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Performance and Haematological Analysis of sheep Fed Different Multi-nutrient Blocks (MNB) as Supplement to Millet Stover in Semi-Arid Zone of Nigeria.

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Abstract

The study was conducted to determine the influence of multi nutrient blocks (MNB) as supplement to millet stover in the Semi-arid region of Nigeria. Four multi nutrient blocks (MNB) were formed and subjected to in vivo trial. Twenty (20) sheep with an average body weight of 21.75kg were used for the study. The animals were divided into four (4) treatment groups. The study lasted for 60 days. The data obtained was subjected to Analysis of variance and the differences among the means were separated using Duncan Multiple Range Test. The results revealed that the initial and final body weight gain, daily basal, daily supplement and total feed intake show no significant (P>0.05) differences between the treatment. While there were significant (P<0.05) differences among the treatment on Feed conversion ratio, daily live weight gain and total weight gain. The results of pack cell volume (PCV) showed that there were no significant difference (P>0.05) between the treatment means with a ranged value of 25.67 (T5) to 28.00 % (T1). Similarly, no significant differences was observed in haemoglobin value among the treatment. On the other hand, white blood cell count was significantly differently among the treatment (P<0.05) with the highest value recorded in T3 ($8.53X10^3/mm^3$) and the lowest value in T2 ($6.23X10^3/mm^3$). Therefore, it could be concluded that, animals on T3 had better performance, therefore addition of Faidherbia albida +Locust bean pulp +Wheat bran in diet of sheep increased intake and performance and there is no hazard effect and therefore it is recommended as alternative animals feed sources in ruminant feeding.

Key words: Multi-Nutrient Blocks (MNB) supplement, Millet Stover, Growth traits, hematology and sheep

Introduction

Feed availability has been the major factor affecting ruminant livestock production during the dry season. Poor quality roughages such as crop residues and dry grasses are the available feed resources for feeding ruminants during the dry season. These feed resources are characterized by low intake and digestibility which result in poor animals performances. Supplementation with conventional protein based feed to ameliorate the problem are not within the reach of the small holder farmers. The use of agro- industrial by-products by livestock farmers especially in Nigeria is restricted to few, wealthy individuals because of high cost (FAO, 1996).

Browse plants have been used as supplements to a wide range of forages and agricultural by-products. Norton (1998) stated that they have been incorporated into concentrates as substitute for more expensive processed protein source such as groundnut cake, cotton seed cake, palm kernel cake etc. Studies by Njidda et *al,.(*2009) and El- Bahiery *et al.* (2009) showed that *Ziziphus mauritania* and *Faidherbia albida* have high crude protein (CP) content and could be used as supplement for feeding ruminants. The browsed plants are available in the semi-arid region and they have low anti-nutritional factors. The use of these browse plants as potential protein sources with millet, wheat and rice bran as energy source in formulating multi- nutrient blocks (MNB) will reduce the cost of production. Uses of feed additive in formulation of multi nutrient blocks are encouraged by many scientist such as molasses. However, use of molasses is expensive compare to locust bean pulp as binder.

In order to develop affordable and sustainable supplementation packages to improve the productivity of small holder farmers, the strategy of producing, formulating, developing and use of multi-nutrient blocks

(MNB) as non-conventional feed resources has been proposed by the International Atomic Energy Agency (IAEA) (Kayouli, 1994). Multi-nutrient blocks (MNB) are now gaining acceptance in parts of Africa by pastoralists as well as small holder farmers (Sansoucy and Aarts, 1998). The technique consists of mixing the required ingredients in a container and pouring the mixture into moulds and leaving to solidify into blocks (Bheeke *et al*., 2004). Multi- nutrient blocks are licks that contain various nutrients such as energy, protein, mineral, vitamins and other nutrients mixed together from various feed ingredients that are used as livestock feeds (Sansoucy, 1998). Feeding of the blocks is convenient and inexpensive method of providing array of nutrients required by both the rumen microbes and animals, which may be deficient in the normal diet (leng, 1997). Thus, the aim of this study was to evaluate the performance and haematological parameters of sheep fed different multi-nutrient blocks as supplement to millet stover in semi-arid zone of Nigeria.

