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The effects of utilizing melon husk meal with wild mushroom (*Ganoderma* sp.) and enzyme supplement on performance characteristics of broiler chicken

A.O.Ogbe[1*] and S.E.Alu[2]

[1]Department of Veterinary Medicine and Surgery, Faculty of Veterinary Medicine, University of Abuja, Nigeria
[2]Department of Animal Science, Faculty of Agriculture, Nasarawa State University, Keffi, Nasarawa State, Nigeria

***Corresponding author**

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A B S T R A C T

Melon husks are Agricultural waste materials usually discarded in large quantities in Nasarawa State of Nigeria, thereby polluting the environment. An experiment was therefore conducted to determine the nutritional value and effect of utilizing melon husks as feed ingredient in broiler diets. Melon husks were collected from Nasarawa State in Nigeria, and milled into powder (meal) for inclusion at 10% and 15% w/w in broiler starter (23% crude protein) and finisher (20% crude protein) mash feed. Feeding trial was carried out for 56 days on broiler chicken (Marshal Hybrid), procured at day old from a commercial hatchery in Nigeria. At seven days of age, the chicks were randomly distributed into different dietary treatments, group T1–7 (10 chicks each) in duplicate. Group T1 represent control = 0% melon husk meal with no enzyme and no mushroom, T2 = 10% melon husk meal with no enzyme and no mushroom, T3 = 10% melon husk meal with mushroom but no enzyme, T4 = 10% melon husk meal with enzyme but no mushroom, T5 = 15% melon husk meal with no enzyme and no mushroom, T6 = 15% melon husk meal with mushroom but no enzyme, T7 = 15% melon husk meal with enzyme but no mushroom. The birds were reared on a deep litter house, and feed and water was provided, ad libitum. Proximate analysis result showed that the melon husk meal contained essential nutrients (protein, fibre, fat, fatty acids) and minerals. Dietary inclusion of melon husk in broiler starter and finisher diets with or without the wild Ganoderma and enzyme supplement did not significantly affect feed intake and weight gain ($P>0.05$). However, the broilers that were fed 10% melon husk meal in their diets with the mushroom as supplement had improved feed intake and weight gain. It was therefore concluded that melon husks supplemented with wild Ganoderma like enzyme could be utilized as valuable feed ingredient in broiler diets to improve growth performance.

Introduction

In Nigeria, the high cost of poultry feed and competition for feed raw materials between farm animals and human has increased the search by nutritionists and researchers for

alternative sources. Melon husks are agricultural by-product or wastes that are usually discarded or burnt after removal of the melon seeds (*Citrullus vulgaris*). Melon is a cucurbit crop belonging to the family cucurbitaceae (Abiodun and Adeleke, 2010; Fagbohun *et al.*, 2011). The melon seeds are removed from the fruit, washed, sun-dried and sold in large quantities (tonnage) annually for commercial purpose (as a special soup condiment). They are also used as remedy for urinary tract infection, hepatic congestion, intestinal worms and abnormal blood pressure (Moerman, 1998; Gafar and Itodo, 2011). However, the melon husks are either discarded or burnt as waste materials due to their fibrous nature and possible presence of phytochemical or anti-nutritional factors that hinders their utilization by monogastric animals including poultry.

In Nasarawa state of Nigeria, large tonnage of melon seeds are produced and processed annually, but the husks are usually discarded, which pollute the environment. The high fibre content of the melon shells may limit their utilization by poultry. The aim of this study was to determine the nutritional potential of melon husks as source of feed ingredient for broiler chicken. The aim is to evaluate the potential of melon husks as feed ingredient in broiler diets. The specific objective is to evaluate the effect of melon husk meal in broiler diets on the performance of broilers. The general objective was to convert melon husks into useful feed ingredients for poultry. The use of exogenous enzyme preparations having high xylanase activity was because poultry are unable to utilize high crude fibre diets. Exogenous enzymes are known to improve nutritional value of high fibre diets and can also destroy anti-nutritional factors (Bedford, 1996; Raza *et al.*, 2009; Oladunjoye and Ojebiyi, 2010). A new veterinary research study findings in Nigeria reported by Ogbe *et al* (2009a) showed that wild *Ganoderma lucidum* contained appreciable levels of essential nutrients and bioactive compounds that are beneficial to broiler chicken. The objective of this study therefore is to use the wild mushroom (*Ganoderma* sp) as source of crude enzyme supplement in the broiler diets containing melon husks. *Ganoderma lucidum* contained polysaccharides and enzymes (such as xylanase), capable of converting high fibrous material into easily digestible and absorbable nutrients for utilization by poultry.

