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PERFORMANCE RESPONSE OF GROWING RABBITS FED DIFFERENT SOURCES AND LEVELS OF DIETARY FIBRE

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Target Audience: Rabbit scientists, animal nutritionists and feed millers

ABSTRACT

Two experiments were designed to investigate the effect of source and level of dietary fibre from five agricultural and industrial by-products corn cobs, (CC), Cowpea husk (CPH), Mango leaaves (ML), Sawdust (SD), and Rubber seed shells (RSS) on the performance of growing rabbits. In experiment 1, rabbits were fed diets in which the fibre sources were evaluated at 30% fixed level of inclusion.

Fifteen rabbits 1100g average initial weight, of mixed breeds and sexes were used for each experiment such that three individuallly caged rabbits served as replicates for each dietary treament. The feeding trial lasted for 56 days.

In Enperiment 1, weight gains of rabbits on diets containing CC and CPH were significantly (P<0.05) higher than those on the other diets. In experiment 2, the superior effect on weight gains were observed for CPH and ML-fed rabbits. The diets containing the material with the highest crude fibre level (Sawdust) was the least digestible. However digestibility was not consistently correlated with crude fibre content in Experiment 2. Feed and water consumption pattern, fiscal output amd carcass characteristics were not significantly influnced by either level or source of dietary fibre. In Experiment 1, rabbits on ML- diets had significantly higher stomach content than those on the other diets. The same effect was observed for ML and CC-containing diets in experiment 2.

On account of body weight changes, it would appear that cowpea husks, mango leaves and corn-cobs are superior to rubber seed shells and sawdust as a fibre source in rabbit feeding.

Keywords:- By product, fibre source, rabbit performance

DESCRIPTION OF PROBLEM

The potential for increase animal production through feeding of crop residues is high (1). It has been reported that on a worldwide scale, over 1.5 billion tons of crop residues are produced each year (2). Nigeria produces large quanties of agricultural and agro-indusrial by-products, which are regarded as non-conventional feed resources (3).

Recent reseach efforts in the nutrition of non-ruminant animals have focused on the use of agricultural by-products and residues, some of which are abundant and available all year round. The utilization of these products in livestock feeds is subject to some inherent constrains. Of particular importance are problems associated with procurement, storage, poor feed intake, high fibre content, toxic substances, low digestibility and low nutrient content, all of which result in poor animal performance (4).

High fibre materials, usually a constraint in poultry diets, are beneficial to rabbit for preventing enteritis (5). Determination of the optimum dietary fibre level has been one of the major aims of reseach in rabbit nutrition. Level of 100g kg-1 DM dietary fibre measured by the acid detergent fibre or crude fibre techniques has been recommended as the minimum requirement for optimum growth of rabbits (6). Dietary fibre may be defined as dietary fraction not digested by endogenous enzymes of the digestive tract (7). Fibre is a chemical compound, which can show somewhat variable characteristics depending upon its nature and source. Therefore, both the amount of fibre contained and its nature should be considered for any fibre material to be used in rabbit feeding.

This work was designed, therefore, to investigate the effect of fibre nature using five fibre source viz: cowpea husk (CPH), corn cobs (CC) mango leaves (ML), sawdust (D) and rubber seed shell (RSS), on growth ralated attributes caracass characteristics and digestive function of rabbits and to assess the influence of level of dietary fibre on these measurements when the fibre sources were included at a fixed level in the diet.

MATERIALS AND METHODS

Location of study

The study was carried out at the Rabbit Unit ot the Teaching and Research Farm of Ogun State University, Ago-Iwoye, Nigeria.

Origin and preparation of fibre sources

Cowpea husk (CPH) and corn-cobs (CC) were obtained from crops cultivated and processed on the University Farm. Mango leaves (ML) were collected arround the University Campus. Sawdust (SD) was collected from the Ogun State Rubber Plantation, Ikenne. All samples except sawdust were ground in a hammer mill (2.5mm screen) prior to feed mixing.
The proximate composition of the fibre sources according to standard methods (8) is shown in Table 1.

