International Journal of Research Studies in Biosciences (IJRSB)
Volume 1, Issue 2, November 2013, PP 1-10
www.arcjournals.org

Utilization of Melon Husk with Wild Mushroom (*Ganoderma sp*) and Enzyme Supplement: Effect on Performance of Broiler Chicken

A.O. Ogbe

Department of Animal Science, Faculty of Agriculture,
Nasarawa State University, Keffi, NIGERIA.
ogbeadamu@yahoo.com

Alu S.E

Department of Animal Science, Faculty of Agriculture,
Nasarawa State University, Keffi, NIGERIA.
ogbeadamu@yahoo.com

Moses Atsong

Department of Animal Science, Faculty of Agriculture,
Nasarawa State University, Keffi, NIGERIA.
ogbeadamu@yahoo.com

Obeka A.D.

Department of Animal Science, Faculty of Agriculture,
Nasarawa State University, Keffi, NIGERIA.
ogbeadamu@yahoo.com

Abstract: *Melon husks are shells usually discarded in large quantities (tonnage) as agricultural waste materials in different parts of Nasarawa State in Nigeria, thereby polluting the environment. An experiment was therefore conducted to determine the nutritional value and effect of utilizing melon husks meal in broiler diets as feed ingredient with or without wild mushroom (Ganoderma sp) and exogenous enzyme supplement. Melon husks were collected from Nasarawa Local Government Area of Nasarawa State and milled into powder (meal) for inclusion at 10% and 15% w/w in broiler starter and finisher mash feed, respectively. Broiler starter (23% crude protein) and finisher (20% crude protein), melon husks and the wild mushroom were subjected to proximate analysis. Feeding trials was carried out for 56 days on broiler chickens (Marshal Hybrid), procured at day old from a commercial hatchery in Nigeria. The chicks were randomly distributed into different dietary treatments, group T1–T7 (10 chicks each) in duplicate. Group T1 represent broiler chicks fed with diet 1 (0% melon husks, no enzyme, no mushroom) as control for comparison, T2 = diet 2 (10% melon husks, no enzyme, no mushroom), T3 = diet 3 (10% melon husks supplemented with mushroom, no enzyme), T4 = diet 4 (10% melon husks supplemented with enzyme, no mushroom), T5 = diet 5 (15% melon husks, no enzyme, no mushroom), T6 = diet 6 (15% melon husks supplemented with mushroom, no enzyme), T7 = diet 7 (15% melon husks supplemented with enzyme, no mushroom). The birds were reared on deep litter system of management and feed and water was provided, ad libitum. Daily average feed intake and body weight gain were monitored and evaluated. The results showed that melon husks meal and wild mushroom contained valuable amounts of essential nutrients (protein, fibre, minerals, fat and fatty acids). Dietary inclusion of melon husk in broiler diets with or without the wild Ganoderma and enzyme supplement did not significantly affect feed intake and weight gain (P>0.05). However, broilers fed 10% melon husk inclusion rate with wild Ganoderma supplement had improved feed intake and weight gain. It was therefore concluded that melon husks could be utilized as valuable feed ingredient in broiler diets with either wild Ganoderma or enzyme supplements.*

Keywords: *Melon husk meal, wild mushroom, crude enzyme, broiler performance.*

1. INTRODUCTION

Poultry are monogastric animals, which depend on highly digestible feed ingredients to improve their growth performance and health. Energy-providing feed (such as maize or corn) and body building food like soybean and groundnut in form of cake as protein sources are required by poultry (birds). In Nigeria, these feed ingredients, which are also stable foods for human, are expensive. There is competition for these feed ingredients between farm animals (particularly poultry) and human. Some workers reported that under normal conditions the cost of poultry feeds accounted for more than 70%

of the total cost of poultry production [1, 2, 3]. This proportion has been on the increase due to volatibility of the feed market and the competition for feed resources between human food sector and animal feed industries [3]. Consequently, nutritionists and research scientists are turning attention to alternative sources of feed ingredients for use in poultry livestock and poultry production.