Materials and Methods

Collection and processing of melon husks and wild mushroom (*Ganoderma* sp)

Dried melon husks were collected from the rural women who process melon seeds for commercial purpose in Nasarawa Local Government Area of Nasarawa State, Nigeria. The husks were milled into powder to form a meal using a locally made miller machine (unbranded) and then sun-dried at 35^{o}C for 3 hour (Ogbe and George, 2012). Matured and fresh fruiting bodies of the mushroom (seen as red open caps) were collected around the premises of the College of Agriculture, Lafia in Nasarawa State of Nigeria. The freshly harvested wild mushroom were washed with water from the borehole and sun-dried at 35^{o}C for 3-5 days and then milled manually into powder using pestle and mortar, followed by further milling using a locally made grinding machine (unbranded).

Chemical analysis

Melon husks and mushroom, as well as the broiler diets were subjected to proximate analysis according to the methods of

AOAC (1990). All determinations were done in duplicate. Total soluble carbohydrate was determined by the difference of the sum of all the proximate composition from 100%. Calorific (energy) value was obtained according to the methods of Akinyeye *et al* (2010, 2011). This was done by multiplying the value of carbohydrate, protein and crude fat by Atwater factors of 17, 17 and 37 respectively (Akinyeye *et al.,* 2011). Crude fat was converted into fatty acid by multiplying with conversion factor of 0.80 as described by Akinyeye *et al* (2010, 2011). All proximate values were reported in percentage.

Minerals in the melon husks meal and mushroom was determined using Atomic Absorption Spectrophotometer (AAS-Buck 205 model) and phosphorus was done colorimetrically (AOAC, 1990). The values of calcium, magnesium and potassium were reported in percentage (%). Sodium, iron, zinc, phosphorus, manganese and copper were reported in parts per million (ppm). Quantitative phytochemical analysis was carried out to determine presence of phytochemical compounds or anti-nutrients (Sofowora, 1993). All determinations done in duplicate.

Chicks and Management

One hundred and fifty (150) day-old broiler chicks (Marshal Hybrid) were obtained from a commercial hatchery in Nigeria. The birds were brooded together under a deep litter house for the first five days of age to enable them acclimatize to the environment. At 7 days of age, they were randomly distributed into different compartments (10 chicks per group) separated from each other by wire-mesh supported with wooden frame-work. They were provided with one 200 watt bulbs to supply light and heat for brooding through electricity. Feed and drinking water was provided to the birds on *ad libitum* basis throughout the experiment (56 days).

Experimental Design and Diets

Broiler starter (Table 1) and finisher diets (Table 2) were prepared using melon husk meal as feed ingredient at different inclusion rate. Dried mushroom powder (at 5g/kg feed) was used as source of crude enzyme, and exogenous enzyme (Maxigrain at 1g/20kg feed) as control for comparison.

The following dietary groups were prepared;

Diet T1 (control group) = 0% melon husk in broiler diet (no enzyme, no mushroom).
Diet T2 = 10% melon husk in broiler diet (no enzyme, no mushroom)
Diet T3 = 10% melon husk in broiler diet with mushroom supplement (no enzyme).
Diet T4 = 10% melon husk in broiler diet with enzyme as additive (no mushroom).
Diet T5 = 15% melon husk in broiler diet (no enzyme, no mushroom)
Diet T6 = 15% melon husk in broiler diet with mushroom supplement (no enzyme).
Diet T7 = 15% melon husk in broiler diet with enzyme as additive (no mushroom).

Statistical Analysis

All the data generated were analyzed using descriptive statistic and analysis of variance according to the methods described by Olawuyi (1996).

