

AMM -04

Blood Profiles and its Relationship with Milk Production Traits in Agro-pastoral Goats

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Abstract

This study was conducted to evaluate blood profiles and its relationship with milk production traits in agro-pastoral goats. A total of 250 does whose parity were between 1-6 and average weight of 28.84kg were used for this study, the animals were milked twice a week, and milk production traits investigated were average daily yield (ADY), total yield (TY), peak day (PD), peak yield (PY), lactation length (LL), and last day yield (LDY). 5 ml of blood was collected from each of the sampled animals by jugular venipuncture, using needle and syringe. 2mls of each blood sample were poured into a bijou bottle containing ethylene diaminetetraacetic acid (EDTA) for hematological evaluation which were Pack Cell volume (PCV) and haemoglobin concentration (Hb). The remaining samples were allowed to coagulate to produce sera for blood chemistry analysis. The separated serum samples were properly labeled and stored at -20°C till further analysis. Serum samples were analyzed for different biochemical profile namely sodium (Na), total protein (TP) albumin, globulin and glucose. Correlations between blood profiles and milk production traits were obtained using Statistical Analysis system. The results indicated that the agro-pastoral goats were within the range of normal reference values for goats (28.47% PCV, 9.49g/dl Hb, 136.40 mmol/L Na, 64.44g/l Total protein, 31.12 g/l Albumin, 33.12 g/l globulin and 4.44 g/l glucose). The correlation between blood constituents and milk production traits revealed that PCV, Hb and glucose were positively correlated with milk yield traits. Thus suggesting that increase or improvement in these blood parameters may increase milk production in goats.

Key words: Biochemical profile, milk yield, relationship and agro-pastoral goats

Introduction

Goats form the most important group of milk producing animals after dairy cattle in both temperate and tropical agriculture. The dairy goat industry is rapidly gaining importance throughout the world. Blood parameters have been widely used to determine genetic diversity in animal population. The concentration of metabolites in animal blood is an important indicator associated with health and production (Casasus *et al.*, 2002). The development of different traits in animals depends on the good order of complex biochemical processes each of them functioning under a rigorous genetic control (Mariana *et al.*, 2006). In lactating animals blood biochemical variables including total protein are important indicator of metabolic activity (Karapehivan *et al.*, 2007). In addition some blood metabolites including total protein and glucose are significantly correlated with milk yield in goats (Anwar *et al.*, 2015).

Milk production depends on mammary development and the availability of nutrients especially glucose. Increasing glucose availability could promote milk production by enhancing lactose synthesis. There is paucity of information in Nigeria on the relationship that exists between blood profiles and milk production traits in goats.

Therefore, the objective of this study was to evaluate blood profiles in agro-pastoral goats and its relationship with milk production traits.

Materials and Methods

The Study was carried out in Jigawa State which is within the Sudan savannah zone of North-West Nigeria. Jigawa State falls within latitude 11°-13°N and Longitude 8°-10°E; the State has an altitude of between 400 – 600m above sea level. The mean annual rainfall varies from 500 mm to 1000 mm. The mean daily maximum and minimum temperatures are 35°C and 19°C respectively (Magashi, 2011).

The goats used for this study were under semi intensive system of management. The animals were taken out to graze every morning from 8.00am to 5.00pm by children and were penned at night. The goats were given water and supplement which included groundnut haulms, cowpea haulms and dry grasses, before setting out for grazing every morning. Each animal was tagged with a number for individual identification.

A total of 250 agropastoral goats that comprised of Red Sokoto goats, Sahel goats, Kano Brown and their Crosses (whose parities were between 1-6 and average body weight of 28.84 kg) were hand milked twice a week and the milk obtained per each milking per doe was measured using graduated plastic beakers. Milking of does commenced from day 7 postpartum and lasted till the milk yield was less than 100ml. Kids were separated from their dams at 6.00 pm on the evening preceding the day of milking. On the test day, the two halves of the udder of each lactating doe were hand-milked for all herds from 06.00 to 08.00 am and the milk yield was recorded to the nearest gram. The average of the total volume of milk collected for the two test days was taken as the average daily yield of the doe for that week.