Materials and Methods

Study Area

The study was carried out at the Livestock Teaching and Research Farm of the Department of Animal Scince, Borno State University Njimtilo along Kano Road Maiduguri. Maiduguri is situated on latitude 11^0 49' 10.3"North, longitude 13^0 11'45.29'' East and at altitude of 354 m above sea level. The area falls within the semi –arid zone of West Africa. Which is characterized by short duration of rainy season (3-4 months) per annum and very long dry season (8-9months). The mean ambient temperature is low in December to January ranging from 15- 19^{o}C and high in March to June, ranging from 33-44 ^{o}C and low relative humidity ranging from 30-45% in August which usually lowers to about 5% in December and January. Day length varies from 11- 12 hours (MCN, 2018).

Feed Ingredients and Preparation

The feed ingredients used for the study are millet bran, rice bran and wheat bran as energy sources. While *Faidherbia albida* pod and *Ziziphus mauritania* fruit as protein sources, and locust bean pulp used as binder and also for energy source for multi nutrient blocks. And above ingredients were used to formulate supplement diets which are presented in Table 1.

Multi Nutrient Block Formulation

The blocks were formulated using *Faidherbia albida* pods and *Ziziphus mauritania* fruits as protein sources while Millet bran, Rice bran and Wheat bran as energy sources, Locust bean pulp was used as a binder and also serve as energy source. All ingredients were used in various proportion and cold method of production was used (Leng, 1997).

Mixing of Feed Ingredients

The feed ingredients were mixed manually in a 200 L drum cut to a height of 50 cm. A batch of 15 kg (ingredients) were mixed in various ratio in order to get a homogeneous mixture as recommended by Mohammed *et al.,* (2007). The mixing was done as described by Aarts *et al*. (1990).

Moulding of the Blocks

Cold method of production was used, after preparation of a homogeneous mixture the content is placed in a metallic compacter and press manually using hand in compartment measuring 14 x 7 cm (Mohammed *et al*., 2007). The inner surface of the metallic compacter was washed and cleaned is to facilitate and remove smoothly, the multi-nutrient blocks when formed.

Drying of Blocks

After molding, the blocks were air dried and arranged and allowed to dry in an open space under shade. A dry environment was maintained for proper and quick drying of the blocks for 14 days.

Block Assessment

Laboratory Block Assessment

The blocks were taken to Civil Engineering Laboratory for testing Hardness and Compactness using Concrete crusher manufactured by Seidner © Riedlingen West Germany.

Feeding and Management

Prior to the commencement of the study, the animals were given prophylactic treatment consisting of intra- muscular injection of oxytetracycline (LA: 1ml/10kg body weight, multi vitamin and ivermetin 1m/50kg). The basal diet (millet stover) and water was provided *ad- libitum*, while the supplement was provided. Concentrate were provided to T1 (control) while T2, T3, T4 and T5 were supplemented with different multi nutrient blocks.

Feeding trial

Animals and experimental design

Twenty (20) non- descript growing sheep on average were used for the feeding trial. Feeding trial was carried out using multi-nutrient blocks (MNB) as a supplement to millet stover. The four (4) multi-nutrient blocks (MNB) were selected based on proximate composition and *in sacco* digestibility. Multi- nutrient block (MNB) that are high in crude protein (CP) content and dry matter degradability were selected as supplement. The animals were weighed and divided into five (5) groups. Each group of four animals with four replicate were randomly assigned to one of the five (5) treatments in a completely randomized design. Each group was receive each multi- nutrient block except for the control (T1), which was not be administered the multi- nutrient blocks a formulated diet, and water were offered *ad-libitum* to all group as basal diet. The experiment was last for 60 days.

Blood Collection and Analysis

The blood samples were collected from the animals through the puncturing of the jugular vein with syringe at the end of the experiment. Five mill (5 ml) samples obtained from each treatment, preserved in EDTA bottle and analyze for haematological parameters using the method of flow cytometry.

