



EFFECT OF GRADED LEVELS OF ALKALI TREATED NEEM KERNEL CAKE ON HAEMATOLOGY AND BIOCHEMICAL PARAMETERS OF BORNO WHITE GOATS

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ABSTRACT

The study evaluated graded levels of Alkali Treated Neem Kernel Cake (ATNKC) on haematology and biochemical characteristics of Borno white goats. Sixteen Borno white bucks with initial average weight of 16 kg were quarantined for two weeks during which they were fed diets containing 0 (control), 5, 10 and 15 % ATNKC, designated A, B, C and D, respectively. Completely Randomized Design (CRD) was used with four replicates each. Results showed that Bucks fed 10 % ATNKC diet recorded higher ($P < 0.05$) value for haemoglobin concentration (11.31 g/dl) than the rest of the diets (8.50 to 10.15 g/d). Bucks on higher ATNKC diet (15 %) recorded higher ($P < 0.05$) total protein (70.50 g/dl) and albumin (35.67 g/dl) than bucks on rest of the diets (8.50 to 10.15 g/dl). It was concluded that ATNKC up to 20 % in the diets of Borno white goat does not have hazardous effect on haematological and serum biochemical parameters of the animal.

Keywords: Alkali; neem kernel; haematology; Borno white goats

INTRODUCTION

Ruminant animal production in Nigeria is popular among the rural, urban and peri-urban farmers, representing about 64% of the total grazing domestic animals in Nigeria (Lakpini, 2002). Ruminants account for major sources of national meat supply. However, the level of domestic livestock production falls short of demand. The most important factor responsible for the gap is the relationship between the demand and supply both in quantity and quality (NAERLS, 1999).

It has been reported that in the dry season, ruminant livestock cannot meet their nutritional needs due to scarcity of energy and protein feed stuffs (Adegbola, 2004). This has led to the introduction of more supplements for feeding ruminants which are higher in nutritional quality, more palatable, highly accepted by animals and are available throughout the northern part of the country where most of the animals are found. The commonest protein supplement for livestock feed in Nigeria during the periods of low yield and poor quality of herbage, are groundnut cake (GNC) and cotton seed cake CSC. However, the prices of GNC and CSC have been rising over the years thereby increasing the cost of production (Maigandi, 2001). Therefore, it has been recommended that researchers should consider using alternative sources of feed ingredients that can reduce the cost of production. One of the identified

promising materials is the neem kernel cake, which is a byproduct of neem tree (*Azadirachta indica*) seeds processing following extraction of oil from the seeds (Katiyar, *et al.*, 1993).

Finding alternative feed ingredient that are less competitive, less costly among human and livestock while at the same time performing similar role is paramount. This study evaluated ATNKC on hematology and biochemical characteristics of Borno White Goat (BWG).

MATERIALS AND METHODS

Experimental Site

This study was carried out at the Teaching and Research Farm of the Department of Animal Production Technology, Ramat Polytechnic Maiduguri of Borno State, Nigeria. Maiduguri the capital city of Borno State is located between latitude 11° 40'N to 11° 44'N, longitude 13° 05'E to 12° 14'E at an altitude of 354 m above sea level. Maiduguri has very short duration of rainy season (3-4 months) with about 645.9 mm/annum and a long dry season of about 8-9 months (World atlas, 2015).

Treatment and Experimental Design

Four complete diets were formulated; containing 0 (control) A, 5 (B), 10 (C) and 15 % (D) of Alkali Treated Neem Kernel Cake (ATNKC). Gross compositions of the experimental diets are shown in table 1. All the ingredients used except treated neem kernel were purchased from the Maiduguri livestock market. The sixteen bucks of Borno white goats' phenotype were allotted randomly to the four treatment diets in a Completely Randomized Design (CRD) replicated four times.

