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THE EFFICACY OF MULTINUTRIENTS FEED BLOCK USING SHEA NUT CAKE WITH OTHER AGRO INDUSTRIAL BY-PRODUCTS AND ITS ACCEPTABILITY BY WEST AFRICAN DWARF GOATS IN NIGERIA

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Shea nut cake enriched with urea, soybean cheese waste and *Gliricidia sepium* was made into feed blocks using three binders (cement T1, cassava flour T2 and industrial starch T3). The feed blocks were air dried for 21 days at air temperature of about 28°C to investigate their physical properties and acceptability. Twelve (12) healthy growing West African Dwarf (WAD) goats of average weight 8.0 kg were used with *Daniella oleiveri* as basal diet for 14 days in a completely randomized design. Feed blocks using industrial starch as binder was harder and more compact compared to the two other binding agents throughout the drying period. Chemical composition showed that the highest content of dry matter was recorded for T3 (96.32%) and the lowest in T2 (94.23%). T2 recorded the highest crude protein content (32.71%) while T1 had the the least (30.18%). Crude fibre content was also the highest in T2 (4.50%) and the lowest in T3 (4.42%). In addition, the highest ash content was observed in T2 (8.82%) and the lowest in T1 (6.79%). In terms of physical properties (hardness and compactness), feed block produced using industrial starch as binder is the best. Among the treatments, T3 was the most acceptable with coefficient of preference above unity. The cost of production was highest in T3 (N80.25/kg) and lowest in T1 (N54.00/ kg). From the results obtained, feed block produced using industrial starch as binder is recommended for adoption by farmers as dry season feed supplement in ruminant nutrition due to its properties and acceptance by the animals.

Keywords: chemical composition, WAD goat, multinutrients feed block, free choice intake, shea nut cake

Fodder shortage during the dry season is a major problem for developing countries in meeting the nutritional requirement of livestock. Shea nut cake is a by-product that is left after fat extraction from shea nuts (*Vitellaria paradoxa*, Gaertn.). It is available in large quantities in West Africa most especially Nigeria and Ghana where shea butter trees abound. Shea nut cake was reported to have similarities in its nutrient composition to wheat bran (NRC, 1994). Wheat by-products are used extensively in livestock feed in Western Africa. These by-products are often imported and thus can be scarce and expensive, and may not be idea for ruminant production. Annongu *et al*. (1996) observed that shea nut cake contains some anti-nutritive factors, particularly tannins that are in the range of 98.7 to 156.4 g/ kg. The tannin concentration is similar to or higher than other high tannin-containing feedstuffs such as sorghum grains (*Sorghum vulgare*) and faba beans (*Vicia faba*). These may not pose a problem to ruminants as they tolerate certain concentration of tannins in their rumen. The importance of the quantity consumed is receiving recognition since tannins in several types of forage can have beneficial effects in moderate amounts (Min et al., 2003).

Makkar, (2007) indicated that the use of solid feed supplementation blocks, i.e. multinutrient blocks, provides the nutrients deficient in fibrous feeds which are available to this animal during dry season period.

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Block supplementation with crop-residue-based diets has resulted in increased milk production, with a favourable cost– benefit ratio, varying from 1:2 to 1:5, depending on the purchase price of ingredients and selling price of milk (Makaar, 2007). Increase in lactation length has also been observed. Decreases in inter-calving days and in the age at first calving are additional beneficial effects of feeding the blocks. Feeding of crop residues with UMMBs can sustain a milk yield of up to 4 or 5 litres per day in cattle (Makkar, 2007). Generally, multinutrient feed block will bring improvement in livestock productivity, coupled with more efficient utilization of locally available feed resources (especially fibrous feed), and will further lead to economic and social benefits for the local population. Therefore, this experiment was designed to produce affordable multinutrients feed block us shea nut cake as dry season feed supplement for ruminants.

MATERIALS AND METHODS

Experimental site

The experiment was conducted in small ruminant section at the Teaching and Research farm, College of Agriculture, Kwara State University, Malete, Moro Local Government.

Methods of feed block production

The cold process was used for the production. The blocks were made by hand (manually) in batches (Sansoucy, 1986). The mixed material was placed into a 16cm x15cm x16cm wooden mold. The mold was lined with plastic sheeting to prevent the block from sticking to the walls and to allow easy removal from the molds (Asaolu, 2012).

