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Effects of Feeding Graded Levels of Sawdust Obtained from *Daniellia ogea* Tree on the Performance and Carcass Characteristics of Broiler Chickens

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Abstract: An experiment was conducted with 72 day old Anak broiler chicks to investigate the effects of Sawdust (SD) obtained from *Daniellia ogea* (Ogea) on their performance, carcass characteristics and gut dimensions. Six experimental diets were formulated designated diet A (0% SD-control) diet B (2% SD), diet C (4% SD) diet D (6% SD) diet E (8% SD) and diet F (10% SD). The diets were formulated to be isonitrogenous (22% crude protein) and isoenergetic (2.60 kcal g^{-1} M.E.). Each dietary treatment was replicated 3-times with 4 birds per replicate. The study lasted for 5 weeks. Daily feed intake, weight gain and feed conversion ratio were significantly ($p<0.05$) influenced by the experimental diets. Experimental birds fed diets B, C, D, E and F consumed more feed than the group on diet A, the control (96.57, 118.29, 149.14, 203.71, 194.00, 63.14 g day^{-1}, respectively). This resulted in the values of the feed conversion ratio of these birds being inferior ($p<0.05$) to the control. Birds on diets D and E had the highest ($p>0.05$) daily weight gain of 27.51 and 28.09 g, respectively. Birds fed diet F recorded the least daily weight gain of 20.57 g. The dressing percentage, carcass parts (Neck, Wings, Drumstick, Breast, Back, Thigh) and gut weights were significantly ($p<0.05$) different.

Key words: Sawdust, broiler chickens, performance, carcass parts, gut dimensions

INTRODUCTION

Lack of good quality feeds throughout the year, which is attributed to the seasonal fluctuations in supply of convectional ingredients, is a major problem preventing optimum performance of chickens in the tropics. Attention is, therefore, being focused on cheap but suitable alternative feedstuffs, especially crop residues and industrial by-products, to sustain livestock industry (Alhassan, 1985). The evaluation of unconventional feed resources alongside other strategies would reduce pressure on the demand for conventional feed ingredients and accelerate the attainment of feed security for poultry (Fajimi *et al*., 1993).

A large number of alternative feedstuffs with promise as poultry feed ingredients abound in Nigeria (Doghobo, 1992). An example is the sawdust, a lignocellulose material that is burnt away annually in industrial sites resulting in pollution thereby aggravating the existing environmental problems. Millions of tons of these lignocellulose materials, which are wasted every year, are found around industrial sites such as sugar mills and sawmills (Pidgen and Bender, 1975). However, scarce information exists on the utilization of this by-product by chickens.

This study is envisaged to highlight the nutritional potential of sawdust from *Daniellia ogea* tree in the ration of broilers on their performance and carcass characteristics.

MATERIALS AND METHODS

The experiment was conducted at the Poultry Unit of the Teaching and Research Farm, Olabisi Onabanjo University, Ago-Iwoye, Nigeria. Sawdust from Ogea tree obtained from a sawmill in Nigeria was sieved to remove unwanted objects and then sun dried. The dried sawdust was used to compound the rations at 0, 2, 4, 6, 8 and 10% (Table 1). The rations were designed to be isonitrogenous (23% crude protein) and isocaloric (2.68 kcal g^{-1} ME) in formulation.

Seventy-two day old Anak commercial broiler chicks of mixed sexes were used for this experiment that lasted for five weeks. The birds were randomly allotted to the six experimental diets. Each treatment consisted of three replicates with four chicks each. Feed and water were supplied *ad libitum* to the chicks and necessary medications were administered. The birds were reared in an open-sided naturally ventilated broiler house.

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Table 1: Composition of experimental diets (g kg^{-1} Dry matter)

Ingredients	A 0%	B 2%	C 4%	D 6%	E 8%	F 10%
Maize	536.60	516.00	494.10	475.90	455.70	440.40
Groundnut Cake	255.80	258.00	265.20	263.90	266.50	263.10
Fish meal	42.60	43.00	43.40	44.00	44.40	44.90
Blood meal	42.60	43.00	43.40	44.00	44.40	44.90
Cassava flour	89.40	87.00	81.00	79.30	76.00	73.70
Sawdust	0.00	20.00	40.00	60.00	80.00	100.00
Oyster shell	10.00	10.00	10.00	10.00	10.00	10.00
Bone meal	15.00	15.00	15.00	15.00	15.00	15.00
Salt	3.00	3.00	3.00	3.00	3.00	3.00
Vitamin\premix	5.00	5.00	5.00	5.00	5.00	5.00
Chemical analysis (g kg^{-1})						
Crude protein	217.10	217.30	220.00	218.30	218.40	220.20
Crude fibre	28.7	41.1	54.4	67.9	80.3	93.8
Metabolizable energy (kcal g^{-1}m)	2.67	2.65	2.59	2.69	2.68	2.67

Records of daily feed intake, water intake, weight gain and feed conversion ratio were kept. At the end of the fifth week of study, a chick per replicate was randomly selected, starved of feed and water for six hours, weighed and later killed by cervical bone dislocation method. Scalding and evisceration then followed. Carcass and gut dimensions were taken.

