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Evaluation of Eight Diets as Livestock Supplements in Semi–Arid Zone of Niger Republic

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Abstract
This study was undertaken to explore the nutritive potential of eight (8) diets supplementation. Diets samples were analyzed for proximate principles. The higher (11.35±0.71%) value of ash content was obtained from D4 followed by (8.92±0.59%) from moisture in D8 while higher value of protein was (22.11±1.22%) in D8. However, a higher (53.09±0.75%) value of crude fibre was obtained from D1. Also, higher value (10.50±0.57) of ether extract was obtained from D1 while nitrogen free extract had 23.90±0.66% from D7. Value of metabolizable energy was 2086.57±10.16 kcal from D8 and value of dry matter was 95.90±0.21. Acid detergent fiber had the highest 41.44±1.59 % values from D4 while the highest value (55.75±0.64%) of nitrogen detergent fiber was obtained from D2. Calcium value was (258.50±6.59 mg/kg) from D3 while total phosphorous was (75.60±0.04 mg/kg) from D4. Conclusively, the result obtained had a similar range values compared to other reports and could be used as reference point within the corridors of Niger–Nigeria and beyond.

Keywords: Proximate, diet, livestock, semi–arid zone

Introduction
In Niger, crop and livestock production are the mainstay of the national economy, of which livestock contributed 12% of national GDP and 35% of agricultural GDP (Geesing *et al*., 2006). Agricultural and pastoral activities are carried out in different agro-ecological zones of which the semi–arid zone covering the southern part of the country, with receiving 600 to 800 mm of rainfall per year, and being more suitable for agriculture (MEL, 2010). Diet formulation with mineral concentrations close to the cattle's requirements would seem to be an appropriate means of reducing concentrations of urea, calcium, and phosphorus in waste without affecting animal performance. However, mineral requirements of these animals are not easily determined. Another strategy for reducing trace mineral concentrations in diets is the inclusion of mineral sources that may have greater bioavailability than the alternative inorganic form (Spears, 1996). This study was designed to exploit the locally available feeds resources in Maradi Region of Niger Republic in order to contribute to the nutrients requirement of ruminant animals. These might likely address, to some extent, the development of least cost feeding regimes using the local feed ingredients in the area of research and to also determine the nutritive value of the feed supplementation and to come up with cost effectiveness of these feeding regimes. Although, most authors concentrated their research work in far areas of Niger Republic while leaving the corridors with scanty data. However, the need to conduct this research arises in order to come up with baseline information on the nutritive evaluation on some diets used for supplementation.

Materials and Methods
The proximate composition of the different formula of supplement and experimental diets (Table 1) was carried out according to the method described by AOAC (2000). All the samples were properly labeled and analyzed in Animal Feed and Nutrition Laboratory of Faculty of Agriculture, Bayero University, Kano–Nigeria. The samples of feed supplement used in the experiment were grounded in a Wiley mill through a 1mm screen and were analyzed for dry matter (DM), crude protein (CP), ether extract (EE) and ash according to the standard methods of AOAC (2000). Nitrogen content was determined by the micro-Kjeldahl method, while crude protein (CP) was calculated by multiplying the nitrogen content with a factor of 6.25. Also, crude fibre (CF) was determined by the method of James (1995). However, neutral detergent fiber (NDF) and acid detergent fiber (ADF) were determined by the methods of Van Soest *et al.* (1991). Calcium (Ca) and Total Phosphorus (TP) were estimated using an atomic absorption spectrophotometer (AAS). Data from the study was sorted out, stored in Excel sheet and later analyzed using statistical package for social science (SPSS), version 20. The data of chemical composition wereanalyzed by the following statistical procedures: one-way ANOVA. The means were compared using the Tukey's test at 95% significance level.

Table 1: Feed composition of the experimental diets

Ingredients	Diets							
	D1	D2	D3	D4	D5	D6	D7	D8
Millet stalk	45	45	35	35	35	35	35	35
Cowpea fodder	14	13	19	19	18	18	14	13
Cotton seed cake	15	15	15	15	15	15	15	15
Faidhebia albida pod	10	10	10	10	10	10	10	10
Wheat bran	15	15	15	15	15	15	15	15
Salt	1	1	1	1	1	1	1	1
Urea	0	1	0	0	0	0	0	0
Phosphorus	0	0	5	0	0	0	0	0
Calcium	0	0	0	5	0	0	0	0
Urea+phosphorus	0	0	0	0	6	0	0	0
Urea+Calcium	0	0	0	0	0	6	0	0
Phosphorus+Calcium	0	0	0	0	0	0	10	0
Urea+Phosphorus+Calcium	0	0	0	0	0	0	0	11
Total%	100	100	100	100	100	100	100	100