Results and Discussion

Nutritional composition of melon husk meal and broiler starter and finisher diets

Table 3 showed the proximate (nutrients) and mineral composition of melon husk meal, which contained appreciable levels of crude protein (19.94% ±0.46), carbohydrates (61.01% ±0.35), crude fibre (7.19% ±0.85), ash (7.73% ±0.12), crude fat (1.71% ±0.04) and fatty acid (1.37% ±0.03). Minerals detected in the melon husk meal included calcium (2.1% ±0.13), potassium (1.3% ±0.04), magnesium (0.42% ±0.1), sodium (259.85±1.78), iron (98.42±1.55), manganese (58.83±0.54), zinc (47.77±1.06), phosphorus (30.11±0.2) and copper (5.94±0.3) in parts per million (ppm). Presence of essential nutrients and minerals imply melon husks could be utilized as feed ingredient for poultry. Valuable amounts of essential nutrients (16.79% ±0.13 CP, 7.77% ±0.34 CF, 3.2% ±1.20 ash, 1.52% ±0.09 fat, and 1.52% ±0.09 fatty acids and minerals were also detected in the wild mushroom (*Ganoderma* sp). The levels of anti-nutrients (tannins, phytates, oxalates, trypsin inhibitors and saponins) detected in the melon husks were very low (less than 5%). These were earlier reported by Ogbe and George (2012). Environmental factor (such as high temperature) and method of processing (drying and grinding) may lead to low concentration of anti-nutrients in the melon husk.

Proximate evaluation of the nutritional composition of the broiler diets in groups 1-7 (Table 1 and 2) showed there were no significant variations (P>0.05) in the nutrients levels between the diets in group 2, 3 and 4 (Table 4 and 5). There were no significant difference (P>0.05) in the crude protein (18-20% CP) and crude fibre (11-14%) levels of all the broiler diets when compared with the control (group 1).

However, at 10% melon husk meal inclusion rate, the broiler starter diet of group 3 (melon husk meal + mushroom) the level of nitrogen (3.45%) and crude protein (21.75%) were higher (Table 4). At 15% inclusion rate of the broiler starter diet, the level of nitrogen (3.58%) and crude protein (22.4%) of group 6 (melon husk meal + mushroom) was higher (Table 4), followed by group 7 (melon husk meal + enzyme). Also, the broiler starter diets, group 3 and 6 had slightly higher ash content (7.25 and 7.4%, each); this may be due to the presence of high mineral content. The mushroom used in all the broiler feeds in this study was reported earlier to contained appreciable amounts of valuable minerals, which are nutritional requirements of poultry (Ogbe *et al.*, 2009b). Diet of group 2 and 5 had slightly higher crude fibre content, group 2 (11.45%) and group 5 (11.65%). These diets contained melon husk meal but no mushroom and no enzyme supplemented in them. The ash content of the two feed (group 2 and 5) were also low (about 6.45%) compared to the mushroom group (about 7.4%) and enzyme supplemented group (Table 4).

In the broiler finisher diets (at 10% and 15% melon husk inclusion rate), the crude protein content of the diets, group 1, 3 and 6 were higher than the others. Group 3 and 6 also had higher ash content, which may be due to the presence of high minerals in the ingredients (melon husk and mushroom). Diets of group 2 and 5 had the least crude protein and ash content (Table 5).

Table.1 Composition of broiler starter diet (23% cp) with or without melon husk meal and wild mushroom (*Ganoderma* sp) and enzyme

Feed Ingredient	Group dietary inclusion rate (%w/w)						
	1	2	3	4	5	6	7
Maize	39.68	41.47	41.47	41.47	42.97	42.97	42.97
Maize offal	6.00	2.50	2.50	2.50	2.50	2.50	2.50
Ground nut cake	15.25	10.95	10.95	10.95	10.90	10.90	10.90
Soybean cake	22.50	19.00	19.00	19.00	15.45	15.45	15.45
Rice bran	6.00	5.00	5.00	5.00	3.50	3.50	3.50
Bone meal	2.50	2.53	2.53	2.53	1.12	1.12	1.12
Blood meal	2.45	0.50	0.50	0.50	0.50	0.50	0.50
Palm oil	4.62	7.05	7.05	7.05	7.06	7.06	7.06
Melon meal	0.00	10.00	10.00	10.00	15.00	15.00	15.00
Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt (sodium chloride)	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total =	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Dietary treatment: group 1 (control) = 0% melon husk (no enzyme, no mushroom), 2 = 10% melon; husk (no enzyme, no mushroom), 3 = 10% melon husk with mushroom (no enzyme), 4 = 10% melon; husk with enzyme (no mushroom), 5 = 15% melon husk (no enzyme, no mushroom), 6 = 15% melon; husk with mushroom (no enzyme), 7 = 15% melon husk with enzyme (no mushroom). Dried; mushroom powder = 5g/kg feed, and exogenous enzyme (maxigrain) = 1g/20kg feed.