Proximate values of the sawdust and experimental diets were determined by AOAC (1990) method. All data were subjected to analysis of variance procedure using the complete randomized design and where applicable the treatment means were compared by Duncan's Multiple Range Test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The chemical composition of the Ogea sawdust used in compounding the diets is presented in Table 2. The values of crude protein and crude fibre obtained in this study were higher than those reported by researchers for Masonia plant (Blewu and Banjo, 1999) and mixed wood species collected from five sawmills in western part of Nigeria (Sourande *et al*., 2002). The differences in chemical values could be as a result of the length of storage of the timber and sawdust at the sawmills, species and type of trees sawn, the milling pattern etc.

Data on performance characteristics are shown in Table 3. The mean feed intake, weight gain, feed conversion ratio and daily water intake were significantly different ($p<0.05$) between treatments. SD induced significantly ($p<0.05$) higher feed intake in birds on diets B, C, D, E and F when compared with those fed the control (0.0 g kg^{-1} SD). It is known that the methods of processing have profound effect on the utilization of fibre. Milling or wet processing exposes fibre to attack by micro-organisms to some extent (Crampton and Harris, 1968) thereby leading to its digestibility. The milling and partial fermentation processes that the test ingredient might have been subjected to in the sawmill before collection and sun drying could have had some effects on its intake when incorporated into the experimental diets. Also high fibre contents of these diets might have been responsible for high feed intake of birds assigned to the treatments since the fibre levels of the experimental diets increased correspondingly as the SD inclusion level increased (Table 1). Fibre reduces density of diets (Savory and Gentle, 1976) and makes birds to consume more feed in order to acquire enough energy for metabolic activities (Abdelsamie *et al*., 1983; Moran, 1977; Fanjiyi and Ologhobo, 1999; Scott *et al*., 1982). Japanese quails fed on diet diluted with either oak sawdust or cellulose powder (high fibre) consumed more feed than birds fed on the same diet undiluted (low fibre) (Savory and Gentle, 1976). Daily live weight gain increased ($p<0.05$) as the level of sawdust in the experimental diets increased up to 80 g kg^{-1} and declined at 100 g kg^{-1} inclusion rate. Birds fed diets D (60 g kg^{-1} SD) and E (80 g kg^{-1} SD) maintained relatively superior ($p>0.05$) growth performance (27.51 g, 28.09 g, respectively) as against the control (25.26g). This superior performance could be related to the fact that the fibre contents were still within the tolerable level and did not depress growth except for birds fed diet F. This observation contrast sharply with the established trend of depressed growth rate in birds as dietary fibre level increased (Abdelsamie *et al*., 1983; Sobamiwa, 1994 a,b). In the present study, the fibre contents of dietary treatments ranged from 28.7 g kg^{-1} (diet A) to 93.8 g kg^{-1} (diet F). Poultry species particularly the broiler chicks have consistently demonstrated inelastic responses to dietary fibre (Sobamiwa, 1993). Fibre levels as low as 1.0-2.0% (Oluyemi and Roberts, 2000) and as high as 9%

Table 2: Proximate composition of Ogea sawdust

Component	g kg^{-1} Dry matter
Dry matter	997.20
Ash	6.40
Crude protein (N×6.25)	8.80
Crude fibre	676.10
Ether extract	14.70
Total carbohydrates	294.00

Table 3: Production performance of 5-week broiler chicks fed on diets containing sawdust

