Nigerian J. Anim. Sci. 2020 Vol 22 (3): 331-337 (ISSN:1119-4308)

Blood profile of Red Sokoto goats fed baobab seed meal fermented at different durations

***Ikyume T.T., Afele T., Kwakwah P.P., Ikyon J. T. and Shagari Z.**

Department of Animal Production, College of Animal Science, Federal University of Agriculture, Makurdi, Nigeria

**Corresponding Author: ikyumett@uam.edu.ng; Telephone Number: +2348135149131*

***Target audience**: Ruminant nutritionists, livestock farmers, feed processors, and researchers*

Abstract

The utilization of baobab seed meals in the diet of ruminants has continued to address the problem of search for non-conventional feed resources which may be available even in the dry season. The study was designed to assess the blood profile of Red Sokoto goats fed a 20 % level of inclusion of baobab seed meal fermented at different duration (24, 48, and 72 hours). Sixteen (16) Red Sokoto bucks with an average weight of 6.96±1.44 kg were used for the study. Four experimental diets were formulated ($T_1 – T_4$). T_1 was the control diet, while T2, T3, and T4 were 24WFBSM (24 hours water fermented baobab seed meal), 48WFBSM (48 hours water fermented baobab seed meal), and 72WFBSM (72 hours water fermented baobab seed meal), respectively. The experiment lasted for 84 days and was laid in a completely randomized design with four replicates per treatment. The results obtained indicated that the duration of the fermenting period on baobab seed significantly ($p<0.05$) reduced serum total protein, globulin, zinc, and sodium. Other blood metabolites measured were however not influenced ($p>0.05$) by the duration period of fermentation. The findings of this study revealed that fermenting baobab seed meal beyond 24 hours is likely to impair some physiological activities of Red Sokoto goats.

***Keywords:** baobab seed, blood profile, fermentation, Red Sokoto goat*

Description of Problem

The continued search for unconventional feed resources in livestock production has identified the use of baobab seed meal for ruminant feeding. Baobab seed is a less popular feed with higher energy and protein values (1). It also has high concentrations of oxalates, phytates, saponins (2; 3), amylase and trypsin inhibitors, and tannins (4; 5). Therefore, its utilization could probably solve the problem of feed shortages especially in the critical period of the year (dry season).

Processing has been suggested to enhance their use as feed ingredient (6) and this is necessary to achieve optimum utilization. A 15 % inclusion of water fermented baobab seed meal in the diet of West African Dwarf goats gave optimum cost/kg body weight gain compared to raw and palm wine fermented type (7). In its raw form, baobab pulp and seed at 30% level of inclusion gave better milk mineral composition from Red Sokoto goats while only 20% inclusion in the diet of Red Sokoto goats was recommended for highest milk yield (8). Duration of fermentation of baobab seed meal (24, 48, and 72 hours) was reported to improve nutrient utilization in Red Sokoto goats (9). It is important to also note if such an effect can alter the physiological status of the animals.

Changes in blood composition are useful indices to predict potential resistance of livestock to environmental, nutritional, and pathological stresses. Previous research on the physiological responses of West African Dwarf goats indicates that 24-hour water fermented baobab seed meal increase packed cell volume with no changes in other blood parameters measured (7). There is, however, a paucity of information on the use of the

different duration of fermented baobab seed meal on the blood profile of Red Sokoto goats. Hence, the present experiment assessed the hematological, biochemical, and mineral profiles of Red Sokoto goats on diets containing baobab seed meal fermented at different duration.

Materials and methods

Experimental site

The study was carried out at the Teaching and Research Farm, University of Agriculture Makurdi, Nigeria. The site lies between latitude 7° 44' 1.50" N and longitude 8° 31' 17.00" E (10).

Procurement and processing of baobab seed

Baobab seeds were from rural communities in Taraba State, Nigeria between December and January 2017. They were sun-dried for a week and later split into three equal portions. The first portion was fermented in clean water for 24 hours, while the second and third portions were fermented for 48 and 72 hours, respectively. After the fermentation process, the seeds were sundried and milled to fermented baobab seed meal (24WFBSM, 48WFBSM, and 72WFBSM respectively).

