GROWTH RESPONSE AND CARCASS CHARACTERISTICS OF BROILERS FED HEAT TREATED JATROPHA SEED CAKE-BASED DIETS

***A.F. AGBOOLA, AND B.R.O. OMIDIWURA**

*Department of Animal Science, University of Ibadan, Ibadan, Nigeria; *Correspondence: Agboola, A.F., 234(8)022004830, aadebunmi@yahoo.com*

ABSTRACT

This study was carried out to determine the performance and carcass characteristics of broilers fed heat treated Jatropha Seed Cake (JSC) in an experiment that lasted for 28 days. 200 seven-day-old Arbor acre broiler chicks were weighed and randomly assigned to 4 dietary treatments consisting of 5 replicates with 10 birds per replicate. Treatment 1 was the basal (corn-soyabean meal diet) with no JSC. Treatments 2, 3 and 4 contained the basal diet and 5, 10 15% JSC respectively. Weekly weight gain, feed intake and percentage mortality of birds were assessed. On day 28, two birds were slaughtered from each replicate, carcass primal cuts and organ weights were harvested and weighed. The highest final weight, weight gain and feed intake were observed in birds on the control diet (0% JSC inclusion). No significant differences ($P>0.05$) were observed in the final weight and the weight gain of birds on diets with 5% and 10% JSC based diets. The least final weight (685.38g/b) and weight gain (553.98g/b) were recorded for birds on 15% JSC diet. The feed intake of birds on the control diet was significantly ($P<0.05$) higher (1419.18g/b) than that of birds on JSC diets. Similar feed conversion ratio was observed in birds on the control diet and those on 5 and 10% JSC diets. There was no mortality recorded in birds on experimental diets. There were significant ($P<0.05$) differences observed in the live weight, wings, breast, drumstick and back of birds on experimental diets. Highest live weight was recorded for birds on the control diet (1002g/b) while the least (685.38g/b) was observed in birds on 15% JSC diet. Resembling trends were observed in the wings, breast, drumstick and back of birds on the control diet. Similar results were observed for wings, breast, and drumstick and back of birds on 10% and 15% JSC diets. Spleens of birds on JSC diets were identical. Thigh, gizzard, liver, pancreas and heart were not significantly ($P>0.05$) influenced by diets. Meanwhile, bursa of fabricius of birds on the control diet and 5% JSC diet were similar and significantly different from those on 10 and 15% JSC diets.

Keywords: Jatropha seed cake, heat treatment, performance, carcass evaluation, broilers

INTRODUCTION

One of the major obstacles to the development of livestock industries in most countries of the world is high cost of feed which often account for 60- 80 percent of the total cost of production. This is due to high cost of protein and energy feedstuffs which usually constitute the bulk of compound feeds. A pragmatic approach that has been explored by nutritionists to solve this problem is the use of cheap and readily available but less utilized waste products of agro-industries. *Jatropha curcas* is a large drought-resistant shrub or tree belonging to the family Euphorbiaceae. It is originated in Central America and has become naturalized in many tropical and subtropical areas including India, Africa and North America (Heller, 1996). Jatropha seed cake (JSC) is a waste byproduct of biodiesel production industry. After extraction of oil, large quantity of JSC is turned out as waste. It has been reported to contain crude protein (56.4%) higher than that of soyabean meal (48%), and substantial amount of energy and minerals (Chivandi *et al.*, 2006). However, JSC contains anti-nutritive compounds, such as lectin, trypsin inhibitor, saponin and a toxic principle (phorbol ester) (Makkar *et al.*, 1998) which renders its use unfit for livestock feeding. The detoxification of this seed cake is very important for adding economic value and also to reduce potential environmental damage that may be caused by improper disposal of this by-product. Many detoxification methods have been employed with their intrinsic limitations. It was therefore the objective of this study to determine the performance and carcass characteristics of broilers chickens fed heat treated jatropha seed cake.