Statistical Analysis

All data collected were subjected to analysis of variance (ANOVA) using completely Randomized Design (CRD). Significant differences between means were compared using Duncan Multiple Range Test (DMRT) at 0.05% level of significant using computer package of SAS version 9.1

Results and Discussion

Proximate Composition (%) of the Multi Nutrient blocks (MNB), Basal diet (Millet stover) and Concentrate diet

The result of proximate composition of multi- nutrient blocks and concentrate diet were presented in Table 1. The highest dry matter (DM) content (96.1%) obtained in this study was recorded in F2, F5 and F9 respectively. while the lowest dry matter (DM) content were recorded in diet F3 and F8 which are (92.4%) and (92.2%) respectively. The lowest crude protein (CP) content in F2, F5 and F9 could be due high dry matter content of rice bran in the diet of F5 and F9. The crude protein (CP) value obtained from this study ranged from 10.24 % in F7 to 16.90 % in F3. This range values are above the 7% protein requirement for optimum microbial growth in the rumen (Gatemby, 2002). The highest crude protein content of F3 (55% wheat bran + 5% locust bean pulp + 40% *Faidherbia albida*) could be due to high crude protein content of *Faidherbia albida* 20.1% reported by Njidda *et al*, (2009). Furthermore, this is higher than 12% CP requirement for growth of sheep and goat reported by (Gatemby, 2002). The crude fibre ranged from 16.0% in (F7 and F8) to 22.50 % in F9).The high crude fibre content in T9 (55% rice bran + 5% locust bean pulp+ 20% *Faidherbia albida* + 20% *Ziziphus mauritania*) could be due to high fibre content of rice bran. This is lower than crude fibre estimated range from 25.55% to 26.20% reported by Aruwayo *et al.* (2013) when alkaline treated neem kernel was fed to fattening uda rams. The ether extract varied between 5.5% in F2 and 9.6% in F3. This is comparable to the estimate of ether extract ranged from 4.30% to 5.50% reported by Maigandi (2001) when four stomach digesta was fed to fattening rams. The Ash content on the present study ranged from 2.0% in F4 and F5) to 5.5% in F8. The highest ash content in F8 (55% wheat bran + 5% locust

bean pulp + 20% *Faidherbia albida* + 20% *Zizipphus mauritania*) could be due to high mineral content of wheat bran in the formulation. These values differ from ash content reported by Aruwayo *et al.,* (2013); Maigandi and Abubakar 2004); Maigandi and Nasiru (2006). The nitrogen free extract from this research ranged from 58.90% in T6 to 71.34% in T4. These values are comparable to the values reported by Aruwayo *et al.,* (2013) and also higher than value of 20.34% reported by Lawan *et al*., (2008).

Growth performance of sheep fed multi nutrient blocks (MNB) as supplement to millet stover

The results of growth performance of sheep fed different multi nutrient blocks (MNB) as supplement to millet stover based diet are presented in Table 2. There were significant (P<0.05) differences in feed conversion ratio, total and daily weight gain, while initial and final body weight, daily basal, daily supplement and total feed intake were not significantly (P>0.05) different among the treatment groups. Animals on all treatments gained weight indicating that the multi nutrient blocks had positive effect on the live weight performance of the sheep. However, T3 was significantly (P<0.05) higher than other treatments in the feed conversion ratio, total and daily weight gain. The highest performance observed in T3 could be due to low feed conversion ratio recorded compared to other treatments group.

The initial body weight of sheep ranged from 20.00 kg (T2) to 21.78 kg (T5). The final body weight was highest in T3 (32.38 kg) while the lowest value (27.25 kg) was recorded in T1 (control). The highest value recorded in T3 (55% wheat bran + 5% locust bean pulp + 40% *Faidherbia albida*) might be due to high crude protein content of *Faidherbia albida* as earlier stated. This is similar to the study of Ranjbari and Raste (2000) who supplemented mineral blocks and grass in sheep and stated that multi nutrient blocks (MNB) improved the body weight of the animals, compared to control which received no multi nutrient blocks (MNB). Master and White (1996) also reported that multi nutrient blocks (MNB) are essential for achieving the needs for growth, reproduction and metabolism of animals.