Experimental animals and management

Two experiments were undertaken concurrently. Thirty growing rabbits

Table 1: Gross Energy (MJ kg-1) and proximate components (g kg-1) of the fibre sources.

Fibre Sources	Dry Matter	Crude Protein	Crude fibre	Crude fat	Ash	Gross energy (MJkg-1)
Corn cobs	936.0	14.8	233.4	14.6	6.8	18.2
Cowpea husk	925.0	87.1	468.8	10.9	9.6	17.5
Mango leaves	898.0	84.8	308.0	113.4	10.5	17.9
Rubber seed shell	904.0	21.0	222.3	3.6	8.7	18.6
Sawdust	921.0	31.5	562.2	5.9	9.1	20.4

of mixed breeds and sexes weighing, on the average, 1100g were randomlyallotted to five dietarv treaments comprising three individually caged rabbits in each experiment. In experiment 1, each of the fibre sources was incorporated to contribute 120g kg-1 crude in the experimental diets, while in experiment 2 the different fibre sources were incorporated at 300g kg-1 fixed level of inclusion (Table 2). the rations were provided in a mash form and offered twice daily at a level that allowed ad libitum feeding. Water was supplied ad libitum. Quantities of feed and water consumed were recorded daily. Records of weight gain were kept weekly throughout the 56-day experiment. Feed conversion ratio was computed from records of weekly feed consumption and weight gain. Faecal output from rabbits

Table 2: Composition and nutrient content of experimental diets (g kg-1)

	Experiment 1					Experiment 2				
Ingredient:	CC	CPH	ML	RSS	SD	CC	CPH	ML	RSS	SD
Maize	156.0	447.3	339.2	140.0	483.5	311.0	311.0	311.0	311.0	311.0
Fish meal	70.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Soybean oil	80.0	-	70.0	80.0	-	40.0	40.0	40.0	40.0	40.0
Soybean meal	-	242.7	177.2	-	249.0	150.0	150.0	150.0	150.0	150.0
Full fat soybean	155.9	-	-	146.2	-	-	-	-	-	-
Blood meal	-	-	-	-	-	30.0	30.0	30.0	30.0	30.0
Bone Meal	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Oyster shell	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vit-Min Premix	5.0	5.0	5.0	5.0	5.0	10.0	10.0	10.0	10.0	10.0
Salt	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Rice husk	-	-	-	-	-	110.0	110.0	110.0	110.0	110.0
Fibre Source	514.1	256.0	359.6	539.8	213.5	300.0	300.0	300.0	300.0	300.0
Nutrient Content										
Crude fibre(g kg-1)	132.4	145.0	138.6	131.5	149.4	119.6	190.2	142.0	116.3	218.2
Crude Protein(g kg-1)	139.1	183.6	188.4	137.1	179.0	146.5	163.0	189.9	150.7	151.2
Digestible Energy (MJ kg-1 DM)	10.2	10.3	10.7	10.2	10.5	9.6	9.6	9.3	9.3	9.2

CC=Corn cobs; CPH=Cowpea husk; ML=Mango Leaves; RSS=Rubber Seed shell; SD=Sawdust were collected and weighed fresh and sub-samples dried later in the oven at 105°C overnight for dry matter digestibility measurements.

Carcass Evaluation

At the end of the experimental period, all the rabbits were fasted overnight, weighed in the following morning and slaughtered by neck dislocation. Each was dressed by removing the head at the atlas joint, the feet at the carpal joint and between the tibia and calcareous joint for the fore and hind feet respectively. The pelt was removed followed by evisceration along the median line of the belly to remove the entire gastro-intestinal tract. Data on carcass characteristics and gut dimensions were collected.

Analytical Techniques.

Chemical Analysis

Samples of test materials, experimental diets and faeces were subjected to proximate analysis acoording to standard methods (8).

