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Response of broiler birds fed diets containing varying levels of dried watermelon rind at finisher phase

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Target Audience: *Farmers, Researchers,Students*

Abstract

A feeding trial was conducted to investigate growth performance and nutrient digestibility of experimental diets formulated with dried watermelon rind to replace wheat offal, fed to broiler chickens at finisher phase. One hundred and fifty day-old "ROSS 360" broiler chicks were randomly allotted to five dietary treatments of thirty (30) birds per treatment. Each treatment was replicated three times with ten birds per replicate in a Completely Randomized Design (CRD) arrangement. Five experimental diets containing dried watermelon rind at varying levels of replacement were formulated and designated as T1, T2, T3, T4 and T5 with replacement levels of 0 %, 25 %, 50 %, 75 % and 100 % respectively. Initial body weight, final body weight, body weight gain, feed itake, feed conversion ration and apeparent digestibility of crude proten, fibre, ash and nitrogen free extract were measured. There were no significant (P>0.05) differences among the treatment groups for all the growth parameters except for feed conversion ratio. Final weight ranged from 1223.33 to 1305.19 g; while daily feed intake, daily weight gain and feed conversion ratio ranged from 89.46 to 97.95 g, 35.26 to 38.25 g and 2.35 to 2.78, respectively.. The nutrient digestibility indicates significant (p<0.05) difference in crude fibre, ash, ether extract and NFE, while that of crude protein, dry matter and total digestible nutrient were not significantly (P>0.05) different. Crude protein, dry matter and TDN ranges between 67.47 % to 69.15 %, 79.10 % to 80.72 and 74.35 to 78.68 respectively. The study concluded that 25 % replacement of wheat offal with dried watermelon rind can be effective for optimal growth performance and complete replacement for fibre and energy requirement in producing broiler chickens without compromising performance or any deleterious effect.

Key words: *Broilers; Finisher; Growth; Digestibility; Watermelon; Rind*

Description of the Problem

Discarding agricultural waste produced an enormous heaps in Nigeria andthis is presently an ecological problem. In numerous region of Nigeria and other developing countries, this agricultural by-product is allowed to amass in large volumes, and allowed to deteriorate or are burnt broadly, in so doing impacting negatively on the ecosystem by discharging harmful volatile substances into the atmosphere, soil and water as a result, poses a severe threat to human well-being. The impending pollutants from the breakdown of agricultural ravages are usually pathogens, ammonia gas emissions, methane and nutrients (1). The resultant effect of abandoned disintegration of agricultural by-product could be a significant contamination of soil, air and water (2; 3; 4). It has been projected that the breakdown of one metric heap of biological solid ravage could release 50.11 m^3 of carbon dioxide and 90 m^3 to 140 m^3 of methane into the environment (2;4). Wth their attendant greenhouse effect, these gasses can contribute to climate change problems confronting the world today.

Livestock business, most particularly in growing countries has been overwhelmed by

several hitches, which include scarce feed ingredient competing with man's nutritional requirement. Livestock's farmers have been sent out of the industry due to the imperative cost of conventional feedstuffs thus resulting in the decline in total animal protein production and accessibility of human nutritional needs. 60 - 80 % of overall cost of animal production in developing countries has been attributed to the cost of feed alone (5;6). However, due to the increasing cost of animal feed, attention is shifting to alternative feed sources. Many agricultural crops have been considered for this purpose (7; 8). Therefore , the competition between human beings and animals for agricultural crops has moved scholars to exploit agricultural wastes for their nutrient contents. Hence, this study evaluated the effect of diverse inclusion levels of dried watermelon rind on the growth performance and nutrient digestibility of broiler birds at the finisher phase.

