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Influence of Crop Residues as Major Fibre Sources in Diets on Growth Indices of Rabbits

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Abstract

Crop residues are a sustainable feed resource for livestock production in Nigeria. Incorporation of fibre in the diets improves the nutrition and gut health of rabbits. Corn cob, rice straw, groundnut and cowpea stovers, millet straw, sugarcane tops are a few of the available crop residues in Nigeria. In a study, conventional maize offal (MO) was replaced by corn cob (CC) and rice straw (RS) as fibre sources in the diets of growing rabbits. Eighty four growing rabbit bucks of New Zealand White × Chinchilla crosses weighing 746 ± 2.3 g were randomly allocated to seven dietary treatments, with twelve rabbits per treatment at three replicates of four rabbits per replicate in a 56-day feeding trial. The experiment was laid as completely randomized design in which corn cob and rice straw were each used to replace a proportion of the 30% MO in the control diet at three graded levels to have seven dietary treatments labelled: Control, 10% CC, 20% CC, 30% CC, 10% RS, 20% RS and 30% RS. All the diets were pelleted. Daily dry matter intake (64.5 ± 0.4 g day⁻¹) of rabbits on 20% CC based diets was found to be higher ($P > 0.05$) than the MO based control diet (59.0 ± 2.4 g day⁻¹). Feed cost per kilogram gain was lowest ($P > 0.05$) on 20% CC based diet (₦515 ± 60.9), against ₦612 ± 155.1 for the control, while the highest feed cost per kilogram gain was found for the 30% RS based diet (₦763 ± 183.9). There was significant difference in carcass weight for rabbits that consumed 20% CC based diet (1629 ± 161.6 g) as compared to the rabbits fed 30% RS based diet (1243 ± 101.3 g), but comparable to the control (1542 ± 61.6 g). Increasing levels of CC in the diet increased the length of small intestine of rabbits but a contrary observation was recorded for rabbits fed RS based diets. In conclusion, replacing the conventional maize offal with corn cob up to 67% in the diet of growing rabbits was more economical, improved carcass weight, and did not compromise growth performance.

Keywords: Carcass characteristics, crop residue, growth performance, livestock production, Rabbits

Introduction

The scarcity and high cost of conventional fibre sources such as maize offal and wheat offals used in livestock feed is a major limiting factor to large scale commercial rabbit production in Nigeria. Therefore to increase rabbit production, it is important to develop appropriate and cost effective feeding systems. The increasing scarcity of animal protein and high cost of the

conventional feedstuffs in developing countries can therefore be solved by incorporating forages in the diets of rabbits (Bawa *et al.*, 2008).

Cereal crop residues are cheap, readily available all-year round in Nigeria, and also contain high fibre which is very important in rabbit diets. Some of these cereal crop residues present in Nigeria are corn cobs and rice straw. Despite the high demand for these crop residues for the ruminants, large quantities are still unused year after year (Bawa *et al.*, 2008). This study therefore, was designed to evaluate the influence of replacing maize offal with varying levels of corn cob and rice straw on the performance and carcass characteristics of growing rabbits.

Materials and Methods

The study was carried out at the Rabbitry Unit, Department of Animal Science, University of Ibadan, Ibadan, Nigeria. Eighty four young rabbit bucks of mixed breeds (New Zealand White x Chinchilla) with an average initial weight of 746 ± 2.3 g were used for the trial. The animals were randomly allocated to seven dietary treatments, with twelve rabbits per treatment at three replicates of four rabbits per replicate. The experiment was laid as completely randomised design in which corn cob (CC) and rice straw (RS) were each used to replace a proportion of the 30% maize offal in the control diet at three graded levels to have seven dietary treatments labelled: Control, 10% CC, 20% CC, 30% CC, 10% RS, 20% RS and 30% RS (Table 1). Feed and water were served *ad-libitum* for fifty six days. The animals were allowed adjustment period of two weeks before performance data were taken. The animals were weighed weekly. Data collected were used to compute daily feed intake, daily weight gain and feed to gain ratio.