Table.2 Composition of broiler finisher diet (20% cp) with or without melon husk meal and wild mushroom (*Ganoderma* sp) and enzyme

Feed Ingredient	Group dietary inclusion rate (%w/w)						
	1	2	3	4	5	6	7
Maize	39.68	42.08	42.08	42.08	43.10	43.10	43.10
Maize offal	10.00	9.50	9.50	9.50	4.50	4.50	4.50
Ground nut cake	17.25	10.00	10.00	10.00	11.00	11.00	11.00
Soybean cake	16.00	12.85	12.85	12.85	13.95	13.95	13.95
Rice bran	6.50	5.00	5.00	5.00	4.00	4.00	4.00
Bone meal	2.50	2.50	2.50	2.50	1.50	1.50	1.50
Blood meal	2.45	2.45	2.45	2.45	2.45	2.45	2.45
Palm oil	4.62	4.62	4.62	4.62	3.50	3.50	3.50
Melon meal	0.00	10.00	10.00	10.00	15.00	15.00	15.00
Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt (sodium chloride)	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total =	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Dietary treatment: group 1 (control) = 0% melon husk (no enzyme, no mushroom), 2 = 10% melon husk (no enzyme, no mushroom), 3 = 10% melon husk with mushroom (no enzyme), 4 = 10% melon husk with enzyme (no mushroom), 5 = 15% melon husk (no enzyme, no mushroom), 6 = 15% melon husk with mushroom (no enzyme), 7 = 15% melon husk with enzyme (no mushroom). Dried mushroom powder = 5g/kg feed, and exogenous enzyme (maxigrain) = 1g/20kg feed.

Table.3 Proximate-nutrient and mineral composition of melon husk meal from Nasarawa State, Nigeria

Nutrients	% Dry matter	Minerals	Content
Crude Protein	19.94 ±0.45	Calcium (%)	2.10 ±0.13
Crude Fibre	7.19 ±0.85	Magnesium (%)	0.42 ±0.10
Crude Fat	1.71 ±0.04	Potassium (%)	1.30 ±0.04
Ash Content	7.73 ±0.12	Sodium (ppm)	259.85 ±1.78
Moisture	2.42 ±0.70	Iron (ppm)	98.42 ±1.55
Nitrogen	3.19 ±0.25	Zinc (ppm)	47.77 ±1.06
Carbohydrate (NFE)	63.43 ±0.35	Phosphorus (ppm)	30.11 ±0.20
Fatty acid	1.37 ±0.03	Manganese (ppm)	58.83 ±0.54
Dry Matter (DM)	97.58 ±3.56	Copper (ppm)	5.94 ±0.30
Energy value (Kcal/100kg)	1440.11 ±0.30	-	-

DM = Dry matter; ppm = parts per million.

Table.4 Proximate composition of broiler starter diet (23% cp) with wild mushroom and enzyme

Content (%)	Group						
	Control (0%)	10% inclusion			15% inclusion		
	1	2	3	4	5	6	7
Nitrogen	3.50 ±0.30	3.40 ±0.10	3.45 ±0.02	3.29 ±0.11	3.25 ±0.04	3.58 ±0.01	3.51 ±0.11
Crude protein	21.85 ±0.04	21.45 ±0.06	21.75 ±0.40	20.56 ±0.04	20.31 ±0.20	22.40 ±0.31	21.93 ±0.04
Ash content	7.10 ±0.05	6.50 ±0.11	7.25 ±0.12	7.05 ±0.30	6.45 ±0.10	7.40 ±0.11	6.85 ±0.16
Lipid (fat)	7.08 ±0.10	6.40 ±0.02	7.26 ±0.20	7.31 ±0.04	8.04 ±0.06	8.01 ±0.06	7.05 ±0.06
Moisture	7.41 ±0.01	7.25 ±0.08	6.45 ±0.10	7.03 ±0.04	7.73 ±0.03	7.42 ±0.04	7.35 ±0.02
Crude fibre	11.00 ±0.20	11.45 ±0.05	10.85 ±0.13	10.93 ±0.20	11.65 ±0.40	11.15 ±0.40	11.05 ±0.08
Carbohydrate (NFE)	52.97 ±0.02	54.20 ±0.15	52.89 ±0.30	54.15 ±0.22	53.55 ±0.40	51.04 ±0.10	53.12 ±0.07