MATERIALS AND METHODS

The experiment was carried out at the Poultry unit of the Teaching and Research Farm, University of Ibadan, Nigeria. The jatropha seeds used were toasted whole for about 20 minutes before oil extraction was done using a mechanical screw press. The press residue which was the seed cake was immersed in water and heated to about 90^0C for 45 minutes for further

oil removal. Cooling was allowed to take place for separation of oil-moisture and the residue. The separated seed cake was sun dried and milled. The preparation process was done to simulate the technique carried out by the local farmers. Two hundred one-week-old unsexed Arbor acre broilers chicks were weighed and allotted to 4 diets consisting of 5 replicates of 10 birds each. Diet 1 was the basal diet, a corn-soyabean meal diet without inclusion of jatropha seed cake (JSC), while diets 2, 3 and 4 contained the basal diet and 5, 10 and 15 of JSC respectively in a 28-day experiment (Table 1). The experimental diets were given *ad libitum* and birds had free access to clean water. During the experimental period, weekly feed intake was determined by deducting the left-over from the total quantity of feed supplied to the birds and the weekly weight gain of the birds was also taken. At day 28 of experiment, two birds from each replicate were selected and slaughtered for carcass characteristics and organs were harvested and weighed. Data were analyzed as a completely randomized design using ANOVA, the GLM procedure of SAS (2008). Means were separated using Duncan Multiple Range Test.

RESULTS AND DISCUSSION

The results of performance indices of broilers fed the experimental diets are shown in Table 2. The highest final weight, weight gain and feed intake were observed in birds on the control diet (0% JSC). No significant differences ($P>0.05$) were observed in the final weight and the weight gain of birds on diets with 5% and 10% JSC based diets. The least final weight (685.38g/b) and weight gain (553.98g/b) were recorded for birds on 15% JSC diet. The feed intake of birds on the control diet was significantly ($P<0.05$) higher (1419.18g/b) than that of birds on JSC diets. Similar feed conversion ratio was observed in birds on the control diet and those on 5 and 10% JSC diets. There was no mortality recorded in birds on experimental diets. The result of this study showed that the inclusion of heat treated jatropha seed cake in the diets of broilers chickens did not improve the feed intake and the weight gain of birds on dietary treatments. This is in agreement with the experiment conducted by Belewu *et al.* (2010) on the effect of fungi treated jatropha kernel cake on performance of goats. The authors concluded that jatropha kernel cake had a negative effect on the palatability and acceptability of feed and this reduced their feed intake and weight gain across dietary treatments but animals on the control diet had highest feed intake and weight gain. Similarly, Kasuya *et al.* (2013) also reported reduced feed intake, weight gain, live weight and organs weight of birds fed with detoxified jatropha seed cake. It was further explained that growth performance and carcass characteristics of birds were impaired with highest inclusion of jatropha seed cake in the diets. This was further substantiated with the findings of Chivandi *et al.* (2006) on performance of pigs fed jatropha seed cake respectively. The result of carcass characteristics and relative organ weight of birds on jatropha seed cake-based diets is presented on Table 3. Highest live weight was recorded for birds on the control diet (1002g/b) while the least (685.38g/b) was observed in birds on 15% JSC diet. Resembling trends were observed in the wings, breast, drumstick and back of birds on the control diet. Similar results were observed for wings, breast, drumstick and back of birds on 10% and 15% JSC diets. Spleens of birds on JSC diets were identical. Thigh, gizzard, liver, pancreas and heart were not significantly ($P>0.05$) influenced by diets. Meanwhile, bursa of fabricius of birds on the control diet and 5% JSC diet were similar and significantly different from those on 10 and 15% JSC diets. The result of the present study showed that the inclusion of heat treated jatropha seed cake in the diets of broiler chickens did not improve the carcass characteristics and relative organs weight of the birds when compared with birds on the control diet. This result is in agreement with the findings of Pasaribu *et al.* (2010) who reported significant reduction in the live weight, wings, breast, drumstick and weights of organs broiler chickens fed with 4% jatropha seed meal diet that were processed by different methods of detoxification. This reduction can be attributed to the effect of the residual anti-nutrition factors in the JSC. Similarly, Wang *et al.* (2011) reported that dietary inclusion of detoxified jatropha kernel meal did not affect carcass weight, dressing percentage, back fat thickness or visceral organ weight when compared with the control group. The authors' observation on the visceral organ was contrary to the result of the present study as the gizzard, liver, pancreas and heart were comparable to what was obtainable in birds on the control diet.

Conclusion

The result of this study showed heat treated jatropha seed cake in the diets of broilers had no pronounced effect on the performance and

carcass characteristics of birds when compared to those on the control diet, although birds' health was not compromised as no mortality was recorded. Other methods of detoxification which are friendly to both the farmers and the environment such as the biological method should be considered.