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 [4, 5]. 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 (6, 7]. However, the melon husks (shells) are discarded or burnt as waste materials due to the fibrous nature and possible presence of some phytochemical or anti-nutritional factors that hinders their utilization by monogastric animals including poultry (birds).

In Nasarawa State (Nigeria), large tonnage of melon seeds are produced and processed annually in virtually all the 13 Local Government Areas, particularly in Udege-Mbeki Development Area of Nasarawa Local Government Council. The melon husks are usually discarded after processing or shelling of melon seeds, which pollute the environment. The high fibre content of the melon husks may limit its utilization by poultry (birds).The aim of this study was to determine the nutritional potential of melon husks as feed ingredient for broiler chickens. The aim is to evaluate the potential of melon husk as feed ingredient in broiler diets. The specific objective is to evaluate the effect of melon husks meal in broiler diets on the growth performance and health status of broiler chickens. The general objective was to convert melon husks into useful ingredients for human benefits. The use of crude enzyme preparations having high xylanase activity or exogenous microbial enzyme was because poultry (chickens) are unable to utilize high crude fibre diets. Exogenous enzymes were reported to improve nutritional value of high fibre diets and can also destroy anti-nutritional factors [8, 9, 10]. A new veterinary research study findings in Nigeria reported by Ogbe *et al* [11] showed that wild *Ganoderma lucidum* contained appreciable levels of essential nutrients and bioactive compounds that are beneficial to broiler chicken.

2. MATERIALS AND METHODS

2.1 Location of the Study Area

The study was conducted at the Livestock Research and Demonstration Farm of the Faculty of Agriculture, Nasarawa State University, Keffi (Lafia Campus). It is within the guinea savannah zone of North Central Nigeria and located between Latitude 6^{o} 15^{0}N and 9^{0} 30'N and longitude 6^{0} 30^{0}N and 11^{0} 00E. The mean environmental temperature of the area ranges between 28.5^{o}C and 30.9^{o}C during the period of study (January–March, 2012). The mean annual rainfall ranges between 1270 and 1530mm, and the vegetation type is dominated by savannah trees and small woody shrubs.

2.2 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 (also called "egusi" by the people) in Nasarawa Local Government Area of Nasarawa State, Nigeria. The melon husks were milled into powder to form a meal using a locally made miller machine (unbranded) and sun-dried at 35^{o}C for 3-5h [12]. Wild *Ganoderma* species of mushroom were collected from Lafia, Nasarawa State, and milled into powder form using pestle and mortar manually.

2.3 Proximate study and mineral analysis

The melon husks and mushroom and broiler diets used in this study were subjected to proximate (nutrients) analysis using the methods of the Association of Official Analytical Chemists [13]. All determinations were done in duplicate. Total soluble carbohydrate was determined by the difference of the sum of all the proximate composition from 100%. The calorific (energy) value was obtained according to the methods of Akinyeye *et al* [14, 15]. This was done by multiplying the value of carbohydrate, protein and crude fat by the Atwater factors of 17, 17 and 37 respectively [15]. The

crude fat was converted into fatty acid by multiplying with conversion factor of 0.80 as described by Akinyeye *et al* [14, 15]. All the proximate values were reported in percentage.

Minerals in the melon husks meal and wild mushroom were determined using Atomic Absorption Spectrophotometer (AAS-Buck 205 model) and phosphorus was carried out colorimetrically [13]. All determinations were done in duplicate. The values of calcium, magnesium and potassium in melon husks and mushroom were reported in percentage (%), and sodium, iron, zinc, phosphorus, manganese and copper were reported in parts per million (ppm). Quantitative phytochemical analysis was also done to determine presence of phytochemical or anti-nutrients [16]. All determinations done in duplicate.

2.4 Experimental Chicks and Management

One hundred (100) 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 (5 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 water was provided to the birds throughout the experiment (56 days), *ad libitum*.