The daily basal intake were 0.84, 0.84, 0.83, 0.85 and 0.77 (kg DM) for T1, T2, T3, T4 and T5 respectively. The highest value was recorded in T4 0.85 (kg DM) while the lowest value was recorded in T5 0.77 (kg DM). The highest values recorded in T4 could be attributed to the high crude protein intake. Among the treatments that were supplemented with multi nutrient blocks T3 had the highest crude protein intake followed by T4. The results of daily supplement intake were also recorded that there was no significant (P> 0.05) among the treatment groups, the values ranged between 0.14 – 0.15 (kg DM). This indicated that the daily supplement consumed from each treatment are statistically similar. The values recorded for total dry matter intake were 0.99, 0.88, 0.99, 0.99 and 0.93 for T1, T2, T3, T4 and T5 respectively. The highest value of total dry matter intake was recorded in T1, T3 and T4 0.99 (kg DM) while lowest value were recorded in T2 0.88 (kg DM). This is in line with the report of Bistanji *et al.* (2000) when sheep fed with multi nutrient blocks and agro industrial by products, who stated that formulated multi nutrient blocks (MNB) with different variety of ingredients with or without molasses increased feed intake .It is also in line with the findings of Mubi *et al*. (2011) when supplemented multi nutrient blocks on the performance grazing yankasa sheep, whose recorded higher feed intake in the groups that received the multi nutrient blocks (MNB) over the control group that received no multi nutrient blocks (MNB).

The result of total weight gain showed that there were significant differences (P <0.05) among the treatment groups. The values were 6.23, 8.63, 10.88, 8.63 and 9.85 kg for T1, T2, T3, T4 and T5 respectively. T3 recorded the highest value (10.88 kg) and the lowest value was recorded in T1 (6.25 kg).

However, the total weight gain recorded for T2 and T5 are statistically similar while T3 and T5 are statistically similar 10.88 to 9.85 kg respectively. T1 was significantly difference ($P < 0.05$) from the treatment groups.T1 control (without multi nutrient blocks) recorded the lowest value among other treatment groups. The difference might be due to the supplementation with multi nutrient blocks (MNB). Multi nutrient blocks (MNB) provide an almost continuous supply of nutrients which is usually deficient in millet stover that limit fibre digestion in the rumen and multi nutrient blocks (MNB) can be a source of rumen protein, macro and micro minerals, vitamins, and additive to manipulate rumen fermentation (Hadjipanayiouton *et al.,* 1993). The value recorded for T1 (6.25 kg) was similar to the value (6.30 kg) reported by Mubi *et al.* (2013) when supplemented sheep with multi nutrient blocks And the positive effect of multi nutrient blocks (MNB) on overall performance on a low plane of nutrition that is a crop residue or millet stover based diet given in large quantities.

The average Daily weight gain differed significantly ($P < 0.05$) among the treatments. The highest value was recorded in T3 0.19 kg while the lowest value was recorded in T1 with the value of 0.11 kg. However, the T2 and T4 values are statistically the same 0.15 kg while among these treatment groups only T1 which served as control (without multi nutrient blocks (MNB) recorded the least value. The variation might be attributed to supplementation of (T2 to T5) with multi nutrient blocks (MNB). The higher value recorded for T3 might be due to the high crude protein content of the *F*aidherbia *albida* used in the formulation of the multi nutrient blocks (MNB). Habib *et al.,* (1991) when sheep supplemented with multi nutrient blocks and sorghum stover as basal diet, reveal that those sheep that consumed multi nutrient blocks (MNB) perform better than those fed control diet. This suggests that the multi nutrient blocks (MNB) improved rumen fermentation which provide a better balance of nutrients to the animals for absorption.

