test sample/absorbance of standard concentration.

RESULTS AND DISCUSSION

The plasma/serum biochemical parameters of all does; pregnant, lactating, dry ones and their progeny at puberty and the overall means of biochemical parameters by breed, physiological status and diet are as shown in Table 1.

The values of 2.044, 103.88, 5.498, 139.84mmol/l, 3.415, 33.053mg/dl, 31.327mmol/l, 45.654g/dl, 8.500, 25.0iu/l and, 51.010g/dl, were the overall means of Ca, Cl, K, Na, Urea, CRT, P04, ALB, ALT, AST, and TP respectively. Breed significantly affected Ca, Na ($P<0.001$) and Cl ($P<0.05$). The remaining variables did not vary significantly with breed. For the three significantly different variables, Sahel had higher values than WAD.

All the variables varied significantly with physiological status, but without showing any particular trend. Low Ca (1.817 and 1.863 mono l/l) were observed in pregnant and lactating does respectively, while higher values were recorded in dry does (2.308mmol/l) and those at pubertal state (2.188mmol/l).

On the other hand, lactating does had the highest Cl (114.00mmol/l), while the other statuses; pregnant, dry does and pubertal progenies had similar values; 99.00, 100.62 and 108.88mmol/l respectively.

The highest K (6.642mmol/l) was recorded in pregnant does while, lactating, dry does and pubertal goats recorded lower values of 5.300, 4.842 and 5.208mmol/l) respectively.

The highest values of Na and Urea (146.04mmol/l and 5.942ng/dl respectively were observed for lactating does followed by the corresponding values of 141.20mmol/l and 5.108mg/dl for the pregnant category. The dry and pubertal goats however had lowest Na and Urea values of 135.92 and 136.50mmol/dl and, 1.242 and 1.367mg/dl respectively. Highest (75.208mg/dl) CRT values was recorded in lactating does, followed by 49.125mg/dl for the pregnant and lowest (3.959 and 3.950mg/dl) for dry goats and pubertal progenies.

Similarly, highest PO4 was recorded highest (62.792 and 59.417mmol/l) among the dry and pubertal goats, while the lowest (1.471 and 1.629mmol/l) was observed among the pregnant and lactating does. The ALB was highest (62.542 and 61.958g/dl) among the dry doe and progenies at pubertal stage and lowest (25.333mmol/l) for pregnant goats.

The ALT values 10.125, 8.833 and 8.563 iu/l were highest in lactating, pregnant and progenies respectively but low (6.458 iu/l) in dry does TP was lower (31.917 and 29.833g/dl) in dry does and progenies at puberty, than lactating (73.583g/dl) and pregnant does (68.708g/dl). The AST was highest (30.083 iu/l) in lactating does, and lowest to medium (21.958, 22.500 and 25.750 iu/l) was in dry, pregnant does and progenies at pubertal stage respectively.

Diet significantly affected almost all the parameters except Cl and TP which did not significantly vary. Again, there was no particular trend in variation by diet. Diet was significantly affected AST ($P<0.01$), Ca, CRT, PO4, ALB ($P<0.01$) K, Na, Urea, and ALT ($P < 0.05$) respectively.

Chlorine and TP however did not statistically vary with diet. The value of AST was highest (30.917 iu/l) in Fs + Cph diets, with lowest (19.250 iu/l) in Gm + Cpm and (23.500, 26.625/U/l) in Gm + Cph and Fs + Cpm respectively. Lowest Ca, (1.950mmol/l), values was recorded in Gm + Cph diet, while similar values (2.146, 2.050 and 2.029mmol/l) were observed in Fs + Cpm, Gm + Cpm and Fs + Cph respectively. Diet Fs + Cpm recorded highest values for CRT, PO4, and ALB (38.254g/dl, 35.342mmol/l, and 49.788g/dl) while the other had similar values in each case. Potassium value was highest (5.992mmol/l) in Fs + Cph, lower to medium (5.046, 5.325 and 5.629mmol/l) in Gm+ Cpm, Gm + Cph and Fs + Cpm respectively, Ficus based diet recorded highest (141.96 and 142.54mmol/l) value than the Gmelina counterparts (137.50 and 137.75mmol/l).