2.5 Experimental Design and Diets

i. Diet 1 (control): 0% melon husks (no enzyme, no mushroom) labeled as T1.

ii. Diet 2: 10% melon husks (no enzyme, no mushroom) labeled as T2.

iii. Diet 3: 10% melon husks supplemented with mushroom (no enzyme) labeled T3.

iv. Diet 4: 10% melon husks supplemented with enzyme (no mushroom) labeled T4.

v. Diet 5: 15% melon husks (no enzyme, no mushroom) labeled as T5.

vi. Diet 6: 15% melon husks with mushroom supplement (no enzyme) labeled T6.

vii. Diet 7: 15% melon husks supplemented with enzyme (no mushroom) labeled T7.

2.6 Collection of Data and Statistical Analysis

All the data generated (proximate-nutrients, feed intake, weight gain, feed conversion ratio, carcass and organs body weights ratio) were analyzed using descriptive statistic and analysis of variance according to the methods described by Olawuyi [17]. Results were reported as mean (±SD) standard deviation.

3. RESULTS AND DISCUSSION

3.1 Nutritional composition of melon husk meal and broiler diets

Table 1 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 husks 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). The presence of these essential nutrients and minerals imply melon husks could be utilized as a feed ingredient for poultry. Some valuable amounts of essential nutrients (16.79% ±0.13 CP, 7.77% ±0.34 CF, 3.2% $\pm$1.20 ash, 1.52% $\pm$0.09 fat, and 1.52% $\pm$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 [12]. Environmental factor (such as high temperature) and processing method of

melon husk (drying and grinding into powder or meal) may be responsible for the low concentration of anti-nutrients present in them.

Table 2 showed the nutritional composition of broiler diets (group T1-T7) with or without wild *Ganoderma* and exogenous enzyme supplements. At 10% melon husks inclusion rate there were no significant variations (P>0.05) in the nutrients composition between feed T2, T3 and T4. There were no significant difference (P>0.05) in the crude protein (18-20% CP) and crude fibre (11-14%) levels of all the one way experimental broiler diets when compared with the control normal broiler diet (T1). At 15% inclusion rate, the crude protein level of T6 (melon husk + mushroom) was higher (19.7% CP), followed by T5 (18.4% CP) and T7 (melon husk + enzyme). Generally, diet T5 (melon husk meal without mushroom and no enzyme) had slightly higher crude fibre (14.3%). Diet T3 and T6 had slightly higher ash content (7.54%, each). The wild *Ganoderma* used in this broiler feeds was reported earlier to contained appreciable amounts of valuable minerals, which are nutritional requirements of poultry [18].

TABLE 1. *Proximate-nutrients and mineral composition of melon husks from Nasarawa State, Nigeria*

Nutrients analyzed (% DW)	**Mean composition (% ± SD)**	**Minerals (elements)**	**Mean composition (±SD)**
Crude Protein (CP)	19.94 ± 0.45	Calcium (%)	2.10±0.13
Crude Fibre (CF)	7.19 ± 0.85	Magnesium (%)	0.42 ±0.10
Crude Fat (lipid)	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 (N)	3.19 ± 0.25	Zinc (ppm)	47.77 ± 1.06
Carbohydrate (CHO)	61.01 ± 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	-	-

***Data are mean ± standard deviation (SD) of duplicate results; DW = dry weight; ppm = parts per million (1mg/kg = 1ppm).**

3.2 Effect on feed intake and feed conversion efficiency of broiler chicken

Table 3 showed that at 10% melon husks inclusion rate, the feed intake of broilers in group T2 was low (72.3 g/b/d), but this was better than the fed intake (68.6g/b/d) of broilers that were fed with normal diet (control, group T1). Generally, the broilers that were fed melon husks with wild *Ganoderma* (group T3 and T6) recorded higher feed intake (about 77g/b/d), followed by those supplemented with enzyme (about 75g/b/d). Like exogenous enzymes, these increases may be due to the breakdown of cell wall polysaccharide of melon husks by crude enzymes in the wild macrofungus (mushroom) into easily digestible fibre fractions or nutrients. *Ganoderma sp*ecies of mushroom also contained crude enzymes (xylanase and beta-glucanase), which are capable of degrading non-conventional feed ingredients (like melon husks) to yield easily digestible fibre fractions (or metabolisable energy) that are utilized by poultry (birds).