The results of feed conversion ratio (FCR) Showed that there were significant ($P < 0.05$) difference among the treatment groups. The values were 8.99, 5.85, 5.15, 6.49 and 5.5 for T1, T2, T3, T4 and T5 respectively. The highest value was recorded in T1 (8.99) While the lowest value was recorded in T3 (5.15). However, the values recorded for T2, T3 and T5 are statistically similar. For feed conversion ratio the lower the value the better the feed conversion ratio. In the present study T3 recorded the best feed conversion ratio. The result revealed the ability of animals on T3 to convert the feed consumed to weight gain follow by T2 and T5 while T1 (control) recorded the poorest feed conversion ratio. T3 recorded the best feed conversion ratio which indicated efficiency in feed utilization. T1 (control) recorded the poorest feed conversion ratio. The result of this study is in line with the finding of Mohammed *et al.* (2007) when sheep supplemented with different multi nutrient blocks and wheat bran, reported that supplementation of multi nutrient blocks (MNB) with different feed ingredients to sheep under semi arid environment improve the performance of sheep grazing natural pasture.

The results of haematological study of sheep fed different multi nutrient blocks (MNB) as supplement to millet stover based diet are presented in Table 3. There was significant ($P <0.05$) differences in white blood cell. The highest value was recorded in T3 (8.53×10^3 / mm^3) while the lowest recorded in T2 ($6.23 \times 10^3/mm^3$). The value obtained fall within the normal range of 4- 12×10^3 mm^3 reported by RAR (2009), but higher than 2-3 x $10mm^3$ reported by (Njidda *et al*., 2014). Higher white blood cells (WBC) in T3 is an indicator of immune response to infection or toxic substance in the organism and lower WBC count is an indication of pathogenic infection or presence of antigens in the organism (Bradburry *et al*., 1991). While the pack cell volume (PCV), haemoglobin (Hb), red blood

cell (RBC), means corpuscular volume (MCV), means corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration ((MCHC) were not significantly (P>0.05) different among the treatment groups. All the values fall within the normal range as reported by RAR (2009). Lawrence *et al*. 2012) Stated that blood is an important index of physiological, pathological and nutritional status in the organism and the blood variable most be consistently affected by dietary influence. The values of MCV, MCH and MCHC are very important in the diagnosis of anemia and also serve as useful index of the capacity of the bone marrow to produce red blood cell as reported by (Awodi *et al*., 2005).

Conclusion

The results of this study revealed that there is improvement in term of growth performance and there was no adverse effect on the health of the animals fed the formulated multi nutrient blocks (MNB) and all the values were within the normal range. The process of making multi nutrient blocks is simple and does not require sophisticated equipment and can be made by used of wide variety of by products which are available locally.

Recommendation

It is recommended that multi nutrient blocks be used to feed sheep to improve their growth performance with no detrimental effect.

Reference

Awodi, S., Ayo, A.D and Dzende. T (2005). Some Haematological Parameters and the Erythrocyte Osmotic Fragility in the Laughing Dove (*Streptopella senegalensis*) and the Village Weaver Bird *(Ploceucucullatus*).

Bradburry, J.H, Akingbala, J.O and Egan, S.V. (1991). Haematological indices of Yankasa Rams and Pathogenic infectious. *Animal Production Journal of Science* and food *Agriculture. 7 (2) pp. 111-199.*

El-Behiery, M. A. H. (2009). Nutritive evaluation of two *Acacia* population South West Saudi Arabia. *Journal of Applied Science Research*. 5:1030 – 1039.

FAO (1996). IAEA workind document on guidelines for development of food supplementation packages. *World Animal Review,* FAO, Rome, Italy.

Habib L, Chena C, Mucilages recinaires de mai˙s Sur des argiles hormoiniques Sur la micro- organization des complexes forms. C. R Acad. Science 310, 1541-1546.