Table 1: Gross Composition of Experimental Diets Fed to Rabbits

Parameter (%)	Control	Corn cob based diets (%)			Rice straw based diets (%)		
		10	20	30	10	20	30
Maize	20	20	20	20	20	20	20
Maize offal	30	20	10	-	20	10	-
Corn cob	-	10	20	30	-	-	-
Rice straw	-	-	-	-	10	20	30
Soyabean meal	20	20	20	20	20	20	20
Palm kernel cake	21.5	21.5	21.5	21.5	21.5	21.5	21.5
Others*	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Total	100	100	100	100	100	100	100
Analysed Composition :							
Crude Protein (%)	17.75	17.03	16.69	16.10	17.18	16.76	16.13
Crude Fibre (%)	10.16	12.05	13.30	14.15	12.50	13.96	14.48
Ether Extract (%)	6.29	6.10	6.01	5.60	5.79	5.65	5.35
NDF (%)	29.19	33.26	35.18	38.89	32.01	34.87	37.10
ADF (%)	14.15	17.06	20.19	22.37	17.45	21.01	23.99
ADL (%)	5.66	6.15	7.29	7.40	7.63	8.21	8.33
Energy (KcalME/g)	2.58	2.55	2.52	2.51	2.52	2.49	2.43

*Others: Cassava flour = 5%, DCP = 2%, Oyster shell = 1%, Table salt = 0.25%, Premix = 0.25%, NDF = Neutral Detergent Fibre, ADF = Acid Detergent Fibre, ADL = Acid Detergent Lignin

At the end of the feeding trial, four rabbits were selected from each treatment based on the group average weight and starved of feed overnight and then slaughtered for carcass

evaluation. Skinning and evisceration of the carcasses were carried out, the internal organs were weighed separately and expressed as percentage of live weight. The dressed carcasses were then cut into primal parts and each part expressed as a percentage of the dressed carcass.

Statistical Analysis

The data generated were then subjected to analysis of variance (ANOVA) using SAS (2003) statistical software package, and where significant differences were observed, the means were compared using Least Significant Difference (LSD).

Results and Discussion

Growth Performance of Rabbits fed Corn Cob and Rice Straw Meal based diets

Table 2 shows the results of the growth performance of rabbits fed corn cob and rice straw based diets. There were no significant ($P>0.05$) differences in all the growth parameters measured among dietary treatments. This is an indication that corn cob and rice straw can replace corn bran in the diets of growing rabbits without adverse effects on growth performance. This result corroborates the report of Ansah *et al.* (2014) when rabbits were fed four different agro-industrial by-products and observed no significant difference in average final weight, daily dry matter intake and average daily weight gain. Feeding corn cob and rice straw meals to rabbits was equally found to be economical because there were no significant differences in the feed cost per kilogram gain of the treatments compared with the control. The result agrees with the findings of Mohammed *et al.* (2015) who replaced maize with yam and irish potato peel meals in growing rabbits' diets and observed reduction in feed cost per kilogram gain.

Table 2: Growth Performance of the Growing Rabbits fed Corn Cob and Rice Straw - based diets

Parameters	Control	Corn cob based diets (%)			Rice straw based diets (%)			P-value
		10	20	30	10	20	30	
Av. Initial Wt.	748.17± 3.17	747.42± 0.63	746.83± 2.04	751.08±1. 53	748.08± 3.84	750.58± 1.53	749.33± 3.25	0.20
Av. Final Wt.	1794.39± 78.19	1619.28± 162.19	1745.50± 69.54	1628.00± 3.70	1599.17± 126.26	1606.11± 99.94	1473.33± 136.64	0.52
DM Int.(g/day)	58.97± 2.36	61.78±3.06	64.50±0.39	63.56±0.45	60.84±2.65	60.83±0.40	62.30±3.22	0.51
ADG(g/day)	18.02± 1.22	16.06±2.49	17.30±0.35	15.66±0.05	15.20±2.22	14.16±1.05	13.21±2.31	0.49
FCR	5.02± 1.27	5.42±0.84	4.74±0.60	5.21±0.23	5.32±0.80	5.90±1.57	7.76±2.28	0.22
FC/D (₦)	7.71± 0.31	7.55±0.37	7.55±0.05	7.02±0.05	7.62±0.33	7.15±0.08	6.96±0.36	0.30
FC/Kg Gain(₦)	612.03± 155.06	625.52± 97.15	515.26±60.92	532.33±23.80	616.93±92.43	551.80± 241.29	763.37±183.93	0.32

DM Int = Dry Matter Intake, ADG = Average Daily Gain, FCR = Feed Conversion Ratio, FC/D = Feed Cost per rabbit per day, FC/Kg gain = Feed Cost per Kg gain.