Materials and Methods

The study was carried out at the Teaching and Research Farm of the Federal University of Technology Minna, Niger State, located within latitude 9° 36' 50" N and longitude 6° 33' 25" E, degrees minutes' seconds respectively. The altitude of the location is 700, 000 metres above sea level, day light fluactuating to 38 ^{o}C at the onset of wet season to 28 ^{o}C at the middle of wet season and average annual rainfall of 1209.7mm (9). One hundred and Fifty day old 'Ross 308' broiler chicks of mixed sexes from Agrited farm, Ibadan, were obtained and used for the study. The chicks were randomly allotted to five treatment groups with thirty birds for each treatments in a completely randomized design (CRD) arrangement at beginning of the finisher phase (5 – 8 weeks). Each treatment groups were further replicated into three, with ten birds per replicate.

The watermelon rind used for the research was freshly obtained from fruit sellers within Minna metropolis. The rind was washed with clean water, sliced into pieces and thereafter sun-dried for three days and further oven dry at 50^{o}C for 2 hours. They were further reduced into granules form using a grinding machine and stored in air-tight polythene bag until ready to be used. Feed ingredients were acquired directly from the Kure Market, located at Bosso in Minna, Niger State.

Five experimental diets were used in the study. Treatment 1 served as the control with 0 % dry watermelon rind (DWMR), while treatment 2, 3, 4 and 5 contained DWMR at 25, 50, 75 and 100 % level of replacement respectively. Tables 1 and 2 shows the percentage ingredients composition of the diets fed at the starter (0 – 4 weeks) and finisher (5 – 8 weeks) phase, respectively. Feeding was *ad-libitum* on daily basis in the morning (7-8am) and evening (5-6pm), and water was provided *ad-libitum* all through the experimental period of 4 weeks. The birds were administered vaccines, anti-biotics and multivitamins as at when required. The birds in all treatments were kept under the same management system from the starter phase up to the end of the finisher phase . Proximate analysis of the finisher diets and dried watermelon rind was carried out using the procedure of AOAC (10).

Data of growth parameters and apparent nutrient digestibility collected in the study were subjected to one-way analysis of variance (ANOVA) using the Statistical Package for Social Science (11). Where differences occurred, Duncan version 17.0 was used to separate means.

Table 1: Ingredient composition of experimental diets at starter phase (0–4 Weeks)

Ingredient (%)	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)
Maize	54.50	54.17	53.90	53.58	**53.30**
GNC	33.00	33.33	33.60	33.92	**34.20**
Wheat offal	5.00	3.75	2.50	1.25	**0.00**
Fishmeal (65%)	3.00	3.00	3.00	3.00	**3.00**
DWMP	0.00	1.25	2.50	3.75	**5.00**
Bonemeal	3.50	3.50	3.50	3.50	**3.50**
Lysine	0.25	0.25	0.25	0.25	**0.25**
Methionine	0.25	0.25	0.25	0.25	**0.25**
Salt	0.25	0.25	0.25	0.25	**0.25**
Premix	0.25	0.25	0.25	0.25	**0.25**
Total	100	100	100	100	**100**
Calculated values (%)					
Crude protein	22.48	22.48	22.46	22.45	**22.44**
M.E (Kcal/kg)	2,834.52	2,826.68	2,800.48	2,773.76	**2,747.45**
Crude fibre	3.71	3.60	3.48	3.70	**3.25**
E.E	4.52	4.46	4.40	4.35	**4.29**
Calcium	1.12	1.12	1.12	1.12	**1.12**
Phosphorus	0.71	0.70	0.68	0.67	**0.65**
Determined Analysis (%)					
Moisture	9.40	9.20	9.00	9.00	**9.60**
Crude Protein	22.75	22.05	22.40	21.35	**21.70**
Ether Extract	10.00	17.00	13.50	15.00	**11.50**
Crude Fibre	2.50	3.00	3.00	2.50	**2.50**
Ash	10.00	10.00	8.50	10.00	**8.00**
Nitrogen Free Extract	45.35	38.75	43.60	42.15	**46.70**
Dry matter	90.60	90.80	91.00	91.00	**90.40**

Key- T_1 contain 0 % DWMR; T_2 contain 25 % DWMR; T_3 contain 50 % DWMR; T_4 contain 75 % DWMR; T_5 contain 100 % DWMR; DWMR: dried watermelon rind; GNC: groundnut cake; E.E: ether extract; M.E: metabolizable energy.

