Effect of Feeding Locust Bean on Nutrient Intake and Digestibility of Rabbits

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Abstract

This study was conducted to determine the dietary effect of roasted locust bean meal (LBM), an unconventional plant protein source, on the nutrient intake and digestibility of rabbits. The experiment was carried out using forty male and female Dutch and Chinchilla rabbits, between six to eight weeks old with an average initial live weight of 950g. The rabbits were randomly allocated to four dietary treatments, with ten rabbits per treatment and two rabbits per replicate. The experimental design used was the completely randomized design (CRD). Locust bean was roasted at about 80°C for about four to five minutes. The heat treated locust bean was milled into a coarse meal (LBM) and this was used in compounding the experimental diets. Treatment 1 (control) was maize-soybean based diet with 0% LBM while treatments 2, 3 and 4 contained 10, 20 and 30% LBM in the diets respectively. Diets were isonitrogenous and isocaloric. Nutrient intake and digestibility of rabbits were evaluated during the feeding trial which lasted for five weeks. Dry matter intake (DMI), organic matter intake (OMI), crude protein intake (CPI), acid detergent fibre intake (ADFI) and neutral detergent fibre intake (NDFI) and nutrient digestibility; dry matter digestibility (DMD), organic matter digestibility (OMD), crude protein digestibility (CPD), acid detergent fibre digestibility (ADFD) and neutral detergent fibre digestibility (NDFD) all showed non-significant differences among dietary treatments. The results obtained exhibited that LBM can be included up to 30% in the diets of weaner rabbits without negatively affecting nutrient intake and digestibility.

Keywords: Nigeria, locust bean, unconventional protein sources

1. Introduction

The increasing cost of the conventionally used protein sources for animal feeding is a challenge in many developing countries, particularly Nigeria. The high costs of animal feedstuff particularly of protein origin tend to suggest that alternative protein sources are to be explored. The major conventional protein feedstuffs (soybean and groundnut cake) are greatly relied on for use in feed formulation, thus resulting in escalating cost of these conventional protein sources. The replacement of expensive conventional protein feed ingredients with cheap locally available substitutes in feed formulation is, therefore, necessary [1]. There exist numerous species and varieties of plant protein sources that are yet to be exploited or under-utilized for livestock nutrition. Some of these novel sources may have promising and desirable nutritive quality for future inclusion in the diet of animals. Future use of non-conventional feed ingredients in farm animal nutrition is a possibility if efficiently and properly exploited. Sources of protein for animal feeds are many and varied, with considerable opportunities for further diversification and substitutions. However, more research is required on alternative sources before many of the opportunities can be exploited in practice [2].

One of this unconventional plant protein sources which have the potential for inclusion in animal feed is locust bean. Locust bean has a wide distribution ranging across the Sudan and Guinea Savannah ecological zones. The range extends from the Western coast of Africa in Senegal across of Sudan. Locust bean is found in nineteen Africa countries; Senegal, Gambia, Guinea-Bissau, Sierra Leone, Mali, Cote d' Ivoire, Burkina Faso, Ghana, Togo, Benin, Niger, Nigeria, Cameroon, Chad, Central African Republic, Zaire, Sudan and Uganda [3]. According to [4] who reported that the protein content of locust bean seed (in percentage dry matter) of seeds with and without hull was found to be 28.20% and 32.40% respectively while that of the pulp was 1.84%.

Research studies and information about the use of roasted locust bean in rabbit diets is scarce. It is against this background that the present study was undertaken to evaluate the effect of the dietary inclusion of locust bean, an unconventional plant protein source on the nutrient intake and digestibility of rabbits.

2. Materials and methods

2.1 Processing of the locust bean seed

The roasting of locust bean was at the temperature of about 80°C, with constant stirring to enhance even distribution of heat. The duration of the roasting took four to five minutes, it was allowed to cool and then milled in a hammer mill.

2.2 Feeding Trial

The heat treated locust bean meal (LBM) was used in compounding iso-nitrogenous and isocaloric experimental diets (Table 1).

