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CARCASS CHARACTERISTICS OF BROILER CHICKENS FED DIETS CONTAINING ENZYME-TREATED AND UNTREATED FEATHERMEAL

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ABSTRACT

A single phase feeding trial was conducted using 1,050 Ross 308 broiler chickens to determine the effects of enzyme-treated feathermeal (TFM) and untreated feathermeal (UTFM) on the carcass characteristics of the broilers. Seven diets were formulated in which TFM was included at 8%, 16%, 24% for T2, T3 and T4 while T5, T6, T7 had UTFM inclusion levels of 8%, 16%, 24%. T1 served as the control with 0% inclusion. The broilers were fed this diet in a completely randomized design and each treatment was replicated six times with 25 birds per replicate. The experiment lasted for 8 weeks. At the end of the 8th week, 28 birds were randomly selected (four from each treatment) for carcass evaluation. Results of the carcass characteristics showed significant differences (P<0.05) in live weight (1923-2131g), dressing percentage (58.45-68.57), slaughter weight (1879-2101g) and defeathered weight (1730-.1961). T6 had the best values for all these parameters measured compared to the UTFM groups and the control. Results of the Primal cuts showed significant differences (P<0.05) in head (3.24-91), neck (4.66-6.79), thigh (15.65-17.98), wing(8.28-10.17), breast(24.85-33.11), back(17.28-19.24) and drumstick (11.08-16.47). Although there were variations in proximal values of across treatment group, T6 and T7 had the best breast meat and back meat values. This study therefore suggests that feathermeal treated with keratinase enzyme could be included in diets of broilers up to 24% for improved carcass characteristics and proximal parts of broilers birds.

Keywords: broilers, feathermeal, diet, enzyme, carcass

INTRODUCTION

The rising cost of feed has however, remained one of the greatest challenges in livestock production (Abbas, 2013). In order to ameliorate this situation, recent research efforts seek to incorporate cheap, readily available and nutritionally rich alternative feed resources into livestock feed (Oluseun et al., 2017; Sanda and Abu, 2015; Okpanachi et al., 2015; Babayemi, 2009)

Feathermeal is the byproduct gotten from the processing of poultry such as chicken, turkeys, ducks, quails, guinea fowl, geese etc. The growing demand for poultry meat has led to an increased production of broiler chickens (FAO, 2010). Consequently, increasing amount of poultry feathers are generated which often constitutes environmental pollution (Zhang *et al.*, 2014). Broiler feather have been reported to contain very high amounts of crude proteins of between 81.7-85.8% (Adiati *et al.*, 2004) that can be effectively utilized as an alternative source of protein in poultry (Ajayi and Iyayi, 2015). Most of the proteins in feathermeal are in the form of keratin which is of low solubility due to the presence of sulphur bonds between cysteine amino acids (Brebu and Spiridon 2011), making it a low quality feedstuff. The high content of keratin in chicken feathers has also been reported to be responsible for its low digestibility in the gastrointestinal tract of poultry (Staron *et al.*, 2011; Brebu and Spiridon, 2011).

The common methods involving hydrothermal and chemical treatments of feather often produces feathermeal that is not readily digestible by livestock and this is accompanied by dissipation

of excess gases into the environment which constitutes environmental pollution (Lee *et al.*,2016; Liu *et al.*,2016; Zoccola *et al.*,2012). Keratinase belong to the group of proteases that possess a wide range of temperature and pH that enhances complete breakdown of complex and hardy proteins (Gupta and Ramnani, 2006). The use of keratinase to degrade feather keratins can make poultry feathers a potential source of cheap and readily available protein capable of improving carcass yield and quality of broiler meat.

This study is therefore aimed at evaluating the effect of treated and untreated feathermeals as a protein source in diets of broilers.

MATERIALS AND METHODS

Study Area

This study was carried out at the Animal Production Teaching and Research Farm of the Federal University of Technology, Minna, Niger State in Nigeria. Minna is located between latitude 09^0 30^1 and 06^0 45^1 north and longitude 06^0 30^1 and 06^0 45^1 east of the equator. It falls within the southern guinea savanna agro-ecological zone of Nigeria. The mean rainfall varies from 1100 -1600 mm and mean temperature of between 21^0c and 35^0 (FMSC, 2015).