Values are mean (±SD) of duplicate results; Group 1 = represents broilers fed normal feed without melon husk (0%), 2 = 10% melon husk (no enzyme, no mushroom), 3 = 10% melon husk + mushroom, 4 = 10% melon husk + enzyme, 5 = 15% melon husk (no enzyme, no mushroom), 6 = 15% melon husk + mushroom, 7 = 15% melon husk + enzyme.

Effect on feed intake and feed conversion efficiency of broiler chicken

Table 3 showed that at 10% melon husk meal inclusion, feed intake of broilers in group 2 was lower (72.3 g/b/d) than feed intake (68.6g/b/d) of broilers fed with normal diet (control, group 1). Generally, the broilers that were fed melon husk meal with mushroom (group 3 and 6) recorded higher feed intake (77g/b/d), followed by those supplemented with enzyme (75g/b/d). Possibly, like enzymes, this increase may be due to breakdown of cell wall polysaccharide of melon husks by crude enzymes in the wild macrofungus (mushroom) into easily digestible fibre fractions or nutrients. *Ganoderma* species of mushroom are known to contained crude enzymes (xylanase and beta-glucanase), which are capable of degrading non-conventional feed ingredients to yield easily digestible fibre fractions (or metabolisable energy).

In this study, the feed conversion efficiency did not differ significantly (P>0.05) in all the groups, but feed cost per weight gain (N/kg) in the broilers fed melon husk meal with mushroom or enzyme were significantly low (group 3, 6 and 7). This showed that inclusion of mushroom or enzyme in broiler diets containing melon husks would decrease feed cost per unit live body weight gain of broiler chicken. This mushroom was earlier reported to improve live body weight gain, feed conversion rate and health status of broilers (Ogbe *et al.*, 2008). Ogbe *et al* (2008) reported that pullet chickens fed with the mushroom at high inclusion rate (1-2g/kg feed) had better feed conversion efficiency (3.3–3.4%) than those fed with little or no mushroom (3.6%). Pullets and broilers fed with diets containing the mushroom (*Ganoderma* sp) showed improved weight gain and health performance. This study showed that supplementation of chicken diets with this wild mushroom resulted in better feed conversion efficiency.

Effect on body weight gain and carcass traits of broiler chicken

In this present study (Table 3), the result showed that the body weight gain of broilers fed melon husk meal supplemented with either mushroom or enzyme did not differ significantly (P>0.05). However, the broilers that were fed with melon husk meal at 10% inclusion rate supplemented mushroom (group 3) had higher weight gain (30.8g/b/d). While those in group 5 fed with melon meal at 15% inclusion without mushroom and enzyme had the lowest body weight gain (28.04g/b/d). Possibly, this may be due to the high crude fibre content (14.33%) of the feed that was given to the birds in this group (Table 2). Also, melon husks contained anti-nutrients (tannins and phytates), which may bind with essential minerals (like calcium, iron, magnesium and zinc) in the digestive tract of chicken, and this may lead to mineral deficiencies. Anti-nutrients are known to bind minerals to form insoluble salts, thereby decreasing their bioavailability or absorption (Thompson, 1993; Guil and Isasa, 1997; Muhammad *et al.*, 2011). Tannins are plant polyphenols, which have ability to form complexes with metal ions (minerals) and with macro-molecules such as protein and polysaccharides (De-Bruyne *et al.*, 1999; Muhammad *et al.*, 2011). Dietary tannins are capable of reducing feed efficiency and weight gain in chicks (Dei *et al.*, 2007).