The experiment was carried out using a total of forty male and female Dutch and Chinchilla rabbits, between six to eight weeks old, with an average initial live weight of 950g. The rabbits were randomly allocated to four dietary treatments, with ten rabbits per treatment and two rabbits per replicate. The experimental design used was the completely randomized design (CRD). Treatment 1 (control) was a corn-soybean based diet with 0% LBM while treatments 2, 3 and 4 contained 10, 20 and 30% LBM in the diets respectively. Animals were fed a pre-experimental diet for a period of seven days. Before the commencement of the experiment, the rabbits were weighed and allocated to metabolic cages. Animals were provided with feed and water *ad libitum*. In the fourth week of the feeding trial, a faecal collection was done for seven days. The faeces were dried, bulked and weighed for nutrient digestibility determination. The acid detergent fibre (ADF) and neutral detergent fibre (NDF) of the samples were determined by the method of [5]. Data obtained were subjected to the analysis of variance [6].

Table 1: Ingredient and chemical composition (%) of roasted locust bean meal based diets fed to rabbits

Ingredients	LBM 0%	LBM 10%	LBM 20%	LBM 30%
Maize	36	33	30	26
Soyabean (full-fat)	20	13	6	0
Locust bean meal	0	10	20	30
Groundnut haulms	15	15	15	15
Maize offal	25	25	25	25
Bone meal	3	3	3	3
Salt	0.5	0.5	0.5	0.5
Min/vit/premix*	0.5	0.5	0.5	0.5
Total	100	100	100	100
Calculated analyses				
Crude protein	16.25	16.29	16.33	16.60
Energy (Kcal/kg)	2739	2740	2742	2743
Lysine (%)	0.69	0.71	0.74	0.79
Methionine + cystine (%)	0.51	0.50	0.49	0.49
Calcium (%)	1.20	1.21	1.22	1.24
Phosphorus (%)	0.79	0.77	0.76	0.76
Chemical analyses				
Dry matter	95.71	95.60	95.76	94.76
Crude protein	16.63	17.15	16.41	16.14
Crude fibre	6.13	7.14	7.80	8.85
Crude fat	4.35	5.01	6.37	7.21
Ash	8.01	7.46	7.38	7.48

*Premix (Agricare-mix®) supplied per kg of diet; Vitamin A 20,000IU; Vitamin D 4,000IU; Vitamin E 39.96 IU; Vitamin K 5.99mg; Riboflavin 12mg; Vitamin B_{12} 0.1mg; Pyridoxine Hcl 7mg; Cal-D-Panthothenate 30mg Nicotinic acid 70mg; Folic acid 2mg; Biotin 0.2mg; Potassium 0.41%; Sodium 0.30%; Copper 24mg; Manganese 110mg; Zinc 100mg; Iron 110mg; Selenium 0.3mg; Calcium 0.22mg; Iodine 3mg; Choline 1000mg; Butylated hydroxytoluene (BHT) 140mg and Zeolex 50mg.

3. Results

Nutrient intake and digestibility of rabbits fed diets containing graded levels of roasted locust bean are presented in Table 2. Nutrient intakes (DMI, OMI, CPI, ADFI and NDFI) were not significantly influenced by dietary treatments. Dry matter intake varied from 52.88g for rabbits on 10% LBM based diet to 58.14g for those on 0% LBM based diet. Organic matter intake ranged from 48.93g for rabbits fed 10% LBM based diet to 53.48g those fed 0% LBM based diet. Crude protein intake had values ranging from 8.95 to 10.25g. The range of values obtained for ADFI was 7.04 - 7.77g and for NDFI was 10.71 - 13.18g. Results on the digestibility of nutrients exhibited a non-significant treatment effect of diets. Dry matter digestibilities for rabbits on 0, 10, 20 and 30% dietary levels of LBM were 69.64, 67.96, 67.65 and 67.35% respectively. Slight decreases in dry matter digestibility were

observed with increasing level of LBM in the diets, although the differences were not significant. The range of values obtained for OMD was (71.14 - 74.14%), CPD (81.56 - 86.29%), ADFD (30.24 - 33.83%) and NDFD (42.93 - 48.08%).