Table 2: Ingredients composition of broiler diets at finisher phase (5 – 8 weeks)

Ingridients (%)	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)
Maize	59.03	57.65	57.30	56.94	56.59
Groundnut cake	9.33	9.79	9.90	10.02	10.14
Fullfat soya	18.64	19.56	19.80	20.04	20.27
Fishmeal (65 %)	3.00	3.00	3.00	3.00	3.00
Bonemeal	3.00	3.00	3.00	3.00	3.00
Wheat offal	5.00	3.75	2.50	1.25	0.00
Limestone	1.00	1.00	1.00	1.00	1.00
Methionine	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
DWMR	0.00	1.25	2.50	3.75	5.00
Total	100.00	100.00	100.00	100.00	100.00
Calculated Analysis (%)					
CP	20.20	20.50	20.50	20.50	20.50
ME (Kcal/kg)	2,900.40	2,913.64	2,929.01	2,944.30	2,959.65
Ether extract	7.11	7.24	7.27	7.31	7.33
Crude fibre	4.03	4.15	4.25	4.34	4.43
Calcium	1.32	1.33	1.33	1.33	1.33
Lysine	1.06	1.11	1.51	1.19	1.23
Methionie + Cyst	0.83	0.84	0.84	0.84	0.84
Determined Analysis (%)					
Crude protein	20.50	21.30	20.04	20.83	21.02
Crude fiber	5.00	4.50	5.50	4.00	6.00
Ash	10.50	8.50	5.50	5.50	7.50
Ether extract	10.50	11.00	5.00	7.00	8.00
NFE	46.50	46.87	56.76	55.67	51.28
Moisture	7.00	7.80	7.20	7.00	6.20
Dry matter	93.00	92.20	92.80	93.00	93.80

Keys: T1: Contain 0 % of Dry Watermelon rind (DWMR), T2: Contain 25 % of DWMR, T3: Contain 50 % of DWMR, T4: Contain 75 % of DWMR, T5: Contain 100 % of DWMR, DWMR: Dried Watermelon Rind,

Results

Proximate composition of dried watermelon rind (DWMR)

The results of the proximate composition of dried watermelon rind is shown in Table 3. The watermelon rind has 15.50 % crude fibre, 8 % moisture, 12.25 % crude protein, 8.64 % ether extract, 11.50 % ash, and 44.11 % NFE. The results obtained in this study compared favourably with 16.8 % for crude fibre and 12.93 % for Ash reported by (12). Also 11.21 % CP, 10.72 % moisture, 12.61 % ash reported by (13) are similar to the one obtained for the present experiment.

Proximate compositions of the experimental diets at finisher phase (5 – 8 weeks)

Results of the proximate composition of the experimental diets at finisher phase is as shown in Table 2. The results showed that the dry matter in the diets ranges from 92.20 – 93.8 % while CP, fats, NFE, CF and ash ranges from 20.04 – 21.30 %; 7.00 – 11.00 %; 46.50 – 56.76 %; 4.00 – 6.00 % and 5.50 – 10.50 %

respectively. T2 had the utmost protein value (21.30 %) while T3 had the least protein content (20.04 %). The dry matter was higher (93.80) in T5 and least (92.20) in T2. The high dry matter content in T5 (93.80) could be due to the high inclusion level of the dry watermelon rind.

Growth performance of broiler chickens at finisher phase (5 – 8 weeks)

The results of the effect of diets containg varying levels of DWMR on growth performance is presented in Table 4. The results obtained showed no significant differences ($p>0.05$) on the final body weights of the birds, average body weight of the birds, average body weight gain and average feed intake, measured during the experiment. This may be due to the concentration

Table 3: Proximate composition of dried watermelon rind (DWMR)

Parameters	% Composition
Crude protein	12.25
Crude fibre	15.50
Ash	11.50
Ether extract	8.64
Nitrogen free extract	44.11
Moisture	8.00
Dry matter	92.00

Table 4: Growth performance of broiler chickens fed experimental diets at finisher (5 – 8 weeks) phase.