	Diets						
Parameters	A 0%	B 2%	C 4%	D 6%	E 8%	F 10%	±SEM
Average initial live weight (g)	49.00	47.50	48.00	49.50	50.50	44.00	
Average final live weight (kg)	0.97^{b}	0.91^{b}	0.95^{b}	1.05^{a}	1.07^{a}	0.80^{c}	0.02
Average daily feed intake (g)	63.14^{f}	96.57^{e}	118.29^{d}	149.14^{c}	203.71^{a}	194.00^{b}	0.08
Average daily weight gain (g)	25.26^{b}	23.63^{b}	24.74^{b}	27.51^{a}	28.09^{a}	20.57^{c}	0.06
Feed conversion ratio	2.50^{f}	4.09^{e}	4.78^{d}	5.42^{c}	7.25^{b}	9.43^{a}	0.10
Total water intake (mL bird^{-1})	3455^{f}	4308^{e}	5331^{d}	6439^{c}	7356^{b}	7857^{a}	2.79
Average daily water intake (mL)	98.71^{f}	123.09^{e}	152.31^{d}	183.98^{c}	210.17^{b}	224.4^{a}	1.79

Means differently superscripted are significantly different from one another ($p<0.05$), SEM-Standard Error of the Mean difference

Table 4: Carcass characteristics and gut dimensions of experimental broiler chicks

	Diets						
Parameters	A 0%	B 2%	C 4%	D 6%	E 8%	F 10%	±SEM
Dressing carcass (%)	52.26^{b}	53.27^{a}	54.23^{a}	54.13^{a}	53.33^{a}	51.50^{b}	0.06
Carcass parts (g kg^{-1} body weight):							
Neck	23.00^{e}	34.00^{a}	27.00^{b}	35.00^{a}	33.00^{a}	24.00^{bc}	0.01
Wings	105.00^{d}	136.00^{b}	105.00^{d}	149.00^{a}	147.00^{a}	116.00^{c}	3.95
Drumstick	82.70^{f}	116.40^{c}	86.90^{e}	140.40^{a}	134.10^{b}	95.30^{d}	32.42
Breast	116.40^{e}	207.10^{a}	138.20^{c}	211.30^{a}	189.40^{b}	123.00^{d}	48.75
Back	168.00^{c}	184.00^{b}	137.00^{e}	207.00^{a}	194.00^{a}	144.00^{e}	9.60
Thigh	107.00^{d}	151.00^{b}	116.70^{c}	160.00^{a}	145.00^{b}	103.00^{d}	38.76
Length (cm) of:							
Small intestine	165.00^{c}	170.00^{b}	201.00^{a}	159.00^{d}	214.00^{a}	173.00^{b}	21.10
Colo-rectum	8.50	8.64	8.54	9.00	9.20	9.00	0.47
Caecum	18.00^{cd}	16.00^{d}	18.00^{cd}	19.00^{c}	25.00^{a}	22.00^{b}	2.67

Means differently superscripted are significantly different from one another ($p<0.05$)

(Heuser *et al*., 1945) have been recommended for growing broilers. Young and old birds can tolerate dietary fibre contents of 13 and 15%, respectively for efficient functioning of their alimentary tract (Sainsbury, 1980). In addition the improvement in growth rate of birds fed SD diets (at 20, 40, 60 and 80 g kg^{-1} incorporation) could be attributed to the presence of certain unidentified growth factors contributed by SD since the diets were similar except for 0.0 g kg^{-1} SD in diet A (control). Certain phenolic compounds of lignin have antibiotic-like properties and various fractions isolated from wood hemicellulose extract resulted in improvement of performance of chicks when incorporated into corn-soybean meal diet (Zemek *et al*., 1979). The daily water intake by experimental birds increased in this order F>E>D>C>B>A as the level of SD in the diets increased.

There was significant ($p<0.05$) effect in the development of carcass parts of broiler chickens fed diets B, C, D and E over those fed the control (diet A) and diet F (Table 4). In terms of the weights of these parts, birds on diets D and E gave the best results. Significant ($p<0.05$) differences were observed in the lengths of the gastro-intestinal tract of broiler birds. The differences were attributed to the fibre content of the diets which increased as the SD inclusion in the diets increased. This observation was similarly reported (Abdelsamie *et al*., 1983) that increased fibre content of diets led to increase in weight and length of gastro-intestinal tract. A significant increase in the length of the small intestine was observed when oat hull was added to corn-starch-case in the diets of chicks (Walech *et al*., 1985). The increased length of intestinal segments of the birds on SD diets was probably an adaptation to accommodate the larger volume of feed necessary to meet their nutrient requirement. Mortality was not reported during the experiment. Thus, Ogea sawdust represents a safe by-product for feeding broilers.

CONCLUSION

This study showed that sawdust, up to 80 g kg^{-1} level of inclusion in broiler diets, did not have any detrimental effect on weight gain. Since sawdust is abundant and available throughout the year in many developing countries, Nigeria inclusive, utilization of sawdust will reduce the cost of production. Also biological and chemical treatment of these lignocellulose wastes, in order to improve their digestibility, is hereby suggested.

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