Table 1: Percentage composition (%) of the Multi- Nutrient Block (MNB)

Percentage (%) of Feed Ingredients Used in the Formulation of the Multi-Nutrient Blocks (MNB)	
T1 =	55% M B + 5% LBP +40% FA
T2=	55% MB + 5% LBP + 40% ZM
T3=	55% WB + 5% LBP + 40% FA
T4=	55% WB + 5% LBP +40% ZM
T5=	55% RB + 5% LBP +40% FA
T6=	55% RB + 5% LBP +40% ZM
T7=	55% MB + 5% LBP +20% FA+ 20 %ZM
T8=	55% WB+ 5% LBP +20% FA + 20%ZM
T9=	55% RB + 5% LBP +20% FA + 20%ZM

MB=Millet bran, FA=*Faidherbia albida*, LBP=Locust bean pulp, ZM=*Ziziphus mauritania*, RB= Rice bran and WB=Wheat bran

Table 2: Proximate Composition (%) of the Multi-nutrient blocks (MNB), Basal diet (millet stover) and Concentrate diet

Composition	Millet stover	F1	F2	F3	F4	F5	F6	F7	F8	F9	Concentrate
Dry matter (DM)	96.7	95.4	96.1	92.4	95.4	96.1	94.3	95.5	92.4	96.1	90.01
Crude protein (CP)	4.33	13.65	11.81	16.90	12.16	14.70	11.90	10.24	14.44	12.08	24.01
Crude fibre (CF)	25.0	19.0	18.5	10.0	18.0	18.0	16.5	16.0	16.0	22.5	18.05
Ether extract (EE)	4.0	7.0	5.5	9.6	6.5	5.9	9.2	6.5	9.4	5.9	4.0
Ash	2.5	2.5	4.0	3.5	2.0	2.0	4.5	4.0	5.5	2.5	3.5
Nitrogen free extra	64.17	66.85	65.19	63.00	71.34	69.40	58.90	63.86	59.66	55.52	45.89
ME(kcal/Kg)	2672.25	3445.21	3196.72	3639.40	3508.99	3485.50	3276.45	3172.41	3413.61	2895.32	2841.47

Concentrate (groundnut haulm, cotton seed cake and maize bran)
ME=Metabolisabl energy = (37x%CP) + (81x%EE) + (35.5X%NFE) (Pauzenga, 1985).

Table 3: Growth Performance of Sheep fed different Multi nutrient blocks (MNB) and Millet stover based diet

Parameter	**T1 (control)**	**T2**	**T3**	**T4**	**T5**	**SEM**
Initial body weight (kg)	21.03	20.00	21.50	21.75	21.75	0.91^{NS}
Final body weight (kg)	27.25	28.63	32.38	30.38	31.63	0.92^{NS}
Daily basal intake (kg DM)	0.84	0.80	0.83	0.85	0.73	0.36^{NS}
Daily supplement intake (kg DM)	0.15	0.14	0.15	0.15	0.14	0.11^{NS}
Total feed intake (kg DM)	0.99	0.88	0.99	0.99	0.93	0.11^{NS}
Total weight gain (kg)	6.23^{c}	8.63^{b}	10.88^{a}	8.63^{b}	9.85^{ab}	0.40^{*}
Daily weight gain (kg)	0.11^{c}	0.15^{b}	0.19^{a}	0.15^{b}	0.18^{ab}	0.01^{*}
Feed conversion ratio	8.99^{a}	5.85^{c}	5.15^{c}	6.49^{b}	5.75^{c}	0.34^{*}

a, b, c, = means in the same row with different super scripts are significantly (P>0.05) different
NS = not significantly (P<0.05) different
SEM = standard error of mean
* = means significantly (P>0.05) different

Table 4: Haematological indices of Sheep Fed different Multi nutrient blocks (MNB) and Millet stover based diet