Experimental animals, management, and treatment arrangement

Sixteen Red Sokoto (RS) bucks with an average live weight of 6.96±1.44 kg were used for this study. They were sourced from smallholder goat farmers around Nasarawa State, Nigeria, and were housed individually in an experimental pen. Before the onset of the experiment, the animals were allowed to acclimatize for three weeks. During which, Albendazole (dewormer), Ivomectin (against ectoparasite at 1 ml/50 kg of body weight), and broad-spectrum antibiotic were administered orally, subcutaneously, and intramuscularly, respectively. Four diets were formulated to contain 24, 48, and 72 hrs water fermented baobab seed meal (24WFBSM, 48WFBSM, 72WFBSM respectively) replacing Palm kernel meal (PKC) at 20 %. Feed was offered daily at 09 h and 14 h comprising 1000 g of *Panicum maximum* at 9.00 h and 300g concentrate diet at 14.00 h respectively. The RS bucks were randomly allotted to four (4) treatment diets in a completely randomized design. The diets were labeled Control (No baobab seed meal inclusion), 24WFBSM (24 hrs water fermented baobab seed meal), 48WFBSM (48 hrs water fermented baobab seed meal), and 72WFBSM (72 hrs water fermented baobab seed meal). The experiment lasted for 84 days after 7 days of acclimatization.

Data collection

At the end of the study, 5 ml of blood were collected via the jugular vein of each of the experimental animals for hematological and serum biochemical analyses. Blood samples collected from each animal were divided into two were emptied into sample bottles containing ethylene diamine tetraacetic acid (EDTA) to prevent blood clotting (coagulation), while those for mineral and serum biochemical parameters were collected without anticoagulant.

Haematological parameters

Red blood cells (RBC), white blood cells (WBC), and lymphocyte were determined using an automatic blood analyzer (ADVIA 120, Bayer, USA). The differential counts observed include; neutrophil, lymphocyte, monocyte, eosinophil, and basophil, while packed cell volume (PCV) and haemoglobin (Hb) were determined using the micro-haematocrit and cyan-methemoglobin methods, respectively.

Table 1: Gross composition of experimental diet

Parameter (%)	Control	24WFBSM	48WFBSM	72WFBSM
Maize offal	36	36	36	36
Palm kernel cake	30	10	10	10
Rice offal	10	10	10	10
Soybean meal	10	10	10	10
Cassava peel meal	12	12	12	12
***Baobab seed meal	-	20	20	20
Bone meal	3	3	3	3
Vitamin premix	0.5	0.5	0.5	0.5
Salt	0.5	0.5	0.5	0.5
Total	**100**	**100**	**100**	**100**
Determined Analysis				
Dry matter	86.53	87.49	87.45	87.61
Crude protein	14.32	14.13	14.10	13.90
Ether extract	16.59	17.54	17.32	17.55
Ash	8.11	8.32	8.21	8.33
NDF	42.34	42.29	41.78	41.35
ADF	41.52	41.73	41.12	41.15

***Baobab seed meal include at 20 % were fermented in water for 24 hrs, 48 hrs and 72 hrs for 24WFBSM, 48WFBSM and 72WFBSM respectively

Table 2: Duration of baobab seed fermentation on haematological parameters of Red Sokoto goats

Parameter	Control	24WFBSM	48WFBSM	72WFBSM	SEM
PCV (%)	26.67	35.00	28.67	30.33	1.88
HB (g/dl)	8.87	11.67	9.57	10.10	0.63
RBC ($\times 10^{12/L}$)	14.13	14.33	13.20	12.00	0.56
WBC ($\times 10^{9/L}$)	4.27	4.93	5.27	6.47	0.42
MCHC (g/l)	33.23	33.30	33.33	33.27	0.02
MCH (pg)	6.433	8.10	7.20	8.47	0.47
MCV (Fl)	19.37	24.33	21.90	25.43	1.41
Monocyte (%)	5.67	4.67	6.00	5.33	0.39
Basophil (%)	0.00	0.33	0.00	0.00	0.08
Eosinophil (%)	3.67	3.33	2.33	1.00	0.47
Neutrophil (%)	26.00	24.67	24.67	24.67	1.03
Lymphocyte (%)	64.67	67.33	67.00	70.33	1.46

PCV=packed cell volume, Hb=haemoglobin, RBC= red blood cell, WBC= white blood cell, MCHC= mean corpuscular haemoglobin concentration, MCH= mean corpuscular haemoglobin, MCV= mean corpuscular volume,SEM = Standard Error of Mean, 24WFBSM = 24 hours Water Fermented Baobab Seed Meal, 48WFBSM = 48 hours Water Fermented Baobab Seed Meal, 72WFBSM = 72 hours Water Fermented Baobab Seed Meal.