Experimental animals and management

Twelve growing West African dwarf goats weighing averagely 8kg with good body condition were used. The experimental animals were tagged and randomly assigned to the experimental diets. The animals were given prophylactic treatments against parasites and other infections. The experimental animals were provided with feed block every day before serving *Daniella oleiveri* as basal diet.

Assessment of block hardness, compactness and physical characteristics

The blocks were monitored and assessed for hardness and compactness at 7 and 21 days, respectively by 3 persons independently using a subjective scale: Soft (+) Medium (++) and Good (+++).

Hardness: Hardness was tested by three persons independently by pressing with the thumb in the middle of the block.

Compactness: Compactness was tested by three persons independently by the ease to break the block by hand (Mohammed *et al.*, 2007).

Physical characteristics: Colour, taste, texture and smell/aroma were determined independently by three persons according to Hadjipanayiotou (1994).

Acceptability study

The feeding of the WAD goats to determine

Table 1: Composition of experimental diets using different binders (%)

Ingredient	T1 (Cement %)	T2 (Cassava flour%)	T3(Industrial starch%)
Shea nut cake	30	30	30
Rice bran	5	5	5
Soybean cheese waste	10	10	10
Gliricidia leaves	15	15	15
Urea	10	10	10
Binder	10	10	10
Molasses	15	15	15
Bone meal	3	3	3
Premix	1	1	1
Salt	1	1	1
Total	100	100	100

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relative preference and acceptability lasted 14 days with 7 days adjustment (acclimatization) and 7 days data collection periods respectively and was carried out using the cafeteria method (Ogunbosoye and Otukoya. 2014). Feed block was weighed before giving to the animals. The feed resources preferred was assessed from coefficient of preference (COP) value, calculated from the ratio between the intake of individual feed resource and the average intake of the feed resources. Therefore, feed block was inferred to be relatively acceptable provided the COP was greater than unity.

Chemical analysis

Blocks samples were analyzed for proximate (AOAC,2000) and fibre fractions (Van Soests *et al*., 1991).

Cost analysis

The cost analysis of feed block from the different binders was estimated using the prevailing prices of the various ingredients in the Nigerian Naira (N) at the time of the study (Mohammed *et al*., 2007).

Statistical analysis and design

Data obtained for all determined parameters were subjected to one-way analysis of variance (ANOVA) procedure using SAS package of (2010). Significant means were separated using the least significant difference (LSD) at 5% probability of the same package.

RESULTS AND DISCUSSION

Chemical composition

The crude protein (CP) contents varied between (30.18%) and (32.71 %), the CP was highest in T2 (32.71%) and the least CP value was obtained from T1 (30.18%). These values were similar when compared to other reports (Asaolu, 2012; Aye, 2015). The high concentration of CP was a reflection of the high presence of urea, soybean cheese waste and probably *Gliricidia sepium*, a leguminous forage the block contained. Onwuka (1999) reported that high CP content of the feed block makes it suitable as a source of concentrated supplementary nitrogen necessary for microbial protein synthesis in the rumen. The crude fibre (CF) content was within the range of 4.26% to 4.50%. These values were similar to the values reported elsewhere (Asaolu, 2012) but at variance with the values obtained by Omoniyi *et al*. (2013). The variations may be due to varietal difference in the binder. Dietary fibre through microbial degradation and synthesis supplies energy to support maintenance, growth, lactation and reproduction (Lu *et al.*, 2005). The NDF ranged from 23.42% to 28.32%. The feed block had low content of

Table 2: Nutrient composition (%DM) of feed block (SNC) with different binders

PARAMETERS	T1(cement)	T2(cassava flour)	T3(industrial starch)
Dry matter	96.25	94.23	96.32
Ash	6.79	8.82	8.45
Crude protein	30.18	32.71	31.56
Ether extract	7.35	7.64	7.26
Crude fibre	4.26	4.50	4.42
NFE	44.73	56.51	51.53
NDF	23.43	28.33	27.52

NFE=Nitrogen free extracts, NDF=Neutral detergent fiber

Table 3: Hardness and compactness of feed blocks 7/21 days after molding

	Days of molding					
	7			21		
Parameters	T1	T2	T3	T1	T⅓	T3
Compactness	+	++	+++	+	++	+++
Hardness	+	+++	++	+	+++	++
Weight (kg)	2.3	2.9	2.7	2.1	2.2	2.2