Enzyme production

Keratin- rich soil samples were collected from abattoir, hair and horn dump site and poultry feather dump sites in Bosso, Niger State. The production of enzymes was done by introducing 1ml of each isolate into 250ml Erlenmeyer flask containing 100ml broth enriched with the following mineral salts (gram/100ml): NH_4Cl – 0.05, NaCl – 0.05 , K_2HPO_4 – 0.03, KH_2PO_4 – 0.04, $MgCl_2$ – 0.024, Yeast extract – 0.1, Raw feather – 1, pH -7.5. The flasks were continuously shaken at 150rpm and incubated at 37^0C for 5 days. Feather culture was then centrifuged at 1000rpm for 10minutes at 45^0C. The supernatant were collected to determine the keratinase activity using spectrophotometer by reading the optical density at 280nm of uv-vis spectrophotometer against no hydrolysis mixture as a blank (Mazotto *et al.,* 2011). An increase of 0.01 in the absorbance was considered as equivalent to 1 unit of enzyme activity per ml (Kumar *et al.,* 2014).

Preparation of Untreated Feathermeal

Broiler feather were collected from the poultry slaughterhouse of the Kure International Market, Minna, Niger State. The feathers were then washed to remove contaminants like blood, sand and other visible dirt. Thereafter, it was subjected to sun-drying until completely dried. A Certain quantity was milled using a simple hammer mill and the product designated as Untreated Feather Meal (UTFM).

Preparation of Treated Feathermeal

5kg of the feather that has been washed and cleaned of visible contaminants is poured into a pH and temperature dependent bioreactor containing 50litres of water. The mixture was then pretreated with 1% sodium hydroxide and the bioreactor is agitated for 10minutes at a temperature of 40^0C to allow for even mixing. The feather left behind is then rinsed with water until a steady pH of 7 is achieved. Thereafter, 5 litres of Keratinase enzyme was added to the mixture and agitated again for 30 – 40 minutes in order to achieve complete treatment of the feather. The feather was then rinsed with water until a steady pH of 7 is achieved. The feather was then oven-dried at a temperature of 80^0 C until a moisture content of 10% was attained. The dried chicken feather was then milled by means of a simple hammer mill and the product obtained was designated as Treated Feather Meal (TFM).

Experimental Diet

Seven isocalaoric (3100MEKcal/kg) and isonitrogenous 22% crude protein) diets were formulated T1 has 0% feathermeal, T2, T3 and T4 had 8, 16 and 24 percent untreated feathermeal while T5, T6, T7 had 8, 16 and 24% treated feathermeal inclusion levels. The diets were formulated in accordance with the recommendations of the NRC (1994).

Carcass Evaluation

At the end of the eight week, 28 birds were randomly selected (4 from each replicate) and used for carcass evaluation. The birds were starved of feed overnight and then slaughtered by severing the jugular vein with a sharp knife after

their individual weights had been determined. They were then plucked (defeathered) and eviscerated. The live weights and dressed weights were recorded and the dressing percentage was also determined. Weights of the internal organs such as liver, kidney, heart, lungs and gizzard and the length of the intestine were recorded and all these were expressed as a percentage of the live weight.

RESULTS AND DISCUSSIONS

Results of the measurement of live weight, slaughter weight, defeathered weight and dressing percentage is shown on Table 1. Carcass characteristic is a vital measure of profitability and a major determinant of consumers' preference for broiler products. Significant differences (P<0.05) were observed for all the parameters measured. The highest values were observed in the treatment group of birds fed 16%TFM in their diets with values of 2131g, 2101g, 1961g and 68.57 for liveweight, slaughter weight, defeathered weight and dressing percentage respectively. Results obtained from this study disagrees with the findings of Isika *et al*.(2006) who reported that there were no significant differences(P>0.05) in carcass characteristics of birds fed Broiler offal meal and hydrolyzed feathermeal to broilers. However, results of the present study agrees with the findings of Iyayi and Akoma (2017). The authors reported better carcass characteristics for broilers fed hydrolyzed feathermeal with protease supplementation. The result of feathermeal on the primal cuts of broilers in proximal cuts of broilers (Table 2) revealed variations across treatment groups. Birds fed untreated feathermeal (T2-T4) had better proximal cut values for Head, neck, thigh, and wing while birds fed treated feathermeal had better values for drumstick, breast and back. Generally, proximal cuts for the two treatment groups were better than those fed the control diet (0% feathermeal).The result of this study agrees with the findings made by Ajayi and Akoma (2017) who reported the best breast meat for broilers fed 15.5% CP in diets of broilers fed hydrolyzed feathermeal and protease enzyme in comparison with the control group of that study.