Similarly urea, was higher in the other three diets (3.704, 3.63 and 3.308mg/dl) than in Gm +Cph (2.283mg/dl). The Gm+Cpm recorded lowest (7.208/U/l), medium (8.417/U/l) and the Ficus diets, highest (9.167 and 9.208/U/L) for ALT.

Biochemical parameter like haematology and hormones are functions of the physiological condition of an animal. They have also /therefore been used to assess the physiological status of an animal including disease situations (Tambuwal *et al*., 2002; Gupta *et al*., 2007). They may however be affected by several other factors. Therefore, since the goats were of different breeds, physiological statuses and exposed to differing feeding regime some variations were expected but modified to some extents in different directions.

As already stated, variables for all physiological statuses by breed, the few significantly different biochemical parameters namely, Ca, Cl and Na could also be due to genetic effect. However, that most of the parameters did not vary significantly and the few that did favoured Sahel appeared to mean that this breed was adjusting (adapting) to the new environment and but surpass at WAD in the values of these

parameters. Njidda *et al*. (2013) however, had shown that Sahel and WAD have similar biochemical parameters.

The observation in this study that biochemical parameters varied with status but haphazardly and not showing any trend according to physiological status might be due to different demand /secretion into blood of these parameters with status. It is logically expected that the secretion or utilization of the biochemical parameters should vary with physiological status. For example, it is expected that Ca, K, Na, in the blood should be utilized during lactation for milk synthesis and depending on feeds and other conditions their values (in the blood) may be higher or low at this stage.

The value of Ca (2.308 and 2.188mmol/l) were found to be higher for dry does and pubertal progeny than pregnant and lactating does with the values of (1.817 and 1.863mmol/l) respectively. Cl, on the other hand was higher (114.00mmol/l) in lactating does than the remaining group of group of goat (110mmol/l). They also found higher values of K in pregnant does. Sodium values of (129.3 to 131.0mmol/l) for adults and 138.0 to 138.1mmol/l for kids reported by Bhat *et al.,* (2011).

Generally, the values of urea in this study tends to be lower (7.1 ± 0.09 – 8.5 ± 0.01g/dl) for adults does and kids of Kano brown, white Borno and red Sokoto (Njidda *et al.,* 2013).

Serum creatinine levels were among the normal range for pregnant and lactating but appear to be low in dry does and pubertal kids of Kano brown, white Borno and red Sokoto as reported by Njidda *et al.,* (2013). They are found that serum creatinine levels were of normal range for pregnant and lactating animals, but appeared to be low in dry and pubertal kids. Other variation in biochemical parameters with status have been reported in literature.

Phosphorus and albumin level were observed to be higher in dry does and pubertal kids than in pregnant and lactating does (Bhat *et al.,* 2011). Low albumin may be caused by, malnutrition, and mal-absorption late pregnancy and genetic factors. High albumin has been reported to be caused by dehydration (Njidda *et al.,* 2013)

The serum transaminases (ALT and AST) which are responsible for normal functioning of the liver, varied among the physiological groups of animals studied. This result is in consonance with Ogunbosoye *et al.* (2018).

Total proteins (TP) were found to be highest also in lactating does but lowest in pubertal kids as has also been reported by Ogunbosoye *et al.,* (2018).

Again, the variations in biochemical parameters by diet did not generally favour any particular one (diet) but haphazard without any trend. This indicates that the suitability of diets for the secretion/production of biochemical parameters varied among.

As already stated serum biochemical parameter levels are essential for the proper functioning of the body and should not be altered out of range by the diet. For example, proteins are necessary for maintenance of the right osmotic pressure between circulating and tissue space fluids (Isidahomen *et al*., 2012)

Serum proteins are essential for body, immunity and transport of several substances (Ibhaze, *et al*., 2021). Harper *et al.,* (1971) reported that some serum biochemical is used to evaluate the level of heart attack, liver damage and to estimate protein quality and amino acid requirement of animals. Most of the biochemical parameters examined were not out of the normal ranges (Akinrinmade and Akinrinde, 2012).