Statistical Analysis

All the data collected in each experiment were subjected to a one-way analysis of variance (9) and differences among means tested by the Duncan's Multiple Range Test (10). Allocation of rabbits to dietary treaments ensured that rabbit weight, breed and sex were balanced as much as possible.

RESULTS

Table 3 shows the response of growing rabbits fed diets containing different levels of fibre sources (Experiment 1) and those fed diets containing fixed level of inclusion of the fibre materials (Experiment 2). In the two experiments, there were significant effects of dietary treatment only on daily weight gain (DWG). In experiment 1, weight gains of rabbits fed diets containing CPH and CC were significantly ($P<0.05$) higher than those on the other diets, whereas in experiment 2, the superior effect in weight gains was observed for CPH and ML fed rabbits. Differences in daily feed intake (DFI) as influenced by dietary fibre level followed the same trend as DWG (Table 3), though these were not significant.

Table 4 shows the mean value and standard errors for gut dimension and length of gastro-intestinal tract (GIT) for the two experiment. Table 5 summarises the effect of dietary treaments on carcass characteristics. Including the various fibre materials at a fixed level of crude fibre (120g kg-1) in the diets, had no significant effect on gut and carcass measurement, except the weight of the entire gut in which those of rabbits fed diets containing ML were higher ($P<0.05$) than those fed other fibre materials. Including the various fibre materials at a fixed level of inclusion (300g kg^{-1}) in the diet had significant ($P<0.05$) effect only on the content of the stomach of rabbits fed diets containing CC and ML which were higher than those fed the other fibre materials.

Table 3: Perfomance of Rabbits fed the experimental diets

	Experiment 1						Experiment 2					
Measurement	CC	CPH	ML	RSS	SD	SEM	CC	CPH	ML	RSS	SD	SEM
Daily feed intake(g)	61.6	67.2	61.9	52.8	67.1	12.96	53.7	72.8	75.5.	707.	+	15.8
Daily weight gain(g)	9.5b	13.1b	7.1a	8.7a	8.5a	1.1*	11.7b	14.3b	17.2c	7.6a	+	1.4*
Daily water intake(l)	0.32	0.36	0.37	0.34	0.31	0.05	0.31	0.38	0.34	0.41	+	0.06
Daily dry Matter faecal output(g)	38.1	28.6	30.7	43.6	3.9	10.4	31.3	43.5	44.0	49.9	55.6	10.1
Feed conversion ration (g) Feed/g.gain)	7.5	5.2	6.6	8.7	7.9	1.9	4.6	5.5	4.4	9.9	+	1.34
Dry Matter Digestibility (%)	40.4	50.5	31.6	30.1	56.9	21.2	33.3	39.1	42.8	18.6	8.20	18.3

* Means having different superscripts are significantly different from one another ($P<0.05$).

\+ Digestibility figure was for the only surviving rabbit in Experiment 2. The other two replicates died after a few weeks on the sadust diet. ANOVA CC = Corn cobs; CPH = Cowpea husk; ML = Mango Leaves; RSS = rubber seed shell; SD = Sawdust.

SEM = Standard error of difference between means.

There were no significant effects of dietary fibre or level on all the carcasss characteristics measured.

Table 5: Carcass characteristics of Rabbits fed the experitment diets

	Experiment 1			Experiment 2		
Fibre Source	Dressing %	Weight of thigh (g)	Weight of liver(g)	Dressing %	Weight of thigh (g)	Weight of liver (g)
Corn Cobs	50.4	134.3	33.0	56.7	136.7	34.7
Cowpea Husk	51.4	130.0	35.3	56.6	135.3	32.7
Mango Leaves	50.5	133.7	41.7	54.2	136.7	31.0
Rubber Seed	46.2	132.3	30.7	55.6	145.7	37.0
Shell Sawdust	50.8	139.3	28.7	-	-	-
SEM	1.22	5.38	7.24	3.50	13.64	2.59