Treatment of Neem Kernel Cake

Table 1: Composition and calculated analysis of the experimental diet (%)

Ingredients (%)	A (control)	B (5% ATNKC)	C (10% ATNKC)	D (15% ATNKC)
ATNKC	0	5	10	15
Maize	15	15	15	15
Groundnut Haulms	18	18	18	15
Soybean Meal	15	12	8	6
Wheat offal	10	10	10	9
Cowpea Husk	20	20	20	20
Rice milling waste	20	18	17	18
Bone meal	1	1	1	1
Salt	1	1	1	1
TOTAL	100	100	100	100
Calculated CP (%)	15.9	16.1	15.9	16.1
Calculated CF (%)	19.0	18.9	19	19
Calculated EE (%)	4.1	4.1	4.2	4.2
Calculated Energy (Kcal/Kg)	2130	2145	2152	2182

ATNKC=Alkali treated neem kernel cake

Effect of graded levels of alkali treated neem kernel cake

The ripe neem fruits were sun dried by spreading on concrete floor for 15 days. The dried seeds were soaked in water in an open basin for 72 hours. The seeds were poured into a jute bag to drain the water and later sun dried on clean concrete floor for 15 days. The dried seeds were milled and oil extracted from the seeds as described by Odunsi *et al.* (2009). The neem kernel cake obtained after the oil extraction were later treated with NaOH in order to remove the bitter taste and pungent odour of the neem kernel. This was done by soaking the neem kernel cake in a solution containing NaOH (1:1.5 weight/volume). In which 20 g NaOH/kg kernel cake weight/weight was dissolved for 24 hours. This was followed by sun drying and grinding (Katiyar *et al.*, 1993).

Experimental Animals and their Management

Sixteen Borno white bucks with average age of 12 months and weighing 15 to 17 kg were obtained from the Maiduguri livestock Market and transported to the Teaching and Research Farm of the Ramat Polytechnic Maiduguri. The Animals were quarantined for a period of two weeks and dewormed against endo-parasite with Albendazole suspension at 25 mg/kg which was administered orally.

The Animals were housed individually in feeding pens measuring 2 x 1 m each and managed intensively for the period of 12 weeks.

Blood Sample Collection

Blood samples were collected from the Jugular vein of three randomly selected animals from each of the treatments (Coles, 1986). Blood sample collection was done early in the morning before feeding and 10 ml of the blood sample was collected from each animal. About 3 ml of the blood sample was placed in ethylene diamine tetra-acetic acid (EDTA) (anti-coagulant) bottle to prevent coagulation for hematological studies. The remaining 7 ml was placed in a universal bottle for serum biochemical studies.

Data Collection

Data were obtained on Packed Cell Volume (PVC), Haemoglobin (Hb), Red Blood Cell (RBC), White Blood Cell (WBC), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin Concentration (MCHC), neutrophils, eosinophil, lymphocytes, monocytes, basophils, total protein, albumin, globulin, conjugate bilirubin, total bilirubin, urea, creatinine, cholesterol, glutamine, sodium, potassium, High Density Lipoprotein (HDL), Triglycerides (TG) and Low Density Lipoprotein (LDL).

Data Analysis

The data generated were subjected to Analysis of Variance (ANOVA) using general linear model with Statistix-10. Where significant difference exists, Least Significant Difference (LSD) test at 5 % probability level was used to separate the means.

RESULTS AND DISCUSSION

Haematological profile of Borno white goat fed graded levels of ATNKC

The results on haematological characteristics (Table 2) of Borno white goat (BWG) fed graded level of ATNKC indicated that the packed cell volume (PCV), white blood cell (WBC), red blood cell (RBC) and the mean corpuscular volume (MCV) did not differ significantly ($P>0.05$) between the treatments. This could be due to the balancing of the nutrient of the control and the test diets. The PCV values (30.50 to 32.00 %), WBC (6.40 to 7.80×10^9), RBC (1400 to 14.67×10^{12}) and MCV (21.31 to 22.15 fi) recorded in this experiment for all the treatments were within the normal reference values for goats reported by (Duncan *et al.*, 1994). Haemoglobin concentration shows significant difference ($P<0.05$) between the treatments. The values obtained for haemoglobin (8.50 to 11.32 g/dl) were within the range (8 to 16 g/dl) reported by Coles (1986). The PCV and Hb obtained showed that the experimental diets were adequate for the nutritional requirements, and the test diet did not portend any danger to the animals. The values for RBC was comparable to the reported range of 7.38 to $13.62 \times 10^{12}/l$ for West African goat by Aina and Akinsoyinu (1996). The RBC values obtained also falls within the range reported by Maigandi (2001) and Aruwayo *et al.* (2007) on sheep. The WBC values obtained for the control diet was comparable to the test diet. The RBC and WBC counts obtained in the present study indicated that sodium hydroxide treated neem kernel cake in animal feed can be tolerated up to 15% inclusion level. Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) shows significant difference between the control and the test treatment. The MCH and MCHC values for all the treatments were within the normal reference values reported by Duncan *et al.* (1994). Increase in haemoglobin concentration is associated with greater ability to resist disease infection while low level is an indication of infection and poor plane of nutrition (Cheesbrough, 2004; Tambuwal *et al.* (2002). From the foregoing, the experimental diets were not deleterious to the animals because the haemoglobin concentration of all evaluated treatments fell within the normal range for healthy animals.