The cholesterol level in West African dwarf goats fed various levels of Shea nut cake (SNC) diets was reported to be normal. This indicates that meat of from the animals was safe and would not lead to cholesterol elevation in consumers (Ogunbosoye *et al.,* 2018). They further stated that, the protein provided from the meat was of good quality.

Table 1: Means of serum biochemistry parameters of goats fed different diets

Factors/Variables	N	Ca (mmol/l)	Cl (mmol/l),	K (mmol/l),	Na (mmol/l),	Urea (mg/dl)	CRT (mg/dl),	PO4 (mmol/l),	Alb (g/dl)	Alt (IU/l)	Ast (IU/l),	TP (g/dl)
	96	2.044	103.88	5.498	139.84	3.415	33.053	31.327	45.854	8.500	25.073	51.010
Overall Means												
Breeds		**	*	ns	**	ns	ns	ns	ns	ns	ns	ns
WAD	48	1.954^{b}	100.34^{b}	5.440	137.65^{b}	3.490	34.515	32.056	46.125	8.646	25.646	50.771
Sahel	48	2.133^{a}	107.42^{a}	5.556	142.23^{a}	3.340	31.572	30.598	45.583	8.524	24.500	51.250
Physiological Status		***	**	***	***	***	**	***	***	***	*	***
Pregnant	24	1.817^{b}	99.00^{b}	6.642^{a}	141.29^{b}	5.108^{b}	49.125^{b}	1.471^{b}	25.333^{c}	8.833^{a}	22.500^{b}	68.708^{b}
Lactating	24	1.863^{b}	114.00^{a}	5.300^{b}	146.04^{a}	5.942^{a}	75.208^{a}	1.629^{b}	33.583^{b}	10.125^{a}	30.083^{a}	73.583^{a}
Dry Goats (Doe)	24	2.308^{a}	100.62^{b}	4.842^{b}	135.92^{c}	1.242^{c}	83.929^{c}	62.792^{a}	62.542^{a}	6.458^{b}	21.958^{b}	31.917^{c}
Pubertal state	24	2.188^{a}	101.88^{b}	5.208^{b}	136.50^{c}	1.367^{c}	3.950^{c}	59.417^{a}	61.958^{a}	8.583^{a}	25.750^{ab}	29.833^{c}
Treatments		**	ns	*	*	*	**	**	**	*	***	ns
Gm + Cpm	24	2.050^{a}	100.00	5.046^{b}	137.50^{b}	3.308^{ab}	29.171^{b}	31.543^{a}	46.583^{ab}	7.208^{b}	19.250^{c}	51.125
Gm + Cph	24	1.950^{b}	105.54	5.325^{ab}	137.75^{b}	2.283^{b}	32.479^{b}	33.579^{ab}	44.208^{b}	8.417^{ab}	23.500^{bc}	52.375
Fs + Cpm	24	2.146^{a}	108.54	5.629^{ab}	142.54^{a}	3.363^{ab}	38.254^{a}	35.342^{a}	49.788^{a}	9.167^{a}	26.625^{ab}	52.000
Fs + Cph	24	2.029^{a}	101.42	5.992^{a}	141.96^{a}	3.704^{a}	32.308^{b}	28.833^{b}	42.917^{b}	9.208^{a}	30.917^{a}	48.542

Means within a column with different superscript are significantly different. Ns=not significant. *=Significant at P<0.05; **=Significant at P<0.01 ***=Significant at P<0.001. Gm=*Gmelina arborea;* Fs=*Ficus sycamores*; Cpm= Cassava peel meal; Cph=Cowpea husk; n=sample size; Na=Sodium; K=Potassium; Cl=Chloride; Ca= Calcium P04=Phosphorus; CRT=Creatinine; TP= Total protein; ALB=Albumin; ALT =Alanine Aminotransferase and AST= aspartate aminotransferase