DISCUSSION

The diets formulated in experiment 1 had a fairly constant level of fibre from 132gkg-1 in diet containing RSS to 149kg-1 in the diets based on SD. The major difference in these diets was in the nature of the fibre source contributing the bulk of dietary fibre on the performance of rabbits since the various fibre materials, incorporated at a fixed rate of 300gkg-1 in the diet, generated diets ranging in crude fibre from 116.3kg-1 in the diet containing RSS to 218.2gkg-1 in the diet containing SD. It would appear from these results that cowpea husks and mango leaves or corn cobs are superior to the other fibre sources in growth promotion in rabbits. In spite of contributing a medium (142.0g kg-1) or a high (190.2g. kg-1) level of fibre respectively in the diets (Table 2), both mango leaves and cowpea husks appeared to have promoted sufficiet feed intake which resulted in better weight gains of rabbits fed diets containing them than those fed the other dietary treatments. Dietary fibre seemed to have influenced weight gain though limiting feed intake and in this regard, the nature of fibre appeared to be more important than fibre level in the diet.

The observed lack of significant effects of fibre on feed intake in this study is contrary to reports that increasing dietary fibre level increase dry matter intake of rabbits (11,12,13).

It has been reported that dietary fibre level for rabbits should be in the range of 150-200g kg-1 (14) as a high dietary fibre level in excess of 200g kg-1 may lead to caecal impaction and energy intake limitation (15). The somewhat peculiar nature of sawdust combined with its high level of inclusion in the diet (Experiment 2) resulting in high dietary level of 218.2g kg-1 may have led to poor performance of rabbits on the diet characterized by response of the only surviving rabbit on the diet.

Comparing the weight gain results in the current studies earlier work (16) shows some discrepancies, which may be related to cultivar variations in the sample of fibre materials evaluted which in turn may have influenced their chemical composition, for example, while the corn cobs, cowpea husks and sawdust samples evaluated in the current study had crude fibre contents of 233,469 and 562g kg-1 respectively, similar materials reported earliar (17) contained 284,231 and 355g kg-1 crude fibre.

The apparent digestibility results of experiment 2, though not significant (P>.05) seem to support the weight gain data with regard to the probable superiority of the nature of fibre in cowpea husks, corn cobs and mango leaves over those of rubber seed shells and sawdust.

Fibre is known to shorten transit time of diets in man (18). It plays a key role in digestive physiology and particular in the regulation of gastro-intestinal transit time. A low fibre diet decreases intestinal motor function (!9) while addition of fibre in the diet restores normal transit time (20) in rabbits. Low dietary fibre levels have been reported to promote higher retention period of digesta in the gut and to improve digestion and absopption of nutrients (21,22).

The nature of the particular fibre in question and the influence of such on transit time may be responsible for the observation in the current study where corn cobs and mango leaves seemed to have prolonged transit time relative to the other materials thus yielding greater bulk of material in the gut at sampling. The nutritional implication of the above is that these materials would spend relatively longer time in the gut for improved digestion and absorption of nutrients. This may have been responsible for the slightly (though not significant) better apparent digestibility values recorded for mango leaves, corn cobs and cowpea husks in experiment 2.

The lack of significant influence of source and level of fibre on carcass quality indicate that within the range of crude fibre levels and sources evaluated, the comparative ability of the different materials in promoting carcass quality attributes were same.

CONCLUSIONS AND APPLICATIONS

The data from this investigation have demonstrated that both the level and the nature of fibre in agricultural and industrial by-products seem to have significant inpact on rabbits performance particular rate of growth and on gut dimension and its contents. While these preliminary information are, at the moment, useful in appreciating the nutritional diversity of these potential feeding entities, it is crucially important that more detailed information be availabe on their complete fibre characterization, their effect in dietary nutrient utilization and processing intervention which may be needed to bring about their enhanced application in rabbit feeding. These will be our future research focus in this area of rabbit nutrition.

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