In this study the feed conversion efficiency did not differ significantly (P>0.05) in the entire groups, but the feed cost per weight gain (N/kg) in broilers fed melon husks with either mushroom or enzyme were significantly low (T3, T6 and T7). This showed that inclusion of wild *Ganoderma* or exogenous enzyme in broiler diets containing melon husks meal would decrease the feed cost per unit live body weight gain of broiler chicken. Wild *Ganoderma* was earlier reported to improve live body weight gain, feed conversion ratio and health status of broiler chickens [19]. Ogbe *et al* [19] reported that pullet chickens fed with wild *Ganoderma* at high inclusion rate (1-2g/kg feed) had better feed conversion efficiency (3.3–3.4%) than the chickens that were fed with little or no mushroom (3.6%). Pullet chickens and broilers fed with these diets containing wild mushroom (*Ganoderma* sp) showed

improved weight gain and health performance. These studies showed that supplementation of chicken diets with this wild mushroom resulted in better feed conversion efficiency and the effect is dose dependent.

TABLE 2. *Proximate composition of experimental melon husk meal in broiler diets with or without wild mushroom (Ganoderma sp) and exogenous enzyme*

Proximate Values (%)	Control (0%)	10% inclusion			15% inclusion		
	T1	T2	T3	T4	T5	T6	T7
Nitrogen	3.21±0.10	2.89±0.04	2.80±0.08	2.94±0.11	2.94±0.04	3.15±0.05	2.77±0.11
Crude protein	20.06±0.62	18.06±0.22	17.50±0.53	18.38±1.24	18.38±0.22	19.69±0.31	17.31±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	39.49±0.58	43.66±0.55	45.46±1.03	41.90±1.22	38.97±0.20	36.20±0.53	44.01±0.86
Calcium (Ca)	2.79±0.13	3.03±0.08	3.09±0.09	3.00±0.35	2.78±0.04	2.99±0.20	3.18±0.04
Phosphorus (ppm)	66.33±0.60	70.28±1.32	70.64±0.80	72.63±0.10	66.77±2.14	72.38±0.38	67.70±0.66

Values are mean (±SD) of duplicate results; T1 = represents broilers fed normal feed without melon husks (0%), T2 = 10% melon husks (no enzyme, no *Ganoderma*), T3 = 10% melon husks + *Ganoderma,* T4 = 10% melon husks + enzyme, T5 = 15% melon husks (no enzyme, no *Ganoderma),* T6 = 15% melon husks + *Ganoderma,* T7 = 15% melon husks + enzyme.

3.3 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 broiler chickens fed with melon husks meal with either wild mushroom or exogenous enzyme did not differ significantly (P>0.05). However, broiler chickens that were fed melon husks meal in broiler diet at 10% inclusion rate with the wild mushroom (group T3) recorded higher weight gain (30.8g/b/d). Broilers in group T5 that were fed with melon husk meal in broiler diet at 15% inclusion rate without wild mushroom and enzyme recorded the lowest body weight gain (28.04g/b/d). Possibly, this may be due to the high crude fibre content (14.33%) of the diet 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 [20, 21, 22]. Tannins are plant polyphenols, which have ability to form complexes with metal ions (minerals) and with macro-molecules such as protein and

polysaccharides [23, 24]. Dietary tannins are capable of reducing feed efficiency and weight gain in chicks [24, 25].