Table 2: Biochemical analysis of blood plasma and serum of pregnant does

		Parameters										
Variables	N	**Ca (mmol/l)**	**Cl (mmol/l),**	**K (mmol/l)**	**Na (mmol/l),**	**Urea (mg/dl)**	**CRT (mg/dl),**	**PO4 (mmol/l)**	**ALB (g/dl),**	**ALT (IU/l)**	**AST (IU/l)**	**TP (g/dl),**
Overall	24	1.8167	99.000	6.6375	141.29	5.1083	49.125	1.4708	25.333	8.8333	22.500	68.708
Breeds		**	ns	ns	**	ns	ns	**	ns	**	ns	ns
WAD	12	1.6167^{b}	87.83	6.2750	132.25^{b}	5.0917	47.250	1.3250^{b}	21.750	8.6667^{a}	21.250	65.667
Sahel	12	2.0167^{a}	110.17	7.0000	150.33^{a}	5.1250	51.000	1.6167^{a}	28.917	9.0000^{a}	23.750	71.750
Treatments		ns	ns	**	**	ns	**	**	ns	ns	**	ns
Gm+cpm	6	1.8667	87.83	5.0000^{b}	136.00^{b}	4.8167	39.000^{b}	1.2500^{b}	26.833	9.333	18.833^{ab}	69.000
Gm+cph	6	1.6833	97.83	6.3333^{b}	133.17^{b}	4.8000	45.000^{ab}	1.2333^{b}	25.167	8.333	15.333^{b}	73.000
Fs+cpm	6	1.9000	112.33	6.6000^{ab}	147.33^{a}	5.0667	60.333^{a}	1.7333^{a}	26.333	7.500	22.167^{ab}	63.833
Fs+cph	6	1.8167	98.00	6.6167^{a}	148.67^{a}	5.7500	52.167^{ab}	1.6667^{a}	23.000	10.167	33.667^{a}	69.000

**=P<0.05 abc=means a the column with the same superscript are statistically similar, ns=not significant, Gm=Gmelina *arborea,* Fs=*Ficus sycamores*, Cpm= Cassava peel meal, Cph= Cowpea husk, N=sample size. Na=Sodium K-Potassium, =Chloride Ca=Calcium, Po4=Phosphorus, Urea, CRT=Creatinine TP= Total protein ALB=Albumin ALT=Alanine Aminotransferase and AST aspartate aminotransferase

Table 3: Biochemical analysis of blood plasma and serum for lactating does

		Parameters										
Variables	**N**	**Ca (mmol/l)**	**Cl (mmol/l)**	**Na (mmol/l),**	**Urea (mg/dl),**	**CRT (mg/dl)**	**PO4 (mmol/l) ,**	**K (mmol/l) ,**	**ALB (g/dl),**	**ALT (IU/l)**	**AST (IU/l)**	**TP (g/dl),**
Overall	24	1.8625	110.21	146.04	5.9417	75.208	1.6292	5.2917	33.583	10.125	30.083	73.583
Breeds		ns	ns	ns	ns	**	ns	ns	ns	ns	ns	ns
WAD	12	1.8167	103.42	144.58	6.2250	82.500^{a}	1.6500	5.0500	32.917^{a}	10.000	29.083	74.250
Sahel	12	1.9083	117.00	147.50	5.6583	67.917^{b}	1.6083	5.5333	34.250^{a}	10.250	31.083	72.917
Treatments		ns	ns	**	ns	**	ns	ns	ns	ns	ns	ns
Gm+cpm	6	1.9500	95.00	142.00^{b}	6.0333	69.333^{b}	1.6333	5.1000	32.167	8.833	29.167^{a}	71.000
Gm+cph	6	1.8167	114.33	143.67^{b}	5.9167	75.500^{b}	1.5833	5.1167	31.833	9.833^{ab}	29.000	73.667
Fs+cpm	6	1.9500	116.50	148.33^{a}	5.9333	85.333^{a}	1.6333	5.4833	35.000	11.333^{a}	31.667	78.167
Fstcph	6	1.7333	115.00	150.17^{a}	5.8833	70.667^{b}	1.6667	5.4667	35.333	10.500^{ab}	30.500	71.500