The differential blood count indicated that neutrophils, eosinophils, lymphocytes, monocytes and basophils of the experimental animals showed no significant difference between the treatments. The neutrophils, eosinophils, basophils, and monocytes were all within the normal range of 10 to 50 % neutrophils, 40 to 75 % lymphocytes, 1 to 5 % monocytes, 1 to 8 % eosinophils and 0 to 3 % basophils reported by Coles (1986). The result obtained for differential blood count can be compared with Heath and Olusanya (1988) report of 30 % neutrophils, 62 % lymphocytes, 25 % monocytes, 5 % eosinophil and 0.5 % basophil. Though the basophil presence in the blood is an indication of disease condition (Jain, 1993). The absence of basophils is an indication that the animals were healthy. Eosinophils was also reported to be an indication of parasitic infection, their low level in the blood which fell within the normal range of 1 to 8 % (Coles, 1986) indicates lack of parasitic infection. The values of differential count are possible indicators of health problems in an animal (Fradson and Spurgeon, 1992). Therefore, the differential count value obtained in this study show that the experimental animals were in good health. This indicates that neem bitterness and toxicity may be inactivated by alkali treatment as reported by Nagalakshmi *et al.* (1996). The result was also supported by the report of Reddy (1992) that processing NKC with alkali converted it to a wholesome vegetable protein supplement for growing buffalo calves.

Effect of graded levels of alkali treated neem kernel cake

Table 2: Haematological profile and differential blood counts for Borno white goat fed graded levels of Alkali treated neem kernel cake (ATNKC)

Parameters	Treatments				SEM
	A(control)	B(5% ATNKC)	C(10% ATNKC)	D(15% ATNKC)	
Haematology					
Packed cell volume (PCV %)	30.00	31.50	32.00	30.50	0.7906
Haemoglobin (Hb g/dl)	8.50 ^b	11.13 ^a	11.32 ^a	10.15 ^a	0.4234
Red blood cell (RBC X10 ¹²)	14.00	14.33	14.67	14.33	0.7071
White blood cell (WBC X10 ⁹ /L)	6.40	6.70	6.50	7.80	0.3240
Mean corpuscular haemoglobin (MCH pg)	6.07 ^c	7.79 ^a	7.72 ^a	7.09 ^b	0.1582
Mean corpuscular volume (MCV fi)	21.47	22.15	21.82	21.31	0.6638
Mean corpuscular haemoglobin concentration (MCHC g/dl).	28.32 ^b	35.27 ^a	35.36 ^a	33.28 ^a	0.6692
Differential blood counts (%)					
Neutrophils	56.07	56.03	56.50	56.27	0.6285
Eosinophil	6.90	6.93	6.83	6.87	0.1225
Lymphocytes	35.07	34.57	34.43	35.57	0.4746
Monocytes	1.43	1.36	1.27	1.40	0.1652
Basophils	0	0	0	0	0

a, b, mean values with different superscripts denote significant ($P < 0.05$) differences between means within the same rows.

Biochemical Profile of Borno White Goat Fed Graded Levels of ATNKC

The biochemical characteristics (Table 3) indicated that the total protein and albumin shows significant difference between the treatments. The total protein, albumin and globulin content of the experimental animals are 63.33 to 70.50 g/dl, 30.67 to 35.67 g/dl and 28.33 to 33.00 g/dl respectively. The fact that total protein, albumin and globulin values obtained in the sera of the experimental animals being high infers that the diets were adequate in terms of protein content. However, both the control and the test treatment values were in line with the normal range values for goat reported by Duncan *et al.* (1994). The higher values recorded for total protein in this study indicates that the quality of the protein of the experimental diets is high. This agrees with the report of Awosanya *et al.* (1999) who stated that the higher the value of total protein in the blood serum, the better the quality of protein of the feed fed to the animals. This was in accordance with the report of Coles (1986). Rajna (1999) also reported that low albumin is associated with low protein intake.