Carcass and Organ Characteristics of Rabbits fed Corn Cob and Rice Straw Meal based diets

Table 3 shows the result of the carcass and organ characteristics of the rabbits. There were no significant differences in carcass characteristics in this study except carcass weight and length of small intestine. The observed carcass weight for 20% CC (1629.25g) was found to be the highest and significantly different from 1242.50g recorded for 30% RS, but similar to others. The non-significant difference observed in the weight and length of the viscerals and the

abdominal fat in this study is in line with the observation of Houndonougbo *et al.* (2012) when rabbits were fed palm press fibre-based diets. Small intestine length however increased ($P<0.05$) with increase in corn cob, and decreased ($P<0.05$) with increased inclusion of rice straw. These differences could be attributed to the nature of the fibre source, age of the rabbits and length of the adaptation period of their digestive system to the fibre source, as reported by Alawa and Amadi (1991).

Table 3: Carcass Characteristics of the Growing Rabbits fed Corn Cob and Rice Straw - based diets

Parameters	Control	Corn cob based diets			Rice straw based diets			P-value
		10	20	30	10	20	30	
Live wt.(g)	1586.50± 58.73	1500.50± 242.07	1671.00± 170.66	1584.00± 58.31	1536.25± 111.40	1514.50± 85.72	1345.00± 29.51	0.11
Carcass Wt.(g)	1542.00 ^{ab} ± 961.64	1462.50 ^{ab} ± 237.63	1629.27 ^a ± 161.64	1546.50 ^{ab} ± 64.01	1501 ^{ab} ± 106.15	1451.50 ^{ab} ± 84.83	1242.50 ^b ± 101.28	0.04
Dressing %	55.44± 4.27	59.27± 7.28	58.70± 8.68	50.10± 2.37	51.40± 1.91	53.98± 0.89	51.37± 2.15	0.18
Meat parts (% Carcass wt.)								
Hind limbs	15.19±1.29	15.07±0.75	15.26±0.35	14.58±0.68	14.43±0.53	15.46±0.93	15.97±1.64	0.13
Fore limbs	8.46±1.40	8.05±0.63	8.45±0.38	8.15±0.26	8.58±0.87	8.96±0.50	8.76±0.53	0.99
Thoracic cage	12.74±1.59	14.06±2.47	13.32±1.54	13.43±2.56	11.71±1.08	12.54±0.61	13.56±2.33	0.42
Loin	16.92±1.03	15.77±1.48	16.62±1.20	14.89±1.79	16.63±0.72	16.68±0.49	15.76±1.28	0.75
Skin	10.84±0.58	9.92±0.58	10.23±1.23	10.51±0.72	10.58±0.27	9.83±0.85	10.55±0.52	0.37
Head	9.39±0.73	10.20±0.67	9.50±0.71	9.61±0.52	9.38±0.20	10.64±0.30	10.99±1.50	0.12
Hind legs	2.08±0.06	2.19±0.30	2.20±0.16	2.24±0.33	1.99±0.22	2.20±0.12	2.51±0.19	0.12
Fore legs	0.81±0.05	0.90±0.15	0.74±0.04	0.91±0.21	0.70±0.12	0.86±0.09	1.05±0.11	0.11
Abdominal fat	0.68±0.10	0.72±0.41	0.77±0.12	0.69±0.24	0.75±0.35	0.58±0.22	0.70±0.30	0.64
Organs (% Live wt.)								
Liver	2.74±0.26	2.41±0.30	2.66±0.41	2.44±0.39	2.66±0.29	2.48±0.30	2.49±0.38	0.45
Heart	0.25±0.10	0.30±0.02	0.30±0.08	0.29±0.07	0.31±0.04	0.30±0.06	0.33±0.08	0.90
Kidneys	0.63±0.12	0.60±0.13	0.63±0.10	0.69±0.11	0.71±0.06	0.56±0.14	0.72±0.15	0.35
Visceral (% Live wt.)								
Caecum length (cm)	40.00±6.83	41.75±4.86	38.75±7.50	43.25±3.86	42.00±3.92	40.25±3.50	37.50±2.52	0.32
Small Int. length (cm)	240.75 ^b ± 12.53	247.50 ^b ± 8.06	288.50 ^{ab} ± 27.67	333.25 ^a ± 41.71	308.75 ^a ± 37.26	242.25 ^b ± 21.19	230.50 ^b ± 17.06	<0.0001
Caecum Wt.	5.24±0.61	6.56±3.16	5.02±1.71	6.01±1.35	5.31±1.67	4.67±0.42	4.59±0.44	0.77
Stomach Wt.	3.02±1.39	2.82±0.83	3.84±0.67	4.34±1.09	3.16±0.61	3.04±0.15	2.99±0.89	0.17

Conclusion

Corn cob and rice straw are good sources of fibre in rabbit diet. In a diet containing 30% maize offal for young rabbits, corn cob can replace the maize offal up to 67% without affecting growth performance, and improving carcass weight.

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