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Digestibility and nutrient intake of mango (Mangifera indica) kernel meal based diets by growing West African dwarf sheep feed rice straw.

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Abstract

Mango kernel, a residue after the flesh/juice has been extracted, and usually considered a waste, could be utilized as animal feed. Trials were therefore conducted to evaluate its potential as a feed resource. Performance of sixteen yearling West African Dwarf rams were evaluated using rice straw as basal diet and four levels of mango kernel meal (MKM, 0, 50, 75 and 100%) as concentrate supplements. The four diets (T0, T50, T75 and T100) were fed in a completely randomized design with four replicates to the ram at 2% of body weight, while the rice straw was fed ad-libitum daily. There were no significant (P>0.05) differences in the performance of the animals fed the four diets. On dry matter intake, digestibility was highest in T3 (72.28%) which was significantly different from diets T1, T2 and T4 (65.10, 65.57 and 65.36%). Nutrient digestibility in T3 for CF, EE and NFE was best and differed significantly (P<0.05) from those in T1, T2 and T4. There were however, significant differences (P<0.05) in digestible nutrient intake. Crude fiber intake was highest in T3 (128.02 g/kg LW0.75) which were significantly different (P<0.05) from diets T1 and T2 (107.53 and 113.25 g/kgLW0.75, respectively). Ether extract intake followed the same trend as CF.

Keywords: Digestibility, Nutrient intake, WAD sheep, Unconventional feed, Mango kernel.

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Introduction

The problem of animal protein scarcity in Nigeria and other developing nations has attained a deplorable status which calls for urgent remedy to avert the imminent protein malnutrition [1]. Animal protein content of the diets of most Nigerians is very low and has reached a crisis level [2]. More than half the cost of raising most farm animals is accounted for by the feed [3]. A lot of efforts, time and resources have been invested in searching for alternative high energy feed sources for domestic animals. To salvage this nutritional problem, there is need for utilization of other cheap and indigenous sources of protein and energy particularly those that attract no competition from man and other types of livestock [4]. Mango kernel, which is not consumed by human beings, is a potential feed ingredient. Mango kernel is a good source of soluble carbohydrate; its protein is comparable to that of maize with higher fat than maize [5,6]. Rice straw, a fibrous agricultural residue is a by-product of paddy rice threshing. It is relatively more digestible than other straws and stovers and can be used in feeding ruminants [7]. Ruminant animals have a distinct advantage over monogastric animals being capable of converting fibrous organic materials that are unsuitable for human consumption, into products of high nutritive value to man. Nutritional constraints have been implicated as one of the major problems militating against small ruminant production in Nigeria [8]. This is especially so during the dry season when scarcity of feed materials exists. The objective of this study was to evaluate the effect of diets containing various levels of mango kernel as supplement on nutrient digestibility and intake of Sheep fed rice straw diet.

Material and Methods

The experiment was conducted at the Sheep and Goat Unit of the Livestock Teaching and Research Farm of the University of Agriculture Makurdi in Benue State. Makurdi is located at latitude 7 43′N and longitude 8o 3′E and lies within the Southern Guinea savannah region of Nigeria. Mango seed was collected during the month of May (peak of the mango ripening season). The kernel was obtained by cutting the mature seed open with a knife. The fresh kernel was chopped to reduce the particle size, sun-dried until crispy (less than 10% moisture). The dried kernel was ground and used in the formulation of the experimental diet. Rice straw was obtained from a farm within the University of Agriculture Makurdi premises, after the farmer had harvested and threshed out the grains. It was chopped into smaller pieces of 10-15 cm length using a cutlass and a chopping plank. The chopped rice straw was then packed into synthetic sacs, stored and used in feeding the animals. Sixteen (16) yearling West African Dwarf (WAD) rams were used. The rams were quarantined for six weeks. The animals were given a complete course of antibiotics and multivitamin. They were treated against all primary infections to produce a uniform health status and were then vaccinated against Peste des Petitis ruminante (PPR) using the PPR vaccine. The animals were weighed and randomly allocated to four treatment diets with four replicates i.e., each animal served as a replicate, thus adopting a completely randomized design (CRD). Four concentrate supplements designated I, II, III and IV were formulated such that mango kernel meal (MKM) and maize offal (MO) were mixed at the ratios of 0:100, 50:50, 75:25 and

100:0 respectively and used at 37% level. Palm kernel cake (PKC), Dried brewers grain (DBG), Bone ash and common salt were added at the rate of 20, 40, 2 and 1%, respectively to each supplement at presented in Table 1**.**