Table 2: Nutrient intake and digestibility (%) of rabbits fed diets containing graded levels of locust bean meal

Parameters	Dietary levels of locust bean meal (%)				SEM
	0	10	20	30	
DMI (g)	58.14	52.88	57.70	55.47	3.24 ^{NS}
OMI (g)	53.48	48.93	53.44	51.32	3.00 ^{NS}
CPI (g)	10.25	9.07	9.47	8.95	0.54 ^{NS}
ADFI (g)	7.77	7.04	7.65	7.41	0.43 ^{NS}
NDFI (g)	13.18	10.71	12.07	12.84	0.69 ^{NS}
DMD	69.64	67.96	67.65	67.35	1.38 ^{NS}
OMD	74.14	72.71	71.14	72.77	1.82 ^{NS}
CPD	85.89	83.17	81.56	86.29	1.00 ^{NS}
ADFD	33.83	31.45	30.24	32.32	1.30 ^{NS}
NDFD	43.67	42.93	43.55	48.08	1.85 ^{NS}

DMI = Dry matter intake DMD = Dry matter digestibility
OMI = Organic matter intake OMD = Organic matter digestibility
CPI = Crude protein intake CPD = Crude protein digestibility
ADFI = Acid detergent fibre intake ADFD = Acid detergent fibre digestibility
NDFI = Neutral detergent fibre intake NDFD = Neutral detergent fibre digestibility
SEM = Standard error of mean
NS = Not significant

4. Discussion

The results of this study showed that the intake of nutrients (DMI, OMI, CPI, ADFI and NDFI) were not significantly affected by dietary treatments. The DMI values fell within the range of 52.88g for rabbits fed 10% dietary level of LBM to 58.14g for those fed 0% dietary level of LBM. The OMI, CPI, ADFI and NDFI values were also in the range of 48.93 - 53.48g; 8.95 - 10.25g; 7.04 - 7.77g; and 10.71 - 13.18g respectively. There was no consistent trend in the values obtained for all these parameters. The values for DMD obtained in this study for rabbits fed varying dietary levels of locust bean meal (LBM) fell between 67.35 and 69.64% which is close to the mean value of 68.46% reported by [7] for rabbits fed groundnut cake meal. The OMD was not significantly influenced by dietary treatments, the values obtained ranged from 71.14% for rabbits fed 20% LBM based diet to 74.14% for those fed 0% LBM based diet. Crude protein digestibility was also not significantly affected by dietary treatments; the values fell within the range of 81.56 - 86.29%. These values were very close to the range of 82.89 - 85.08% reported by [8] for rabbits fed graded dietary levels of whole pod of rain tree (*Albizia saman*). The ADFD was not significantly affected by dietary levels of LBM, rabbits on the 0% LBM based diet had the highest value of 33.83% and the lowest value of 30.24% was obtained for rabbits on the 20% LBM based diet. The NDFD of rabbits fed graded dietary levels of locust bean meal was in the range of 42.93 - 48.08% which is comparable with the mean value of 42.53% obtained by [7]. There is great potential in the future use of locust bean as a feed ingredient in animal diets. Recently, [9] reported up to 25% replacement of maize with African locust bean without adverse effect on their experimental animals. Additionally, [10] observed improved nutrient retention in broilers fed African locust bean. These research outcomes are indicative of the potentials of locust bean and the possibility of its future utilization in feed formulation.

5. Conclusion

It is of paramount importance that animal nutrition research studies should focus on the utilization and processing of unconventional protein ingredients. This will allow them to be properly evaluated as sources of protein and other nutrients for incorporation in livestock diets. There is the need to explore the utilization of unconventional feedstuffs in order to increase the protein resource base and so improve livestock productivity. Unconventional protein sources such as locust bean should be explored. Success was achieved by the dietary inclusion of up to 30% LBM without adversely affecting nutrient intake and digestibility.

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