**=P<0.01 abc = means in the column bearing the same superscript are statistically similar, ns=Not Significant, Gm=*Gmelina arborea*, Fs=*Ficus sycamores*, Cpm= Cassava peel meal, Cph= Cowpea husk, N=sample size. Na=Sodium K-Potassium Cl=Chloride, Ca= Calcium, P04= Phosphorus, Urea, CRT=Creatinine, TP= Total protein AKB=Albumin ALT =Alanine Aminotransferase and AST =aspartate aminotransferase;

Table 4: Biochemical analysis of blood plasma and serum for dry doe goats

		Parameters										
Variables	**N**	**Ca (mmol/l)**	**Cl (mmol/l)**	**Na (mmol/l)**	**Urea (mg/dl),**	**CRT (mg/dl),**	**PO4 (mmol/l),**	**K (mmol/l)**	**ALB (g/dl),**	**ALT (IU/l)**	**AST (IU/l)**	**TP (g/dl),**
Overall	24	2.3083	96.833	135.92	1.2417	3.9292	62.792	4.8167	62.542	6.4583	21.958	31.917
Breeds		ns	ns	ns	ns	**	ns	ns	ns	ns	ns	ns
WAD	12	2.3000^{a}	92.42^{a}	135.75^{a}	1.2333^{a}	3.6333^{b}	62.083^{a}	4.7167^{a}	62.667^{a}	6.3333^{a}	25.917^{a}	31.750
Sahel	12	2.3167^{a}	101.25^{a}	136.08^{a}	1.2500^{a}	4.2250^{a}	63.500^{a}	4.9167^{a}	62.417^{a}	6.5833^{a}	18.000^{b}	32.083
Treatments		**	**	**	ns	**	**	**	**	**	**	**
Gm+cpm	6	2.1333^{b}	84.00^{b}	135.00^{b}	1.2833	4.8500^{a}	55.333^{bc}	5.0667^{a}	67.833^{a}	5.6667^{b}	13.167^{b}	35.167^{a}
Gm+cph	6	2.0833^{b}	106.83^{a}	138.17^{a}	1.2833	4.5500^{a}	67.167^{ab}	5.0000^{a}	55.667^{b}	6.8333^{ab}	21.000^{a}	32.000^{b}
Fs+cpm	6	2.5333^{a}	103.33^{ab}	137.17^{a}	1.2167	2.9833^{b}	80.833^{a}	5.1000^{a}	67.000^{a}	8.0000^{a}	26.167^{a}	33.000^{ab}
Fs+cph	6	2.4833^{a}	93.17^{ab}	133.33^{c}	1.1833	3.3333^{b}	47.833^{c}	4.1000^{b}	59.667^{b}	5.3333^{b}	27.500^{a}	27.500^{c}

**=P<0.05 abc = means in a column with the same superscript are statistically similar, ns=Not Significant, Gm=*Gmelina arborea*, Fs=*Ficus sycamores*, Cpm= Cassava peel meal, Cph= Cowpea husk, N=sample size. Na=Sodium, K-Potassium Cl=Chloride, Ca= Calcium P04=Phosphorus Urea CRT=Creatinine TP= Total protein Alb=Albumin ALT Alanine Aminotransferase and AST aspartate aminotransferase.