	Treatment						
Parameters	T1	T2	T3	T4	T5	SEM	LS
Initial weight (g)	225.87	213.25	228.6	234.29	224.49	14.7	NS
Final weight (g)	1223.33	1237.41	1274.08	1305.19	1291.67	70.49	NS
MBW (g)	763.5	775.46	820.32	798.1	811.02	50.07	NS
MBWG (g)	35.63	35.26	37.34	38.25	36.70	13.05	NS
FCR	2.51^{ab}	2.78^{a}	2.61^{ab}	2.35^{b}	2.46^{b}	0.05	*
MFI (g)	89.81	97.95	97.13	89.46	90.08	0.58	NS

Keys: ab, means in the same row with different superscript are significantly different ($P<0.05$), MBW: Mean body weight, MBWG: Mean body weight gain, FCR:. Feed conversion ratio, MFI: Mean feed intake, SEM: Standard error of mean, LS:. Level of significance

of heat stable metabolites presents in the watermelon rind used in the diets which drying could not effectively treat. The results of this research indicated that feed conversion ratio significantly ($p<0.05$) differed across the treatments. T4 and T5 had a comparable FCR, T1 and T3 are similar in their feed conversion ratio whereas T 2 had the least feed conversion ratio. The low FCR ratio recorded in T2 could have been as a result of the low body weight gain recorded which could have been occasioned by depressed nutrient utilization due to the presence of phenolic metabolites.

Nutrients digestibility of broiler chickens at finisher (5 – 8 weeks) phase.

The outcome of the influence of dried watermelon rind on the nutrients digestibility of broiler chickens are indicated in Table 5 below. The results showed that at the completion of the finisher phase, t significant difference ($p<0.5$) were observed

on the digestibility of crude fibre, ash, ether extract, NFE and moisture. However, there were no significant differences (p>0.5) in the digestibility of crude protein, TDN and dry matter. Treatments 1, 3 and 5 had closely related CF values while T 2 had the least CF value. T 1 and T2 had similar moisture content whereas T 5 had the least moisture content.

Discussion

The initial weight, final weight, average body weight, average body weight gain and average feed intake obtained at the end of the study were not significantly (p>0.05) different from the control. This findings agrees with that obtained by (13) on his work on weaner rabbits fed diets supplemented with dry water melon rind and also with the work of (14) on albino rabbit. The final body weight ranges between (1,223.33 – 1,305.19) g was below the recommended final body weight of broiler chicken at 8 weeks of age reported by (15), who stated that well-

Table 5: Nutrients digestibility of broiler chickens fed diet containing varying levels of dried watermelon rind at finisher (5 – 8 weeks) phase

	Treatments						
Parameters (%)	T1	T2	T3	T4	T5	SEM	LS
Crude protein	69.06	69.15	67.49	68.12	67.47	4.2	NS
Crude fiber	60.88^{a}	42.31^{b}	61.79^{a}	46.37^{ab}	61.5^{a}	6.82	*
Ash	68.51^{a}	67.48^{a}	58.42^{b}	55.92^{b}	61.471^{b}	3.83	*
Ether extract	81.37^{a}	84.57^{a}	51.96^{c}	67.83^{b}	68.50^{b}	3.75	*
NFE	85.12^{b}	87.73^{ab}	90.89^{a}	88.89^{ab}	93.24^{a}	2.39	*
Moisture	83.53^{a}	80.33^{a}	70.53^{b}	65.68^{bc}	62.74^{c}	3.23	*
Dry matter	79.10	80.03	80.72	79.52	80.07	2.69	NS
TDN	76.01	78.68	74.35	76.21	78.01	2.77	NS

Keys: **abc,** means in the same row with different superscript are significantly different (P<0.05), NFE: Nitrogen free extract, TDN: Total digestible nutrient, LS: level of significance, SEM: Standard error of mean

managed broiler chickens should attain between (1700 – 2000) g/chicken at the end of finisher phase. This variation may be due to heat stable phenolic metabolites present in the dry watermelon rind included in the diet. The body weight gains ranges of 35.26 – 38.25 g was higher than 32.77 – 33.10 g obtained by (16) on his work on enactment of broiler chicken fed selected cereal brans. The variation in the results may be due to the higher feed intake in this study (89.46 – 97.95g) compared to (70.90 – 75.57g) obtained by (16). This may also be attributed to the likelyhood of the presence of essential amino acids contained in the dry watermelon rind used in this present studies.