Serum indices

The serum protein concentrations were determined using Biuret reagent (11) and albumin concentration was determined using the spectrophotometric dye-binding method (Quantichrom BCP albumin Kit, Bioassay

Systems, Hayward CA) as described by (12). Plasma glucose concentration was determined by the enzymatic colorimetric method using the SP41011 kit (Spinreact, S.A., Spain), while amounts of total Cholesterol, AST, and ALT were estimated spectrophotometrically by the use of Olympus Au 400 system autoanalyzer.

Blood minerals profile

The blood samples for serum mineral analysis were centrifuged at 3000 rpm for 15 minutes (SPEC23) to obtain serum, which was thereafter mixed with 1 ml of concentrated HNO_3 and 0.5 ml of H_2O_2 in the propylene tubes. The mixture was maintained at 60^{o}C for 2 hours under a flame photometer (FP640) to allow the digestion of the serum samples. The digests obtained were diluted with 2.5 ml of distilled water and centrifuge at 200 rpm for 5 minutes and subsequently analyzed using AAS210 VGP to obtain concentrations of trace elements (Zn, Cu, Fe, Na, Ca, Al and Mn).

Statistical Analysis

Data generated on hematological parameters and serum indices (biochemical and mineral components) were subjected to one-way analysis of variance of SAS (2000) statistical software and differences between the means were compared using Duncan's Multiple Range Test (DMRT).

Result and Discussion

Haematological parameters

The result of haematological parameters of the Red Sokoto goats fed a diet containing baobab seed meal fermented at different duration is shown in Table 2. All parameters measured were not significantly ($p>0.05$) affected by the treatment groups. This is an indication that the duration of fermentation did not affect the haematological parameters of Red Sokoto goats. These findings are not consistent with increased PCV observed in WAD goats fed fermented baobab seed meal (7).

Serum parameters

The results of serum constituents of Red Sokoto goats fed baobab seed meal fermented at different duration are shown in Table 3. A significant effect ($P<0.05$) of dietary treatment was observed on total protein and globulin. The control diet (T_1) had the highest for both parameters, while the least values were recorded in T_4 (6.63 and 2.60 g/l vs 5.03 and 1.27 g/l). However, non-significant variation was observed on albumin, cholesterol, glucose, AST, and ALT. The work of (13) showed that different duration of fermentation has a significant effect on proximate composition (protein, carbohydrate, and fat) of baobab seed meal; this could be the reason why varied total protein and albumin were observed. The results also indicated that total protein and albumin are negatively correlated to the fermentation period (that is, as the duration of fermentation increases, the level of total protein and albumin in the blood serum decrease). The mean total protein observed in all treatment groups in the current study was higher than 4.4±1.5 g/l as reported by (14) but within the range of 6.16 and 6.52 g/l in Red Sokoto goats (15). The differences in the range values observed by these authors could be due to the variation in the experimental location. Globulin values obtained in the present report were lower than the value reported by (15). Total protein observed for T3 and T4 were within the range values reported among Red Sokoto goats in Lafia of Nasarawa state which has similar weather conditions to Makurdi (15). The non-significant variation observed on other serum parameters conforms to the report of (8).

Table 3: Duration of baobab seed fermentation on serum biochemical parameters of Red Sokoto goats

Parameter	Control	24WFBSM	48WFBSM	72WFBSM	SEM
Total Protein (g/l)	6.63[a]	6.07[ab]	5.90[b]	5.03[c]	0.19
Albumin (g/l)	4.03	4.20	4.07	3.77	0.13
Globulin (g/l)	2.60[a]	1.87[ab]	1.83[b]	1.27[c]	0.20
Cholesterol (mg/dl)	111.03	113.60	106.67	115.37	1.67
Glucose (mg/dl)	57.70	58.333	58.97	52.57	1.44
AST (IU/L)	176.97	154.07	172.40	173.97	4.04
ALT (IU/L)	47.00	46.87	48.30	50.20	0.94

AST= Aspartate transaminase, ALT =Alanine transaminase, SEM = Standard Error of Mean, 24WFBSM = 24 hours Water Fermented Baobab Seed Meal, 48WFBSM = 48 hours Water Fermented Baobab Seed Meal, 72WFBSM = 72 hours Water Fermented Baobab Seed Meal.