In this study (Table 4), inclusion and intake of melon husks meal in broiler diets with wild *Ganoderma* or exogenous enzyme supplementation appeared to exert a positive effect on broilers body weight gain and tissues development. These feed ingredients (melon husks and medicinal mushroom) contained essential nutrients, which exert beneficial effects on growth and tissue development. Broiler chickens (group T5) that were fed melon husks meal in diet at 15% w/w inclusion rate without mushroom and enzyme recorded the least body weight gain (1.73kg/b), dressed weight (1.16kg/b) and dressed percent (68%). The carcass parts (thigh, breast, wings and rib cage (thorax) were low (group T5). Intake of these ingredients appeared to exert some positive effect on the development of gastrointestinal tract (GIT) and immune organs (bursa). The weight of the gizzard of broiler chickens that were fed on melon husks meal in broiler diets with either mushroom or enzyme was high, group T3 (2.68%), T5 (2.79%), T6 (2.66%) and T7 (3.03%). Also, the weight of the bursa (a humoral immune organ) was higher in T4 (0.56%) and T3 (0.52%), followed by T7 (0.44%) and T6 (0.38%). In earlier studies, poultry feeds that contained mushroom were reported to enhance both humoral and cellular immunity against *Eimeria tenella*-infected chickens [18, 19, 26, 27].

TABLE 3. *Performance characteristics of broilers chicken fed melon husks meal with or without wild mushroom (Ganoderma sp) and exogenous enzyme.*

Group Parameters	**Performance characteristics of broilers**							
	0%	**10%**			**15%**			
	T1	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**LOS**
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
Feed cost/weight gain (N/kg)	3.90	3.60	3.30*	3.80	4.10	3.30*	3.20*	*

Values represent mean ± standard deviation (SD) of duplicate results; asterik*= indicate significant difference at 5% level (P<0.05); NS = not significant; LOS = level of significance; Group T1 = represent broiler chicken fed normal feed (control, no melon husks, no mushroom, no enzyme), T2 = broilers fed 10% melon husks, T3 = broilers fed 10% melon husks + mushroom, T4 = broilers fed 10% melon husks + enzyme, T5 = broilers fed 15% melon husks, T6 = broilers fed 15% melon husks + mushroom, T7 = broilers fed 15% melon husks + enzyme.

3.4 Effect on mortality pattern and health of broiler chicken

No mortality was observed in broiler chickens that were fed with melon husks meal in broiler diet at 10% inclusion rate and wild *Ganoderma* supplement. Also, there was no mortality of broiler chickens (group T5) when they were fed with melon husks meal in broiler diet at 15% inclusion rate. The mortality recorded in T1 (10%), T2 (5%), T6 and T7 (5%, each) were not connected to the utilization of melon husks meal and the wild mushroom or exogenous enzyme supplements in broiler diets. These mortalities occurred during brooding (7–14 days of age of birds) and were due to managerial cause. The observation in this study showed that melon husks meal could be utilized as a feed ingredient in broiler diets up to 15% inclusion level 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 [18, 19, 26, 27].

TABLE 4. *Carcass and organ body weights (%) of broilers chicken fed melon husks meal with or without wild mushroom (Ganoderma sp) and exogenous enzyme*

Parameters		**Group mean weights and organ: body weight ratio (%)**						
	T1	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**LOS**
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 T1 = represent broilers fed with normal broiler mash feed (control, no melon husks, no mushroom, no enzyme), T2 = broilers fed with 10% melon husks (no mushroom, no enzyme), T3 = broilers fed 10% melon husks + mushroom, T4 = broilers fed 10% melon husks + enzyme, T5 = broilers fed 15% melon husks (no mushroom, no enzyme), T6 = broilers fed 15% melon husks + mushroom, T7 = broilers fed 15% melon husks + enzyme.