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Table 1. Gross composition (g/kg DM) of experimental diets

	Jatropha seed cake inclusion			
Ingredient, g/kg	0	50	100	150
Corn	515.0	515.0	515.0	515.0
Soyabean meal	425.0	403.7	328.5	361.2
Jatropha seed cake	0.0	21.3	42.5	63.8
Dicalcium phosphate	16.0	16.0	16.0	16.0
Limestone (38% Ca)	14.0	14.0	14.0	14.0
Salt	2.5	2.5	2.5	2.5
*Vit-Min Premix	2.5	2.5	2.5	2.5
DL- Methionine	3.5	3.5	3.5	3.5
L-Lysine, HCL	2.5	2.5	2.5	2.5
Soyabean oil	20	20	20	20
Total	1000	1000	1000	1000
Calculated Nutrient (g/kg)				
Crude Protein	230	231	232	233
ME (Kcal/kg)	3084	3097	3109	3121
Calcium	9.4	9.4	9.3	9.3
Phosphorus	7.0	6.9	6.8	6.6
Non-phytate P	4.4	4.3	4.3	4.2
Lysine	15.9	15.8	15.8	15.8
Methionine	6.3	6.5	6.8	7.1

ME= Metabolisable energy; Vit-Min= Vitamin-Mineral, *Composition of Premix per Kg of diet: vitamin A, 12,500 I.U; vitamin D3, 2,500 I.U; vitamin E, 40mg; vitamin K3, 2mg; vitamin B1, 3mg; vitamin B2, 5.5mg; niacin, 55mg; calcium pantothenate, 11.5mg; vitamin B6, 5mg; vitamin B12, 0.025mg; choline chloride, 500mg; folic acid, 1mg; biotin, 0.08mg; manganese, 120mg; iron, 100mg; zinc, 80mg; copper, 8.5mg; iodine, 1.5mg; cobalt, 0.3mg; selenium, 0.12mg

Table 2. Performance characteristics of birds fed varying levels of heat treated jatropha seed cake-based diets

	Jatropha seed cake inclusion levels (%)				
Parameter	0	5	10	15	SEM
Initial weight (g/b)	129.90	129.30	129.96	131.40	2.54
Final weight (g/b)	1002^{a}	856.02^{b}	799.72^{b}	685.38^{c}	30.78
Weight gain (g/b)	872.10^{a}	726.72^{b}	669.76^{b}	553.98^{c}	31.16
Feed intake (g/b)	1419.18^{a}	1242.40^{b}	1158.24^{b}	1118.94^{b}	38.33
FCR (g/b)	1.63^{b}	1.70^{b}	1.70^{b}	1.96^{a}	0.07
Mortality (%)	0	0	0	0	

^{abc} Means on the same superscript are not significantly different ($p > 0.05$) g/b = gram per bird, FCR = Feed conversion ratio

Table 3. Carcass characteristics (g/b) and relative organs weight (%) of birds on experimental diets

Parameter	0	5	10	15	SEM
Live weight	1002^{a}	856.02^{b}	799.72^{b}	685.38^{c}	30.78
Wings	89.40^{a}	78.40^{b}	70.20b^{c}	62.60^{c}	3.40
Breast	216.80^{a}	178.60^{b}	154.70^{bc}	132.70^{c}	10.17
Drumstick	107.60^{a}	93.70^{b}	80.20^{c}	79.30^{c}	4.26
Back	130.47^{a}	107.60^{ab}	97.60^{b}	90.90^{b}	7.67
Thigh	101.90	78.70	78.60	67.40	7.02
Gizzard	3.61	3.85	3.90	4.43	0.27
Spleen	0.15^{a}	0.13^{ab}	0.10^{ab}	0.05^{b}	0.03
Liver	2.73	2.58	2.68	3.00	0.15
Pancreas	0.34	0.34	0.34	0.28	0.02
Lungs	0.51^{ab}	0.41^{b}	0.44^{ab}	0.55^{a}	0.04
Heart	0.68	0.46	0.46	0.57	0.09
Bursa of fabricius	0.32^{a}	0.31^{a}	0.15^{b}	0.11^{b}	0.03

^{abc} Means on the same superscript are not significantly different ($p > 0.05$),* relative organs weight as % live weight