In this study (Table 4), inclusion and intake of melon husk meal in broiler diets with either mushroom or enzyme supplementation appeared to exert a

Table.5 Proximate composition of broiler finisher diet (20% cp) with wild mushroom and enzyme

Content (%)	Group						
	Control (0%)	10% inclusion			15% inclusion		
	1	2	3	4	5	6	7
Nitrogen	3.21 ±0.10	2.89 ±0.04	3.00 ±0.08	2.94 ±0.11	2.94 ±0.04	3.15 ±0.05	2.88 ±0.11
Crude protein	20.06 ±0.62	18.06 ±0.22	18.75 ±0.53	18.38 ±1.24	18.38 ±0.22	19.69 ±0.31	18.00 ±0.66
Ash content	6.39 ±0.01	6.06 ±0.11	7.54 ±1.51	7.10 ±0.30	6.18 ±0.05	7.54 ±0.06	6.65 ±0.16
Lipid (fat)	11.16 ±0.06	9.74 ±0.10	11.35 ±0.20	11.55 ±0.15	13.04 ±0.13	13.01 ±0.06	11.02 ±0.06
Moisture	8.82 ±0.30	8.60 ±0.17	6.97 ±0.14	8.06 ±0.14	9.10 ±0.09	9.42 ±0.13	8.32±0.08
Crude fibre	14.08 ±0.17	13.88 ±0.12	11.18 ±0.03	13.01 ±0.08	14.33 ±0.24	14.14 ±1.34	12.69 ±0.11
Carbohydrate (NFE)	48.31 ±0.58	52.30 ±0.55	51.20 ±1.03	50.00 ±1.22	48.10 ±0.20	45.62 ±0.53	52.33 ±0.86

Values are mean (±SD) of duplicate results; Group 1 = represents broilers fed normal feed without melon husk (0%), 2 = 10% melon husk (no enzyme, no mushroom), 3 = 10% melon husk + mushroom, 4 = 10% melon husk + enzyme, 5 = 15% melon husk (no enzyme, no mushroom), 6 = 15% melon husk + mushroom, 7 = 15% melon husk + enzyme.

Table.6 Performance of broiler chicken fed melon husk meal with wild mushroom and enzyme

Group Parameters	Group performance of broilers							
	0%	10%			15%			
	1	2	3	4	5	6	7	Significance
Initial weight (g/b)	160	160	160	160	160	160	160	NS
Final weight (g/b)	1765	1865	1885	1765	1730	1980	2080	NS
Weight gain (g/b)	1605	1705	1725	1605	1570	1820	1920	NS
Weight gain (g/b/d)	28.66	30.45	30.80	28.66	28.04	32.50	34.29	NS
Feed intake (g/b/d)	68.60	72.30	77.10	74.40	72.90	75.60	75.20	NS
Feed conversion ratio (FCR)	2.40	2.40	2.50	2.60	2.60	2.33	2.20	NS
Protein efficiency ratio (PER)	1.90	1.40	1.80	1.70	1.70	1.90	2.00	NS
Mortality (%)	10.00*	5.00	0.00	0.00	0.00	5.00	5.00	*
Feed cost (N/kg)	106.00	102.70	103.60	101.10	100.90	101.90	101.20	NS

Values are mean ± standard deviation (SD) of duplicate results; asterik*= indicate significant difference at 5% level (P<0.05); NS = not significant; Group 1 = represent broiler chicken fed normal feed (control, no melon husk, no mushroom, no enzyme), 2 = broilers fed 10% melon husk, 3 = broilers fed 10% melon husk + mushroom, 4 = broilers fed 10% melon husk + enzyme, 5 = broilers fed 15% melon husk, 6 = broilers fed 15% melon husk + mushroom, 7 = broilers fed 15% melon husk + enzyme.

Table.7 Carcass and organ weights (%) of broilers fed melon husk meal with wild mushroom and enzyme