4. CONCLUSION

In conclusion, the result of this study showed that melon husks contained appreciable amounts of essential nutrients (protein and minerals) and fatty acid to promote growth performance and health of broiler chicken. Melon husks meal could be utilized as a source of feed ingredient in broiler diets with wild *Ganoderma* specie of mushroom and exogenous enzyme as supplements, which help in the breakdown of fibre fractions of the cell wall into easily digestible nutrients for the broiler chicken. Melon husks meal could be recommended for utilization in broiler diets at 10% inclusion rate with or without crude enzymes supplementation, except at higher inclusion rate. In Nasarawa State, Nigeria large tonnage of these Agricultural resources (melon husks) are discarded as waste materials and also burnt thereby polluting the environment. The authors wish to recommend that these Agricultural waste materials (melon husks) should henceforth be channeled towards poultry feed production. This will also help in waste management.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge Mr. B. Ohaegbulem (International Institute of Tropical Agriculture, Ibadan, Nigeria) for the Technical support, and Mr. N.A. Tsaku (Faculty of Agriculture, Nasarawa State University, Keffi), as well as staff of the Livestock Research and Demonstration Farm of the Faculty of Agriculture, Nasarawa State University, Keffi for their assistance during the course of this research work.

REFERENCES

Abubakar, A; Sekoni, A.A; Tukur, H.M. and Hassan, W.A. (2004). Impact of yeast supplementation on the growth performance of pullet chicks fed diets with high levels of rice bran. Proceedings of the 29th Annual Conference of Nigeria Society for Animal Production (NSAP), held 21st-25th March 2004 at Sokoto, 265-267.

Agbede, J.O. and Aletor, V.A. (2003). Evaluation of fishmeal replaced with leaf protein concentrate from glyricidia in diets for broiler chicks: effects on performance, muscle growth, hematology and serum metabolites. International Journal of Poultry Science, 2 (4): 242-250.

Mutayoba, S.K; Dierenfield, E; Mercedes, V.A; Frances, Y. And Knight, C.D. (2011). Determination of chemical composition and anti-nutritive components for Tanzanian locally available poultry feed ingredients. International Journal of Poultry Science, 10(5): 350-357.

Abiodun, O.A. and Adeleke, R.O. (2010). Comparative studies on nutritional composition of four melon seeds varieties. Pakistan Journal of Nutrition, 9(9): 905-908.

Fagbohun, E.D; Lawal, O.U. and Hassan, O.A. (2011). The chemical composition and mycoflora of sundried shelled melon seeds (Citrullus vulgaris) during storage. International Research Journal of Microbiology, 2(8): 310-314.

Moerman , D. (1998). Native American Ethnobotany. Timber Press, Oregon, pp. 453-459.

Gafar, M.K. and Itodo, A.U. (2011). Proximate and mineral composition of hairy indigo leaves. Electronic Journal of Environmental, Agricultural and Food Chemistry (EJEAFChe), 10 (3): 2007-2018.

Bedford, M. (1996). The effect of enzyme on digestion. Journal of Applied Poultry Res., 5: 370-377.

Raza, S., Ashraf, M., Pasha, T.N. and Latif, F. (2009). Effect of enzyme supplementation of broiler diets containing varying level of sunflower meal and crude fibre. Pakistan Journal of Botany, 41(5): 2543-2550.

Oladunjoye, I.O. and Ojebiyi, O.O. (2010). Performance characteristics of broiler chickens (Gallus gallus) Fed Rice (Oriza sativa) bran with or without Roxazyme G2G. International Journal of Animal and Veterinary Advances, 2(4): 135-140.

Ogbe, A.O., Atawodi, S.E., Abdu, P.A., Sannusi, A. and Itodo, A.E. (2009a). Changes in weight, faecal oocyst count and packed cell volume of Eimeria tenella-infected broilers treated with a wild mushroom (Ganoderma lucidum) aqueous extract. Journal of the South African Veterinary Association. SA ePublications, 2009; 80 (2): 97-102.

Ogbe, A.O. and George, G.A.L (2012). Nutritional and anti-nutrient composition of melon husks: potential as feed ingredient in poultry diet. Rsearch Journal of Chemical Sciences, 2(2): 35-39.