	Treatments						
Parameters	**T1**	**T_2**	**T_3**	**T_4**	**T_5**	**SEM**	**Standard** Values**
PCV (%)	28.00	27.67	27.00	25.67	25.00	1.36^{NS}	24-45
Hb (g/dl)	9.30	9.20	8.93	8.50	8.30	0.46^{NS}	8-16
WBC ($X10^3/mm^3$)	6.50^{c}	6.23^{c}	8.53^{a}	6.77^{c}	7.67^{ab}	0.35*	4-12
RBC $X10^6/mm^3$)	11.33	10.33	12.47	10.67	11.53	1.04^{NS}	9-15
MCV (fentolitres)	25.28	27.24	21.69	24.43	22.25	0.54^{NS}	23-48
MCH (pictograms)	8.39	9.06	7.18	8.09	7.38	0.84^{NS}	8-12
MCHC, (%)	33.21	33.35	33.09	33.12	33.19	0.06^{NS}	31-38

a,b,c,. = Means in the same row bearing different superscript differ significantly (P> 0.05) *= Means significantly (P<0.05) different NS = Not significantly (P> 0.05) different SEM = Standard error of means
PCV =Pack cell volume HB = Haemoglobin WBC = White blood cell RBC = Red blood cell MCH = Means corpuscular volume MCH = Means corpuscular haemoglobin MCHC =Means corpuscular haemoglobin concentration RAR = Research Animal Resource **=Source (RAR, 2009).

Hadjipanayiotou, M. Brun-Bellut J. and Lindberg, J.A (1993). Protein nutrition and requirements of growing goats. In: Goat Nutrition Movand -Fehr. P(ed). EAAP publication No.Pudoc, Wageningenn, The Netherlands. PP 94- 403.

Lawrence- Azua O.O, Odetola O.M, Adedeji, O.Y and Yahaya M.O (2012). Growth and serum biochemical indices of growing Rabbits fed Enzymes supplemented with cocoa bean shell. *Proceeding of the 17th conference of Animal Science Association of Nigeria held at Abuja. 458- 459.*

Leng, .R.A (1997). Tree foliage in ruminant nutrition FAO *Animal Production and Health paper* No.139, Rome, Italy. PP 16-23.

Mohammed, I.D., Baulumi M. and Adeyinka, I.A (2007): Multi-nutrient blocks formulation and production under a semi-arid environment of northeast Nigeria. *Journal* of *Biological Science*. Vol. 7, No. 2, 389-392 207 ISSN 1727-3048(1) 2007. Asian network for information.

Mubi. A.A., Kibon, A, and Mohammed, I.D. (2011). Formulation and production of multi nutrient blocks for ruminants in the guinea savannah region of Nigeria. Agriculture and Biology Journal of North America 4(3): 205-215.

Njidda, A. A., Ikhimioya, I., Abbator, F. I. and Ngoshe, A. A. (2009). Chemical composition and some anti-nutritional constituent of selected browses of semi-arid region Nigeria. Proceedings of the 34th Annual conference of Nigerian Society for Animal Production. 15th – 18th March, 2009. University of Uyo, Nigeria. Pp 633 – 635.

Njidda, A.A., Shuaibu, A. A. and Isidahomen, C.E. (2014). Haematological and serum biochemical indice of sheep in semi-arid environment of Northern Nigeria. *Global Journal of Science Frontier Research* (D) 14(12): 49 – 56.

Norton, B.W. (1998). The nutritive value of tree legumes. In: gutterridge R.C and Sheldon, M. (Eds) forage tree.Tree legumes in Tropical Agriculture CAB, International, Wallingford. Pp. 177- 191.

RAR (2009). Reference value for Laboratory Animals: Normal haematological values. RAR websites, Research Animal Resource (RAR), University of Minnesota. Available at: http://www.ahc.umn.edu\rar\refvalues.htmi.

Ranjbari, A.R. and Rasti, M. (2000). The effect of multi nutrient blocks supplementation on weight and carcass components of lambs in grasslands of Esfahan Provience. The final report of research project in Agricultural and natural resources research and education of kohgilooye- va-booyerahmad province.

Sansoucy, R. (1998). The sahel, manufacture of molasses urea blocks. *Journal of Animal Science and Technology*. 57 (4): 40-48.