Results of FCR obtains indicated significant difference (p<0.05) between all treatments and this is related to the outcome of (17) who reported significant (p<0.05) increased as dietary intake of fermented *Mucuna sloanei* meal was served to broiler birds. The outcome of the FCR (2.35 – 2.78) obtained in this study is also similar to the work of (18) who reported significant difference in FCR (2.79 – 4.02) on broiler chickens.

The results obtained for apparent nutrient digestibility indicated that there were no significant differences (p>0.05) in the dry matter and crude protein. . These results are in agreement with the study of (19) on his work

on broiler chickens. It was recorded that all other parameters measured (ash, ether extract, crude fibre and NFE) were significantly ($p<0.05$) different. Results of the ether extract and ash were significantly ($p<0.05$) higher both in T1 and T2 and relatively similar in the other treatments for ash content. This may be as a result of oxalate and phytic content in water melon rind which attempt to bind minerals and stop their absorption in the intestine (20). However, the results obtained for both ether extract and ash are comparable to that of (16) who reported significant differences on the work on broiler chicken fed different sorghum cultivars as a substitute for maize. The results of the crude fibre and NFE obtained by the author did not conform to that obtained in this study. However, report of (18) who fed broiler chickens unprocessed *Senna obtusifolia* seed meals was in partial agreement with this present studies. The results of the total digestible nutrient were insignificantly ($p>0.05$) different among treatments, although T2 (78.68) was higher than the control T1 (76.01) which may be due to the lycopene and Citrulline content of water melon as it is being reported that Citrulline and lycopene improve the gastro-intestinal tract and cures urinary tract infections (21).

Conclusion and Applications

1. Dried watermelon rind can be included in broiler diet at finisher phase in replacement of wheat offal at about 25% for optimal growth performance.
2. Total replacement of wheat offal with dried watermelon rind can be included in broiler diet at finisher phase for energy and fibre requirement.

References

1. Isaac, A., Adetunji, C., Charles, N., Alejolowo, O., Rotdelmwa, M. (2017). Evaluation of selected agricultural solid wastes on biochemical profile and liver histology of Albino rats. *Food and Feed Research. 44. 73-79.*
2. Ghosh, S., Vietez, E.R., Liu, T., Kato, Y. (1997). Biogasification of solid waste by two-phase anaerobic fermentation. Third Biomass Conference of the Americas, Pergamon Press, Montreal, Quebec, UK, *Proceedings*, p. 2
3. EPA (2007). Municipal solid waste in the United States: 2007 facts and figures. Environmental Protection, Washington DC. (*www.epa.gov*). Galighor, A.E., Koziff, E.N. (1976). Essentials of Practical Microtechnique, 2nd Ed., Lea and Febriger, New York.
4. Kwon, E., Kelly, J.W., Marco, J.C. (2009). An investigation into the syngas production from Municipal solid waste (msw) under various pressures and CO2 concentration atmospheres, *17th Annual North Waste-to-Energy Conference, Chantilly, Virginia, USA, Proceedings, pp. 231-236.*
5. Igboeli, G. (2000). Animal production and agriculture in the new millennium. *Book of proceeding 25th annual conference of Nigerian Society of Animal Production. Pp.1-3*
6. Esonu, B.O. (2006). Animal nutrition and feeding. A feeding functional approach, 2nd edition. Memory press, Owerri, Imo state, Nigeria.
7. Kirsti, T., Kettunen, H., Bento, M.H.L, Saarinen, M., Lahtinen, S., Ouwehand, A.C, Schulze, H., & Rautonen, N. (2010). The effect of feeding essential oils on broiler performance and gut microbiota. *British Poultry Science. 51: 381-392.*
8. Cross, D.E., McDevitt, R.M., Hillman, K., & Acamovic, T. (2007). The effect of herbs and their associated essential oils on performance, dietary digestibility and gut microflora in chickens from 7 to 28 days of age. *British Journal of Poultry Science, 48: 496-506.*
9. ClimateTemps.(2015).Minna climate temperature. Retrieved from

ClimateTemps.com: http://www.minna.climatetemps.com.