Table 4: Duration of baobab seed fermentation on blood minerals of Red Sokoto goats

Parameter	Control	24WFBSM	48WFBSM	72WFBSM	SEM
Copper (μgl^{-1})	0.72	0.65	0.68	0.66	0.01
Iron (μgl^{-1})	1.08	0.92	0.96	0.89	0.03
Zinc (μgl^{-1})	0.064[ab]	0.062[b]	0.068[a]	0.056[c]	0.001
Sodium (μgl^{-1})	0.25[a]	0.25[a]	0.26[a]	0.19[b]	0.01
Manganese (μgl^{-1})	0.69	0.62	0.62	0.64	0.02
Calcium (μgl^{-1})	0.39	0.36	0.35	0.35	0.01
Aluminium (μgl^{-1})	0.34	0.29	0.31	0.30	0.01

SEM = Standard Error of Mean, 24WFBSM = 24 hours Water Fermented Baobab Seed Meal, 48WFBSM = 48 hours Water Fermented Baobab Seed Meal, 72WFBSM = 72 hours Water Fermented Baobab Seed Meal.

Blood minerals

Trace elements are involved in numerous metabolic activities in the body. They have been identified as important for normal immune function and disease resistance especially zinc, iron, copper, manganese, and selenium (16). The blood minerals of Red Sokoto goats as affected by the duration of fermenting baobab seed meal are shown in Table 4. The influence of dietary treatment was observed on Zinc and Sodium. Treatment 3 had the highest blood concentration for both elements, while the least was recorded in treatment 4 (0.068 and 0.260 µg/l vs 0.056 and 0.19 µg/l; $P<0.05$). Significantly higher values of zinc up to 48 hrs of fermentation are an indication of membrane stability. However, beyond 48 hrs of fermentation, the membrane stability would probably have reduced as the amount of zinc decreased significantly. Zinc is one of the key elements for maintaining epithelial tissue integrity. As illustrated, one of the first indicators of a marginal zinc deficiency is a depression in gain and conversion that are often present before any change in blood or liver levels (17), there was a marginal decrease in weight change and conversion with an increase in the duration of fermentation of baobab seed meal in Red Sokoto goats (9). Apart from maintaining epithelial tissue integrity, zinc is also a component in numerous enzyme systems associated with carbohydrate and protein metabolism. A lowered sodium level in the blood has been reported to result in polyuria (18) and this is simultaneously accompanied

by decreased glomerular filtration rate associated with the decreased extracellular fluid volume. The results obtained for sodium-ion is within the range values reported by (14). However, the non-significant effect of dietary treatment was detected on copper, iron, manganese, calcium, and aluminum.

Conclusions and Application

1. The study revealed that the duration of fermentation of baobab seed meal did not affect hematological parameters.
2. The total protein and globulin of Red Sokoto goats were decreased as the duration of fermentation increased.
3. Fermentation of baobab seed in water beyond 48 hours decreased serum zinc and sodium concentration in Red Sokoto goats.
3. Also, fermentation of Baobab seed meal in water beyond 24 hours reduced total protein and globulin levels of the serum.
4. It is therefore recommended that fermentation of baobab seed in water should not be beyond 24 hours to maintain the physiological status of Red Sokoto goats.

Acknowledgment

The authors acknowledge the University of Agriculture, Makurdi for providing an enabling environment for the conduct of the research.