Milk yield characteristics were measured as follows: *Average Daily Yield (ADY)*: - As average of all test day yields within the milking period; *Initial Yield (IY)*: - As milk yield at day 7 postpartum; *Total Yield (TY)*: - As milk production during the lactation period up to the point where the production of the doe dropped below 100ml.; *Peak Yield (PY)*: - As the highest test day yield during the lactation period; *Peak day (PD)*: - As the day corresponding to the highest yield within the lactation period; *Lactation Length (LL)*: - As the period from kidding to the point when the milk yield of the doe falls below 100ml.

Five milliliter (5ml) of blood was collected from each of the sampled animals by jugular venipuncture, using needle and syringe. 2mls of each blood sample were poured into a bijou bottle containing ethylene diamine tetra-acetic acid (EDTA) for hematological evaluation which were Pack Cell volume (PCV) and haemoglobin concentration (Hb). The remaining samples were allowed to coagulate to produce sera for blood chemistry analysis. The separated serum samples were properly labeled and stored at -20°C till further analysis. Serum samples were analyzed for different biochemical profile which included. Sodium (Na), total protein (TP), albumin, globulin and glucose. The potassium and sodium concentrations in the blood were determined by colorimetric method using spectrophotometer. Glucose level was determined after enzymatic oxidation in the presence of glucose oxidase. Measurement of albumin was based on its quantitative binding to the indicator 3, 3', 5, 5' - tetrabromo- m cresol sulphonaphthalein (bromocresol green, BCG). Globulin concentration was calculated from total protein and albumin, by subtracting albumin from total protein.

The data collected from this study were analyzed using General Linear Model (GLM) procedure of SAS (SAS, 2000). Correlation coefficients and test of significance were done.

Results and Discussion

The means and coefficient of variation (CV) for concentration of blood biochemical profiles are presented in Table 1. Average PCV, Hb, Na, total protein, albumin, globulin and glucose were 28.48%, 9.49g/dl, 136.40mmol/l, 64.44g/L, 31.12g/L, 33.12g/L and 4.44g/L, respectively. All the blood biochemical constituents measured were within the range of normal values of serum electrolytes of goats as reported by (Rodostis *et al.*, 2000). The percentage of PCV (28.47%) in this study was very close to the 29.4% obtained by Daramola *et al.* (2005) in WAD goats. However, this is higher than 25.7% obtained in Red Sokoto goats (Tambuwal *et al.*, 2002). Earlier reports in Baladi goats (Azab and Abdel – Maksoud 1999) showed PCV values of 27.25%. The Hb concentration in this study (9.49g/dl) was within the range of normal values obtained in Red Sokoto goats (7-15g/dl) (Daramola *et al.*, 2005). This is an advantage in terms of oxygen carrying capacity of the blood, which may lead to better functioning and performance of these animals.

Table 1: Blood profiles of goats (Mean±se)

Characteristic	No	Mean±se	CV	Min	Max
PCV (%)	250	28.48±0.28	15.03	4.00	42.00
Hb (g/dl)	250	9.49±0.09	15.58	4.66	14.00
Na (Mmol/L)	250	136.40±0.42	6.02	125.00	141.00
TP (g/L)	250	64.44±0.49	12.21	46.00	94.00
Albumin (g/L)	250	31.12±0.37	18.32	20.00	51.00
Globulin (g/L)	250	33.12±0.60	28.72	13.00	65.00
Glucose (g/l)	250	4.45±0.04	14.92	2.80	6.60

PCV = pack cell volume, HB =hemoglobin concentration, Na = sodium, TP = Total protein