The total and conjugate bilirubin values in the study conformed within the range reported by Duncan *et al.* (1994). The result indicates that the experimental diets did not have any debilitating effect on the liver. The urea nitrogen level in the control diet and the test diet were all within the normal range values reported by Duncan *et al.* (1994) and Njidda *et al.* (2013). The urea level of the sera being within a normal range infers that the work rate of the liver and kidney are normal. This is comparable to the report of Maigandi (2001). The normal values obtained in the study portends that the test diet provided adequate protein for the animals. Coles (1986) showed that low dietary protein may result in decrease urea nitrogen. This equally showed that ATNKC up to 15 % level of inclusion did not interfere with the renal function. The creatinine levels obtained in the study are within the normal range

reported by Duncan *et al.* (1994) and Njidda (2013). The urea levels together with creatinine levels indicates normal liver.

The result obtained for triglyceride, HDL and LDL being within the reference values indicated that the animals were free from pancreatic and heart disease. According to Schiele *et al.* (1998) normal level of HDL seem to be associated with low incidence of coronary heart disease. The result obtained for triglycerides (0.32 to 1.84), HDL (1.51 to 2.02 mmol/l), LDL (0.36 to 0.65 mmol/l), glucose (1.75 to 1.84 mmol/l) and cholesterol (4.12 to 4.37 mmol/l) were in harmony with the reference values reported by Duncan *et al.* (1994) on haematological and biochemical parameters of goat of semi- arid environment. The sodium and potassium levels in the control and test diets were within the range of 142 to 160 mmol/l for sodium and 4.3 to 6.3 mmol/l for potassium (Boyd, 1984). The result compares with the report of Borjesson *et al.* (2000) who reported values of 153 mmol/l and 4.7 mmol/l for sodium and potassium respectively. The outcomes of all the values obtained for renal function in the study show that ATNKC inclusion up to 15 % level did not interfere with the renal functions of the animals. Khan (1994) reported that inclusion of ATNKC in the diet of rabbits did not alter sensitive urea nitrogen level.

Table 3: Biochemical profile of Borno white goat fed graded levels of Alkali treated neem kernel cake (ATNKC).

Parameters	Treatments				SEM
	A(control)	B(5% ATNKC)	C(10% ATNKC)	D(15% ATNKC)	
Total protein (g/dl)	63.33 ^b	65.67 ^b	70.50 ^a	67.00 ^{ab}	1.2883
Albumin (mmol/L)	35.00 ^a	35.50 ^a	35.67 ^a	30.67 ^b	0.8122
Globulin (mmol/L)	29.33	29.67	33.00	28.33	1.2583
Con. Bil. (mmol/L)	1.20 ^b	2.60 ^a	1.90 ^{ab}	1.35 ^b	0.2165
Total Bilirubin (mmol/L)	2.30 ^b	3.70 ^a	3.30 ^a	3.25 ^a	0.2437
Urea (mmol/L)	6.85	5.35	6.30	4.40	0.8034
Creatinine (mmol/L)	70.00 ^d	81.00 ^c	103.00 ^b	113.00 ^a	0.8028
Cholesterol (mmol/L)	4.19	4.37	4.31	4.12	0.2366
Glucose (mmol/L)	1.84	1.80	1.75	1.79	0.0739
Sodium (mmol/L)	140.33	144.50	140.50	138.50	1.8162
Potassium (mmol/L)	3.83 ^{ab}	5.30 ^a	4.30 ^{ab}	5.25 ^b	0.1596
Calcium (mmol/L)	2.04	2.25	2.15	2.17	0.1300
HDL (mmol/L)	1.51	1.53	1.68	2.02	0.1235
TG (mmol/L)	0.32 ^c	0.33 ^c	1.05 ^b	1.84 ^a	0.0809
LDL (mmol/L)	0.50	0.36	0.48	0.65	0.0959

a, b, c, d mean values with different superscripts denote significant ($P < 0.05$) differences between means within the same rows. HDL=High density lipoprotein; LDL=Low density lipoprotein; TG=Triglyceride; Con. Bil. =conjugate bilirubin

CONCLUSION

It was concluded that ATNKC up to 20 % inclusion does not have hazardous effect on haematological and serum biochemical parameters of Borno white goats.

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