The animals were fed the experimental diets for seven days to allow for adjustment before data collection commenced. Each animal was fed 2% of its body weight/head/day of the concentrate supplement from 09.00 to 12.00 hours. The animals were served rice straw and clean drinking water *ad libitum*. The animals were weighed weekly. Altogether, the study lasted for 77 days. Feed intake per ram was recorded while feed conversion ratio (FCR) was obtained from the ratio of feed intake to body weight gain (BWG). A digestibility trial was conducted in the last week of the experiment using metabolism crates. Faecal output from each animal was quantitatively collected daily, weighed and dried to constant weight to determine their dry matter content. Replicate lots of the samples were then bulked, thoroughly mixed, sub sampled and milled using a hammer mill equipped with a 2 mm sieve. Homogenous samples of the experimental diets i.e., T1, T2, T3, T4, mango kernel meal (MKM), maize offal (MO), rice straw (RS) and the faecal samples were analyzed for their proximate nutrients composition as described by AOAC [9]. Data generated from the trial were subjected to analysis of variance (ANOVA) using Minitab statistical software according to operational manual [10] for Completely Randomized Design (CRD). Significant means were separated using New Duncan's Multiple Range Test [11].

Results and Discussion

The result of the nutrient digestibility and intake of sheep fed rice straw supplemented with concentrate containing various levels of mango kernel meal based diets are presented in Tables 2 and 3. The high DM content of MKM enhanced dry matter digestibility in the animals fed diets II and III and IV. This agrees with the report of Ogundipe [12] who reported that, a certain minimum daily dry matter intake is essential to satisfy an animal's appetite and to permit the proper functioning of the digestive tract. The digestibility of nutrients was best with diet III. The DM, CP, CF, EE and NFE of diet III were most digested by the sheep. Animals fed 75% MKM had the highest CP digestion. This might implied that the protein supplied at 75% level of MKM supplementation could provide adequate protein that would support the rumen microbial activities fermentation which in turn facilitate a better digestibility. The crude fibred intake and CF digestibility were better in the MKM diets. This suggests good source of roughage that could enhance rumination and prevent digestive disorder in the rumen [13]. The ether extract intake was best in diet III and IV than diets I and II which followed the same pattern with the digestibility. In general, the nutrient digestibility was better in sheep that consumed diets containing various levels of mango kernel meal and had better feed conversion ratio than the animals fed diet I i.e., the diet without MKM.

Table 1. *Composition of experimental diets.*

Nutrients %	T1 (0%MKM)	T2 (50%MKM)	T3 (75%MKM)	T4 (100%MKM)
Mango kernel meal(MKM)	0.00	18.50	27.75	37.00
Maize offal	37.00	18.50	9.25	0.00
Palm kernel cake	20.00	20.00	20.00	20.00
Dried brewer grain	40.00	40.00	40.00	40.00
Bone ash	2.00	2.00	2.00	2.00
Salt	1.00	1.00	1.00	1.00

Table 2. *Dry matter and nutrient digestibility (%) of sheep fed rice straw supplemented with concentrate containing various levels of mango kernel meal.*

Nutrients	T1 (0%MKM)	T2 (50%MKM)	T3 (75%MKM)	T4 (100%MKM)	SEM
Dry matter	65.10^{b}	65.57^{b}	72.28^{a}	65.53^{b}	3.62
Crude protein	74.73	70.25	81.87	73.78	13.94ns
Crude fibre	67.88^{c}	72.28b^{c}	77.23^{a}	73.85^{ab}	4.58
Ether extract	46.93^{b}	46.44^{b}	61.41^{a}	55.53^{a}	7.20
Nitrogen free extract	76.31^{c}	77.42^{b}	79.52^{a}	75.06^{d}	0.40

$^{a-c}$Means in the row with similar letter(s) are not significantly different at the 5% level.
ns: Not significant; SEM: Standard Error of the Mean Difference; MKM: Mango Kernel Meal.

Table 3. *Digestible nutrient intake (g/kgLW0.75) of sheep fed rice straw supplemented with concentrate containing various levels of mango kernel meal.*

Nutrients	T1 (0%MKM)	T2 (50%MKM)	T3 (75%MKM)	T4 (100%MKM)	SEM
Dry matter	40.48^{b}	38.71^{b}	43.47^{a}	38.69^{b}	2.25
Crude protein	9.86^{b}	8.96^{c}	10.85^{a}	9.82^{b}	0.77
Crude fibre	2.28^{b}	2.28^{b}	2.95^{a}	2.74^{a}	0.34
Ether extract	5.27^{b}	4.97^{b}	7.37^{a}	6.51^{a}	1.12
Nitrogen free extract	27.83^{a}	26.60^{ab}	25.83^{b}	23.26^{c}	1.93

$^{a-c}$Means in the row with similar letter(s) are not significantly different at the 5% level.
ns: Not significant; SEM: Standard Error of the Mean Difference; MKM: Mango Kernel Meal.

Conclusion

The nutrient digestibility and intake resulting from supplementation of sheep fed rice straw with mango kernel meal diets, indicate that mango kernel meal can be utilized as an unconventional feedstuff as supplement for ruminants during the long dry season.

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