Results and Discussion

The results of the proximate composition of experimental diets at different levels of inorganic minerals are presented in Table II. From the results obtained, the higher (11.35±0.71%) and lower (6.34±0.01%) values of ash content was obtained from D8 and D5 followed by (8.92±0.59%) and (4.10±0.21%) from moisture in D8 and D1 while values of protein were (22.11±1.22%) and (13.18±0.06%) in D8 and D1 respectively. This is in agreement with the report of Mubi *et al*., (2013). The CP content of all the diets from this study ranged from 13.18%– 22.11%. This range is slightly lower than what was reported by Addass *et al.* (2011) who worked on animals in north–eastern part of Nigeria. Also, Onwuka (1999) reported that the crude protein content of livestock diets is sufficient for ruminants which will provide ammonia required by rumen microorganism to support optimum microbial activity. However, a higher (53.09±0.75%) and lower (27.335±0.62%) values of CF was obtained from D1 and D7. Also, higher and lower values (10.50±0.57 and 6.65±0.21%) of EE were obtained from D1 and D7. This is in harmony with the work of Kinfemi *et al.* (2009). NFE had 23.90±0.66% and 4.85±0.17% from D7 and D2 which is a little lower than the value reported by Dibal (1991) for semi–arid browse plants. Values of Metabolizable energy were 2086.57±10.16 and 1617.39±36.06 kcal from D8 and D4 and values of DM were 95.90±0.21 and 91.09±0.59%. ADF had the highest 41.44±1.59 and lowest 31.83±1.02% values from D4 and D1 while the highest and lowest values (55.75±0.64 and 42.19±1.36%) of NDF were obtained from D2 and D3, respectively. Many factors affect the chemical composition such as oil extraction process, stage of growth, maturity and species or variety (Addass *et al*.., 2011). Calcium values were (258.50±6.59 and 85.06±0.66 mg/kg) from D3 and D4 while total Phosphorous were (75.60±0.04 and 2.16±0.18 mg/kg) from D4 and D2. The observed differences in mineral composition in these products may be due to genetic factor and added in different level. Decrease in minerals, energy and protein contents also contribute to lower intake, reduced digestibility and consequently losses in weight by grazing animals (Ikram *et al.,* 2010).

Conclusion

This study clearly indicated that locally available feeds resources can significantly contribute to the nutrients requirement of ruminant animals within the Niger and Nigeria corridor. It was depicted from this work that mixing two or more feeds resources with different protein and energy content can yield a good feed of higher and balanced percentages. Furthermore, using crop by–products and crop residues to formulate diets for ruminants can meet both their metabolizable energy, protein and mineral requirements for maintenance, production and reproduction at a very lower cost especially during periods of feed shortage (dry season).

Table 2: Chemical composition of basal diet with inorganic minerals

Constituents	Diets							
	D1	D2	D3	D4	D5	D6	D7	D8
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Ash (%)	6.44±0.12	8.23±0.32	7.36±0.21	11.35±0.71	6.34±0.01	10.16±0.06	9.69±0.04	9.18±0.25
Moisture (%)	4.10±.021	4.90±0.29	7.43±0.31	6.01±0.01	6.63±0.12	5.37±0.39	8.23±0.11	8.92±0.59
CP (%)	13.18±0.06	19.53±0.23	18.63±0.05	20.56±0.32	21.83±0.07	20.83±0.07	18.60±0.01	22.11±1.22
CF (%)	53.09±0.75	30.82±0.29	52.91±1.00	39.07±0.51	29.29±0.61	48.195±0.25	27.34±0.62	45.64±0.54
EE (%)	10.50±0.57	9.60±0.42	8.35±0.21	7.65±0.21	10.10±1.13	7.20±0.14	6.65±0.21	9.85±0.35
NFE (%)	16.81±0.01	4.85±0.17	12.76±0.95	6.66±0.86	7.99±2.42	13.63±0.11	23.9±0.66	13.24±2.37
ME	1935.61±47.9	1673.17±19.8	1819.30±52.7	1617.39±36.1	1910.47±8.5	1838.32±12.6	2075.79±41.1	2086.57±10.1
DM (%)	95.90±0.21	95.10±0.29	92.57±0.31	93.99±0.01	93.38±0.12	94.64±0.39	91.77±0.11	91.09±0.59
ADF (%)	31.83±1.02	36.92±0.23	40.35±0.78	41.44±1.59	37.86±0.59c	30.11±0.47	37.46±0.83	40.65±0.35
NDF (%)	44.10±0.30	55.75±0.64	42.19±1.36	49.7±1.06	53.52±2.18	49.05±0.08	51.12±0.34	50.28±0.55
Ca (mg/kg)	156.41±2.11	159.50±2.26	258.50±6.59	85.06±0.66	320.61±2.16	195.05±1.37	177.53±14.11	148.53±5.35
TP (mg/kg)	14.92±1.41	2.16±0.18	44.77±0.17	75.60±0.04	41.22±0.02	7.81±0.19	43.63±0.64	45.86±1.36

DM = dry matter, CP = Crude protein, CF = Crude fiber, EE = Ether extract, NFE = Nitrogen free extract, ADF= Acid detergent fiber, NDF = Nitrogen detergent fiber, ME (Kcal/kgDM) = Metabolizable energy , SD = Standard deviation.

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