Parameters	**Group mean weights and organ: body weight ratio (%)**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**Significance**
Pre-slaughter weight (kg/b)	1.77	1.87	1.89	1.77	1.73*	1.98	2.08	*
Dressed weight (kg/b)	1.34	1.37	1.39	1.31	1.16*	1.45	1.54	*
Dressing percent (%)	74	72	73	73	68*	73	73	*
Carcass: body weight ratio (%)								
Thigh (leg)	18.95	18.35	18.66	18.00	17.40*	18.40	18.64	*
wings	9.52	9.39	9.86	9.17	7.93*	9.11	9.31	*
Breast	10.34	10.53	11.23	11.01	9.96*	11.04	11.76	*
Rib cage (thorax)	8.82	7.87*	8.78	8.77	7.98*	8.17	8.67	*
Back (bone)	12.40	11.71	11.76	11.90	11.89	11.36	11.75	NS
Shank	5.47	5.59	6.09	5.90	4.92	6.06	5.51	NS
Neck	5.85	5.16	5.07	4.69	4.80	5.32	4.78	NS
Head	3.35	3.28	3.19	3.43	3.15	3.07	3.00	NS
Organs: body weight ratio (%)								
Liver	1.68	1.48	1.38	1.56	1.61	1.47	1.32	NS
Kidney	0.44	0.56	0.55	0.57	0.58	0.51	0.49	NS
Gizzard	2.29	2.27	2.68*	2.03	2.79*	2.66*	3.03*	*
Heart	1.12	0.78	0.80	1.10	0.88	0.76	0.72	NS
Spleen	0.15	0.19	0.13	0.17	0.18	0.15	0.15	NS
Lungs	0.87	0.91	0.80	1.10	0.89	0.76	0.72	NS
Bursa	0.25	0.22	0.52*	0.56*	0.24	0.38*	0.44*	*
GIT (intestine)	6.00	8.82*	8.05	8.20	8.40*	7.08	7.24	*
Total =	**87.50**	**87.11**	**89.55**	**88.16**	**83.60***	**86.30**	**87.53**	*
Other parts =	12.50	12.89	10.45	11.84	16.40	13.70	12.47	

Group 1 = broilers fed normal diet (control, no melon husk, no mushroom, no enzyme), 2 = broilers fed 10% melon husk (no mushroom, no enzyme), 3 = 10% melon husk + mushroom, 4 = 10% melon husk + enzyme, 5 = 15% melon husk (no mushroom, no enzyme), 6 = 15% melon husk + mushroom, 7 = 15% melon husk + enzyme.

positive effect on broilers body weight gain and tissues development. These feed ingredients (melon husks and mushroom) contained essential nutrients, which exert beneficial effects on growth and tissue development. This study also showed that broilers in group 5 that were fed melon husk meal at 15% w/w inclusion rate without mushroom and enzyme recorded the lowest dressed weight (1.16kg/b) and dressed percent (68%). The carcass parts (thigh, breast, wings and rib cage (thorax) were low (group 5). The weight of gizzard of broilers fed melon husk meal supplemented with either mushroom or enzyme was high in group 3 (2.68%),

group 5 (2.79%), group 6 (2.66%) and group 7 (3.03%). The weight of the bursa (a humoral immune organ) was higher in group 4 (0.56%) and group 3 (0.52%), followed by group 7 (0.44%) and group 6 (0.38%). In earlier studies, poultry feeds that contained mushroom were reported to enhance both humoral and cellular immunity against *Eimeria tenella*-infected chicken (Ogbe *et al.,* 2008; Ogbe *et al.,* 2009b; Guo *et al.,* 2004; Willis *et al.,* 2011).

Effect on mortality pattern and health of broiler chicken

No mortality was observed in broilers that were fed with melon husk meal at 10% inclusion and mushroom supplement. Also, there was no mortality of broilers (group 5) when they were fed with melon husk meal at 15% inclusion rate. The mortality recorded in group 1 (10%), group 2 (5%), group 6 and group 7 (5%) were not connected to the utilization of melon husks and the wild mushroom or enzyme in the broiler diets. These mortalities occurred during brooding due to managerial cause. This study showed that melon husks could be utilized as feed ingredient in broiler diets up to 15% inclusion rate with or without mushroom and enzyme supplements. Other researchers also demonstrated the immune enhancing effect of mushroom in promoting health and abating coccidiosis in broiler chicken (Ogbe *et al.,* 2008; Ogbe *et al.,* 2009b; Guo *et al.,* 2004; Willis *et al.,* 2011).

Conclusion

The result of this study showed that melon husks contained appreciable amounts of essential nutrients, which are requirements to promote growth and health performance of broiler chicken. Melon husk meal could be utilized as source of feed ingredient in broiler diets with wild mushroom and exogenous enzyme as supplements. The wild mushroom (*Ganoderma* sp) used in this study like exogenous enzyme, breakdown fibre fractions of the cell wall into digestible nutrients for utilization by the broilers. Melon husks could be recommended as source of feed ingredients for broilers at 10% inclusion rate with or without crude enzyme supplementation. This will also help in waste management.

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