Table 5: Biochemical analysis of blood plasma and serum for goat progeny

		Parameters										
Variables	**N**	**Ca (mmol/l)**	**Cl (mmol/l)**	**Na (mmol/l)**	**Urea (mg/dl),**	**CRT (mg/dl),**	**PO4 (mmol/l),**	**K (mmol/l)**	**ALB (g/dl),**	**ALT (IU/l)**	**AST (IU/l)**	**TP (g/dl),**
Overall	24	2.1875	96.833	136.50	1.3667	3.9500	59.417	5.1750	61.958	8.5833	25.750	29.833
Breeds		ns	ns	ns	ns	**	ns	**	ns	ns	ns	ns
WAD	12	2.0833	92.42	138.00	1.4083	4.6750^{a}	63.167	5.5750^{a}	67.167	9.5833	26.333	31.417
Sahel	12	2.2917	101.25	135.00	1.3250	3.2250^{b}	55.667	4.7750^{b}	56.750	7.5833	25.167	28.250
Treatments		ns	**	ns	ns	ns	ns	**	**	**	**	**
Gm+cpm	6	2.2500	82.67^{b}	137.00	1.1000	3.5000^{ab}	52.000	4.7333^{b}	59.500^{ab}	5.000^{b}	15.833^{b}	29.333^{ab}
Gm+cph	6	2.2167	103.17^{a}	136.00	1.1333	4.8667^{a}	64.333	4.8500^{ab}	64.167^{ab}	8.667^{ab}	28.667^{a}	30.833^{ab}
Fs+cpm	6	2.2000	102.00^{a}	137.33	1.2333	4.3667^{ab}	57.167	5.3333^{ab}	70.500^{a}	9.833^{a}	26.500^{ab}	33.000^{a}
Fs=cph	6	2.0833	99.50^{a}	135.67	2.0000	3.0667^{b}	64.167	5.7833^{a}	53.667^{b}	10.833^{a}	32.000^{a}	26.167^{b}

**=P<0.01 abc = means in a column with the same superscript are statistically similar, ns=Not Significant, Gm=Gmelina arborea, Fs=Ficus sycamores, Cpm= Cassava peel meal, Cph= Cowpea husk, n=sample size, Na=Sodium (mmol/l), K-Potassium(mmol/l), Cl=Chloride (mmol/l), Ca= Calcium (mmol/l), P04=Phosphorus (mmol/l), Urea (mg/dl), CRT=Creatinine (mg/dl), TP= Total protein (g/dl), Alb=Albumin ,(g/dl), ALT Alanine Aminotransferase (IU/l) and AST aspartate aminotransferase; (IU/l)

Table 6: Correlation Between Serum Biochemistry of Goats fed different Diets

	Na	K	Cl	Ca	UREA	CRT	PO4	TP	ALB	AST
K	0.473**									
Cl	0.593***	0.298**								
Ca	0.073ns	-0.188*	0.128*							
UREA	0.445***	0.342***	0.192*	0.602***						
CRT	0.527***	0.277**	0.265**	0.491***	0.883***					
PO4	0.389***	0.249**	0.106ns	0.511***	0.867***	0.853***				
TP	0.497***	0.296**	0.226**	-0.472***	0.845***	0.874***	0.857***			
Alb	-0.252*	0.307**	0.029ns	0.546***	-.851***	0.724***	0.846***	-.678***		
Ast	0.267**	0.292**	0.196*	0.113*	0.155*	0.242**	-0.106*	0.096ns	-0.102ns	
Alt	0.286**	0.431***	0.260*	0.075*	0.317**	0.323***	-0.167*	0.285***	-0.216*	0.499***

*=P<0.05 **=P<0.01 ***=P<0.001 Na=Sodium (mmol/l), K-Potassium(mmol/l), Cl=Chloride (mmol/l), Ca= Calcium (mmol/l), P04=Phosphorus (mmol/l), Urea (mg/dl), CRT=Creatinine (mg/dl), TP= Total protein (g/dl), Alb=Albumin ,(g/dl), ALT Alanine Aminotransferase (IU/l) and AST aspartate aminotransferase; (IU/l)

CONCLUSION AND RECOMMENDATION

Biochemical parameters are variable indices and are affected by diet and especially goat physiological status. Further, Cpm containing diet increases WBC in goat blood while the Ficus counterpart heightens Na and PO_4 contents in pregnant does.

The study has provided useful body of information/knowledge on the reproductive biology of the two goat breeds of the study area, which hitherto was not available.

Biochemical parameters, though useful measures of physiological statuses are quite variable. These indices should therefore be used with caution for any rigorous interpretation. Furthermore, the diet of goats should be properly monitored to reduce fluctuations in biochemical parameters. The Cpm could be used to boast WBC in goat blood while Ficus is useful for increasing Na and PO_4 content especially in pregnant animals.

The reproductive information provided by this study could be used as baseline data and guide to surrounding farmers for fertility improvement in their herds.

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