The Na concentration obtained in this study (136.40 mmol/L) was within the range reported by Daramola *et al.* (2005) as 135.1 mmol/l of Na in West African dwarf goats. Tambuwal *et al.* (2002) reported 138.0 mmol/l in Red Sokoto goats. Sodium makes up about 93% of the basic mineral elements in the blood serum and is chief cation regulating blood pH (Swartz, 2010). The ability of muscles to contract is dependent on proper sodium concentration. Therefore, these indigenous goats could be said to have normal sodium concentration in the blood. Total protein in this study (64.44g/l) was within the range reported by Tambuwal *et al.* (2002), in Red Sokoto goats. Proteins are the basic components of enzymes, many hormones, antibodies and clotting agents. They act as transport substances for hormones, vitamins, minerals, lipids and other materials. In addition, proteins help balance the osmotic pressure of the blood and tissue (Kaslow, 2011). Total protein in the blood which represents the sum of albumin and globulin is a very strong indicator of the health status of the animals; low albumin is a sign of poor health.

The glucose concentration of 4.44 g/l determined in this study was within the normal reference values, although a little higher than reports of Zubcic (2001). He established that glucose level decreases with age of goats, and most of the animals in this study were between ages 2 – 6 years which probably explains the high concentration of glucose. Glucose is the major precursor of lactose synthesis in the mammary gland, and lactose is the major carbohydrate and osmolyte of milk which controls milk volume and its concentration (Shahbazkial *et al.*, 2010).

Phenotypic correlation between blood biochemical profiles and milk yield characteristics in goats are presented in Table 2. PCV had significantly ($p<0.05$) low, but positive correlation with ADY, TY and IY. It also had positive though not significant relationship with PD and PY, but a negative correlation with LL and LDY. Hb had a positive and significant ($p<0.05$) relationship with TY, non-significant, though positive relationship with PD and PY but negative correlation with IY, LL and LDY. Na concentration had negative correlation with all the milk yield characteristics measured. Total protein had positive and significant ($p<0.05$) relationship with IY and LL, positive though not significant correlation with ADY and TY, but negative correlation with PD, PY and LDY. Albumin had negative correlations with all the milk yield characteristics measured. Globulin had negative correlations with ADY ($r = -0.101$) and PY ($r = -0.066$), but had very low and positive correlation with every other trait measured. Glucose had a positive and significant ($p<0.05$) correlation with LL, positive though not significant relationship with ADY, TY, IY and LDY, but was negatively correlated with PD and PY. The correlation between glucose and LL could be attributed to the fact that lactose which is the major precursor of glucose controls milk volume (Shahbazkial *et al.*, 2009). The negative and very low correlation between milk yield characteristics and albumin had earlier been observed by Hassan *et al.*, (1986) in Egyptian Baladi goats. There were weak correlations among the blood constituents, however, PCV showed a positive and significant correlation with Hb. This explains that increase in PCV led to increase in Hb concentration.

Table 2: Coefficients of phenotypic correlation between blood biochemical profiles and lactation characteristics in goats

Characteristics	PCV	Hb	Na	TP	Albumin	Globulin	Glucose
ADY	0.284*	0.289*	-0.024	0.166	-0.051	-0.101	0.122
TY	0.247*	0.291*	-0.218	0.006	-0.028	0.019	0.194
IY	0.291*	-0.251	-0.176	0.401*	-0.034	0.049	0.218
PD	0.176	0.149	-0.099	-0.038	-0.038	0.018	-0.151
PY	0.092	0.096	-0.036	-0.112	-0.055	-0.066	-0.194
LL	-0.381	-0.360	-0.193	0.720**	-0.023	0.076	0.346*
LDY	-0.075	-0.075	-0.177	-0.002	-0.012	0.005	0.059

* $p<0.05$, ADY = Average Daily Yield, TY = Total Yield, IY = Initial Yield, PD = Peak Day, PY = Peak Yield, LL = Lactation Length, LDY = Last Day Yield, PCV = pack cell volume, HB = haemoglobin concentration, Na = sodium, TP = total protein

Conclusion

It was concluded that blood profiles of the agropastoral goats were within the range of normal reference values for goats. The positive correlation between glucose and ADY, TY, and IY indicate that if glucose level is increased, it will influenced milk production positively.

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