Soft (+), Medium (++) and Good (+++)

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fibre. Since the voluntary DM intake and digestibility are dependent on cell wall constituent (fibre), especially NDF, therefore, the feed block is believed to be easily consumed by the animals (Table 2)

Hardness and compactness

Hardness and compactness of feed blocks has been described by Asaolu (2012) as an important aspect to be considered during block manufacturing. The result of the measurement of hardness and compactness is presented in Table 3. All the formulated feed block, resulted in blocks of comparable hardness and compactness (7 to 21 days) after casting. This is different from what was reported by Chenost and Kayouli (1997) who suggested that the blocks will dry and be ready for use after about (10days) when dried preferably in the shade as the strong sun can cause cracking in the blocks. However, T2 was adjudged to be of optimum hardness (+++) and compactness (+++) which will be too hard for the animals, while hardness and compactness of the T1 blocks was soft and will be too easy for the animals to consume, T3 hardness was observed to be moderate and compactness was observed to be good, not too hard and not too soft for the animals to break. This has the advantage of ensuring gradual release of urea to animals when fed such feed blocks, otherwise, urea toxicity will occur, as noted by Sansoucy *et al*., (1988). Herrera *et al*. (2007) and Asaolu (2012) observed that as block hardness increases, animal intake diminished. It was observed that T3 (industrial starch) produced a good hardness and compactness than T1 (cement) and T2 (cassava flour). This indicates that industrial starch can replace most cement as most animal welfare advocates are against the usage of cement in animal feed preparation.

Coefficient of preference

Presented in Table 4 is the coefficient of preference of the feed block among the diet. T3 was highly preferred, this may be because T3 was palatable with good smell of molasses and not too hard to consume by the animal. During the study period, the preference was not affected by the CP, as all the CP is within the range of requirement. T2 was least consumed and least preferred despite the fact that it has the highest CP. Refusal of it might be due to some factors like taste, odour and the hardness of the block (Karbo, 1993). The order of preference is T3> T1>T2 respectively.

Cost analysis of the feed block

Tables 5 presents the cost of producing the feed blocks. The cost effectiveness of the three formulations was estimated at current price of the feed ingredient in the market in Nigeria currency. The cost of production per

Table 4: Coefficient of preference of the feed block

DAY	T1(cement)	T2 (cement)	T3(industrial starch)
DAY 1	0.87^{a}	0.67^{a}	1.10^{a}
DAY 2	0.92^{a}	0.97^{a}	1.11^{a}
DAY 3	1.02^{a}	0.83^{b}	1.19^{a}
DAY 4	1.00^{b}	0.83^{c}	1.22^{a}
DAY 5	0.96^{a}	0.92^{a}	1.17^{a}
DAY 6	0.93^{b}	0.91^{b}	1.25^{a}
DAY 7	0.94^{b}	0.86^{b}	1.24^{a}

abc= Means (average of 3 analyses each) in different columns with the same superscript are not significantly different (p>0.05).

Table 5: Number of blocks produced per 15kg formulation and cost per block in Naira (₦)

	T1(cement)	T2 (cassava flour)	T3 (industrial starch)
Number of blocks	10	8	8
Cost formulation (₦)	975	1209	1284
Cost/ 2kg block (₦)	108	151.1	160.5
Cost/1kg block (₦)	54	75.55	80.25

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15kg formulation ranged from ₦975 – ₦1, 284. Highest production cost was recorded in T3 with ₦1, 284 which was as a result of high price of the industrial starch binder. The relatively higher cost of production of a feed block expressed in this experiment was basically due to the type of binder used in the formulation. The cost of production of a 15kg formulation of the feed blocks in this experiment was generally less than the cost range for feed blocks reported by Ibrahim *et al*., (2011) whose range was ₦2, 522 – ₦2, 835 and this variation is attributed to the type, quantity of the ingredients used in the production process and the cost of ingredient at that time. Notwithstanding, the cost of producing one multi-mineral block ranged from ₦54 – ₦80.25 per block production is moderate and affordable by local agro-pastoral farmers in the study area.

CONCLUSION

Shea nut cake (SNC) with other agro industrial by-products combined with urea could be a ready-made feed at cheap and affordable cost to improve ruminant production to solving perennial feed shortage during dry season period of the year. The acceptance of the feed block during the study proved its utilization by the animals.

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