Table 1: Effects of Treated and Untreated Feathermeal on Carcass Characteristics of Broilers

	Treatments								
Parameters	T1	T2	T3	T4	T5	T6	T7	SEM	LOS
Live wt(g)	1923^{c}	2003^{bc}	2035^{b}	2076^{ab}	2027^{b}	2131^{a}	2121^{b}	14.91	**
Defeathered wt (g)	1730^{c}	1812^{bc}	1852^{b}	1898^{ab}	1846^{b}	1961^{a}	1850^{b}	16.02	**
Dressed weight (g)	1124^{d}	1224^{c}	1307^{bc}	1368^{b}	1306^{bc}	1461^{a}	1344^{b}	21.52	**
Dressing percentage(%)	58.45^{e}	61.10^{d}	64.23^{c}	65.88^{c}	64.33^{c}	68.57^{a}	66.49^{b}	0.64	**

^{abc} Means in the same row with different superscripts are significantly different

T1 – 0% Feathermeal inclusion, T2 – 8 untreated feathermeal, T3 -16% untreated feathermeal, T4 - 24% untreated feathermeal, T5 – 8 treated feathermeal, T6 – 16% treated feathermeal and T7 - 24% treated feathermeal, SEM – Standard Error of Mean; LOS – Level of significance; ** Significant at (P<0.05); wt – weight; % percentage

Table 2: Effects of Treated and Untreated Feathermeal on Primal Cut of Broilers

	Treatments								
Parameters (% of dressed weight)	T1	T2	T3	T4	T5	T6	T7	SEM	LOS
Head	3.69^{b}	3.91^{a}	3.74^{ab}	3.61^{ab}	3.34^{ab}	3.24^{b}	3.82^{ab}	0.075	**
Neck	5.52^{b}	6.79^{a}	5.19^{b}	5.08^{b}	4.96^{b}	4.66^{b}	4.82^{b}	0.175	**
Thigh	17.11^{b}	17.68^{b}	17.98^{a}	16.96^{ab}	16.84^{ab}	16.61^{ab}	15.65^{b}	0.253	**
Wing	9.25^{abc}	8.88^{bc}	10.17^{a}	9.95^{ab}	9.25^{abc}	8.72^{c}	8.28^{c}	0.169	**
Breast	26.42^{d}	24.85^{d}	26.30^{d}	28.69^{c}	29.80^{c}	33.11^{b}	35.17^{a}	0.698	**
Back	18.88^{b}	18.59^{ab}	17.28^{b}	18.69^{ab}	19.09^{ab}	19.24^{a}	18.68^{ab}	0.226	**
Drumstick	16.42^{a}	16.49^{a}	15.83^{ab}	14.31^{b}	14.36^{a}	12.15^{c}	11.08^{c}	0.396	**

^{abc} Means in the same row with different superscripts are significantly different

[abc] Means in the same row with different superscripts are significantly different
T1 – 0% Feathermeal inclusion, T2 – 8 untreated feathermeal, T3 -16% untreated feathermeal, T4 - 24% untreated feathermeal, T5 – 8 treated feathermeal, T6 – 16% treated feathermeal and T7 - 24% treated feathermeal, SEM – Standard Error of Mean; LOS – Level of significance; ** Significant at (P<0.05); wt – weight; % percentage

CONCLUSIONS

Results obtained from this study showed that enzyme-treated feathermeal improved carcass characteristics and primal cuts of broilers. It is concluded that enzyme treated feathermeals can be included in the diet of broilers as a protein source up to 24% inclusion level for better carcass characteristics and proximal cuts.

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