References

1. Mwale, M., Mupangwa, J. F., Mapiye, C., Saina, H. and Chimvuramahwe, J (2008). Growth performance of guinea fowl keets fed graded levels of baobab seed cake diets. *International journal of poultry science*, 7 (5): 429-432.
2. Nkafamiya, I. I., Osemeahon, S.A., Dahiru, D. and Umaru, H.A (2007). Studies on the chemical composition and physio-chemical properties of the seeds of baobab (Adansoniadigitata). *African Journal of Biotechnology*, 6: 756-759.
3. BELEWU, *M. A.*, Fagbemi, T., Dosumu, O.O. and Adeniyi, M.O (2008). Physio-chemical and anti- nutritional properties of some lesser known tree and leguminous seeds. *International Journal of Agricultural Resources*, 3 (3):237-242.
4. IBOELI, L. C., ADDY, E.O.H AND SALAMI, L.I (1997). Effects of some processing techniques on the antinutrient contents of baobab seeds (Adansoniadigitata). *Bioresources Technology*, 59: 29–31.
5. Osman, M. A. (2004). Chemical and Nutrient Analysis of Baobab (Adansoniadigitata) Fruit and Seed Protein Solubility. *Plant Foods for Human Nutrition*, 59: 29-33.
6. Longvah, T., Deosthale, Y.G. and Kumar, P.U. (2000). Nutritional and short-term toxicological evaluation of perilla seed oil. *Food Chemistry*, 70: 13 – 16.
7. Ikyume, T. T., Eigege, N.N., Bashi, D.T., Oche, N.P., Abdulraheem, A.I., Ojabo, M. and Akalika, I.P (2018). Growth Performance, Blood Profile and Economics of Production of West African Dwarf (WAD) Goats Fed Fermented Baobab (AdansoniaDigitata) Seed Meal. *Journal of Animal Husbandry and Dairy Science*, 2(1): 30-36.
8. Okunlola, D. O., Olorunnisomo, O.A., Adeinola, O.A., Nuga, H.A. and Balogun, N.O. (2015). Milk Yield and Composition of Red Sokoto Goats Fed Varying Levels of Baobab (Adasoniadigitata) pulp and seed meal. *Journal of Biology, Agriculture and Healthcare*, 5(13):186-191.
9. Ikyume, T. T., Okebugwu, P.C. and Afele, T. (2020). Growth Performance and Apparent Nutrient Digestibility of

Red Sokoto bucks fed Concentrate Diet Containing Baobab (*Adasonia digitata)* Seed Meal Fermented for Different Duration. *Nigerian Journal of Animal Science Technology*, 3 (1):60 – 68

10. Google Earth (2018). Global organization of Oriented Group Language of Earth. https://en.wikipedia.org/wiki/Benue_State (Accessed in 2018)
11. King, T.M. and Wooton, T.D.P. (1965). Determination of Total Protein in Plasma or Serum: Medical Biochemistry. Churchill Ltd., London, pp: 138-150.
12. Maier, S.M., Gross, J.K., Hamlin, K.L., Maier, J.L., Workman, J.L., Kim-Howard, X.R., Schoeb, T.R. and Farris, A.D. (2007). Proteinuria of nonautoimmune origin in wild-type FVB/NJ mice. *Comparative Medcine*, 57(3):255-266.
13. Nnam, N.M. and Obiakor, P.N. (2003). Effect of fermentation on the nutrient and anti-nutrient composition of baobab. *Ecology of Food and Nutrition*, 42(4/5): 265-277.
14. Tambuwal, F. M., Agaie, B.M. and Bangana, A. (2002). Haematological and Biochemical Values of Apparently Healthy Red Sokoto Goats, in Proceeding of the 27th Annual Conference of the Nigerian Society for Animal Production (NSAP), March 17-21, pp. 50-53, Federal University of Technology, Akure, Nigeria.
15. Hassan, D. I., Musa-Azara, I.S., Mohammed, J. and Zanwa, A.I. (2013). Influence of age, sex and season on haematology and serum chemistry of Red Sokoto goats in lafia, Nasarawa state Nigeria. *International journal of Agricultural Science and Veterinary Medcine*, 1 (4): 57-63.
16. Adenkola, A.Y., Ayo, J.O., Sackey, A.K.B. and Adelaiye, A.B (2010). Erythrocyte osmotic fragility of pigs administered antioxidant and transported by road for short-term duration during the harmattan season. *African Journal of Biotechnology*, 9(2): 226 – 233.
17. Engle, T. E., Nockels, C.F., Kimberling, C.V., Weaber, D.L. and Johnson, A.B. (1998). Zinc repletion with organic or inorganic forms of zinc and protein turnover in marginally zinc-deficient calves. *Journal of Animal Science*, 75:3074-3081.
18. Whitlock, E.J., Kessler, M.J. and Tasker, J.B. (1975). Salt (Sodium) Deficiency in Dairy cattle: Polyuria and Polydosia as prominent clinical features. *The Cornell Veterinarian*, 65(4): 512-525.