10. AOAC, (2012). Official methods of analysis, Association of official analytical chemist 19th edition, Washington D.C., USA.
11. Statistical Package for Social Scientists (2007). SPSS for Windows, Version 16.0. Chicago, SPSS Inc.
12. El-Badry, N., El-Waseif, M. A., Badr, S.A. and Ali, H. E. (2014). Effect of Addition Watermelon Rind Powder on the Rheological, Physiochemical and Sensory Quality Attributes of Pan Bread. *Middle East Journal of Applied Sciences, Food Science and Technology* Department, Faculty of Agriculture, Al-Azhar University, Cairo Egypt. 4(4): 1051-1046
13. Alagbe J.(2018). Performance and Haemato-Biochemical Parameters of Weaner Rabbits Fed Diets Supplemented with Dried Water Melon Peel (Rind) Meal. *Dairy and Veterinary Science Journal*. 8(4): 55 - 74.
14. Okai D.B, Boateng M, Amaoh K.O, Johnson L.D., (2010). Studies on dried water melon rinds on the nutrient composition and effects on growth performance and carcass characteristics of Albino rats. *Proceedings of the 30th Ghana Animal Science Association Conference*. Pp. 98 – 103.
15. Dafwang, I.I., (2002). Broiler and broiler production in Nigeria. In: Poultry Production in Nigeria. A Training *Manual. National Animal Production Research Institute,* Shika, Ahmadu Bello University Zaria, Kaduna State, Nigeria. Pp. 95 -108.
16. Kwai I. D(2011). Nutrient digestibility and carcass characteristics of broiler chickens fed different cultivars of sorghum replacing maize in the semi-arid zone of Nigeria. B. Agriculture Project submitted to University of Maiduguri P.M.B. 1069, Maiduguri, Nigeria.(Unpublished).
17. Okorie, K.C., Esiegwu, A.C. and Okonkwo U.N., (2016). Evaluation of The Growth Performance, Carcass Characteristics and Blood Indices of Broiler Finishers Fed Graded Levels of Fermented *Mucuna Sloanei* Seed Meal. Agro-Science *Journal of Tropical Agriculture, Food, Environment and Extension Volume 15 Number 1 January, 2016 pp. 39-44*.
18. Augustine, C., Kwari, I. D., , Igwebuike, J. U., Adamu, S. B.and Diarra, S. S.(2017). Nutrient Digestibility and Growth Performance of Broiler Chickens Fed Processed Tropical Sicklepod (*Senna obtusifolia* (L.)) Seed Meal Based-Diets. *Journal of Agricultural Sciences, Belgrade.* 62 (4): 371-384
19. Sobayo, R. A, Oso, A. O, Adeyemi, O. A, Fafiolu, A. O, Jegede, A. V, Idowu, O. M. O, Dairo, O. U, Iyerimah, R. B, Ayoola, O. A, & Awosanya, R. A (2012).Growth, digestibility and gut anatomy by broilers fed diets containing ethanol-treated castor oil seed meal. *Revista Científica Agrícola. 12 (3): 660-667*.
20. Kolawole, S., E. Obueh, H..O. A (2013). Study of the oxalate, phytate and cyanide contents of selected Nigerian foods and diet in Akwa Ibom and Cross River states of Nigeria. *African Journal of Food Science and Technology*.4(4):44–47.
21. Erhirhie, E.O. and N.E. Ekene (2013). Medical values on watermelon (citrullus lanatus). Pharmacological Review. *International Journal of Research in Pharmaceutical and Biomedical Sciences. 4 (4) 1205-1312.*