AOAC (1990). Official methods of analysis, Association of Official Analytical Chemists, Washington, D.C; USA. 15th Edition, pp. 807-928.

Akinyeye, R.O; Oluwadunsin, A. and Omoyeni, A. (2010). Proximate, mineral, anti-nutrients and phytochemical screening and amino acid composition of the leaves of Pterocarpus mildbraedi Harms. Electronic Journal of Environmental, Agricultural and Food Chemistry (EJEAFChe), 9(8): 1322-1333.

Akinyeye, R.O; Oluwadunsin, A. and Omoyeni, A. (2011). Proximate, mineral, anti-nutrients and phytochemical screening and amino acid composition of the leaves of Pterocarpus mildbraedi Harms. Electronic Journal of Environmental, Agricultural and Food Chemistry (EJEAFChe), 10(1): 1848-1857.

Sofowora, A. (1993). Medicinal Plants and Traditional Medicine in Africa; John Wiley and Sons, Ltd, Ife, Nigeria, 55-201.

Olawuyi, J.F. (1996). Biostatistics: A foundation course in health sciences. 1st Edition. University College Hospital, Published by Tunji Alabi Printing Co. Total Garden, Ibadan, Nigeria, pp. 1-221.

Ogbe, A.O., Ditse, U., Echeonwu, I., Ajodoh, K., Atawodi, S.E. and Abdu, P.A. (2009b). Potential of a wild mushroom, Ganoderma sp., as feed supplement in chicken diet: Effect on performance and health of pullets. International Journal of Poultry Science, 8(11): 1052-1057.

Ogbe, A.O; Mgbojikwe, L.O; Owoade, A.A; Atawodi, S.E. and Abdu, P.A. (2008). The effect of a wild mushroom (Ganoderma lucidum) supplementation of feed on the immune response of Pullet chickens to IBD vaccines. Electronic Journal of Environmental, Agricultural and Food Chemistry (EJEAFChe), 7 (4): 2844-2855.

Thompson, L.U. (1993). Potential health benefits and problems associated with anti-nutrients in foods. International Journal of Food Resources, 26: 131-149.

Guil, J.L. and Isasa, M.E.T. (1997). Nutritional composition of leaves of Chenopodium species. International Journal of Food Science Nutrition, 48: 321-327.

Muhammad, A, Dangoggo, S.M, Tsafe, A.I, Itodo, A.U. and Atiku, F.A. (2011). Proximate, minerals and anti-nutritional factors of Gardenia aqualla (Gauden dutse) fruit pulp. Pakistan Journal of Nutrition, 10(6): 577-581.

De-Bruyne, T, Pieters, L, Deelstra, H. and Ulietinck, A. (1999). Condensed vegetable tannins: biodiversity in structure and biological activities. Biochemical Systematic and Ecology, 27: 445-459.

Dei, H.K, Rose, S.P. and Mackenzie, A.M. (2007). Shea nut (Vitellaria paradoxa) meal as a feed ingredient for poultry. World's Poultry Science Journal, 63(4): 611-624.

Armstrong, W.D, Rogler, J.C. and Featherston, W.R. (1974). Effects of tannins extraction on the performance of chicks fed bird resistant sorghum grain diets. Poultry Science, 53: 714-720.

Guo, F.C., Kwakkel, R.P., Williams, B.A., Parentier, H.K., Li, W.K., Yang, Z.Q. and Verstegen, M.W.A. (2004). Effect of mushroom and herb polysaccharides on cellular and humoral immune responses of Eimeria tenella-infected chicken. Poultry Science, 83: 1124-1132.

Willis, W.L., Isikhuemhen, O.S., Hurley, S. and Ohimain, E.I. (2011). Effect of phase feeding of fungus Myceliated grain on oocyst excretion and performance of boiler chicken. International Journal of Poultry Science, 10(1): 1-3.