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Growth Performance, Haematology and Meat Quality Of Broiler Chickens Fed Rumen Liquor-Fermented Wheat Bran-Based Diets

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ABSTRACT

The objective of this study was to evaluate the chemical composition of wheat bran fermented with rumen liquor and its effect on performance and meat quality of broiler chickens. Wheat Bran (WB) was fermented using rumen liquor as source of microbes for 3 days. The unfermented and fermented WB were used to formulate experimental diets at 0, 10, 20 and 30% to give 7 dietary treatments. Two hundred and ten 4-week old Hubbard chicks were allocated to the treatments in a completely randomized design. After the 3-day fermentation, crude protein content was 15.33 and 16.82% for unfermented and fermented WB, respectively. Final weight, total weight gain and feed conversion ratio were not (P > 0.05) influenced by dietary treatments. The diets promoted similar carcass, meat and haematological characteristics. In summary, fermented wheat bran can be included in broiler-chicken finisher diets without significant adverse effects on their performance, haematology and meat quality.

Keywords: Wheat bran, fermentation, rumen liquor, performance, meat quality, broiler chickens.

INTRODUCTION

Low moisture content and soil nutrient defciency are The World's population is on the increase at the expense of food supply. This creates pressure on every form of food with a wide short fall in protein availability and intake. Poultry production, in particular broiler meat production, has great potentials needed to tackle this challenge by improving the animal protein status of humans (Adeniji, 2005).

The rising cost of finished feed, which is 60-80% of the cost of production among others is a major setback (Oluyemi and Roberts, 2000) to commercial poultry production. It is therefore expedient that more efforts be concentrated on the reduction of poultry production cost by improving the nutritive values of feed ingredients such that their level of inclusion could be increased in ration formulation. Wheat bran (WB), obtained as a by-product of wheat flour milling, constitutes almost 10% of the total weight of wheat milled for flour and it contains about 70% carbohydrates (dry matter basis), 80% of which are cellulose and hemicellulose (Eiman *et al*., 2008). Reddish and Scarr (1987) reported that WB, an agro-industrial by-product was produced at 382,666 tonnes in Nigeria in 1985. The increase in human population and concomitant processing of wheat into flour for human food has increased the availability of WB in Nigeria (Christopher *et al.,* 2007).

Cavalcanti and Behnke (2004) showed that WB can be utilized as a possible source of phytase which is capable of increasing growth rate and phosphorus utilization in broilers. Phytase catalyses the hydrolysis of

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phytic acid found in cereals and grains, thus WB which contains 2,400 U/kg (Yao *et al.,* 2007) may contribute to the gastrointestinal hydrolysis of phytate in monogastrics (Steiner *et al.,* 2007). It also contains a large amount of betaine (Zeisel *et al.,* 2003) which is important to poultry health. According to Christopher *et al.* (2007), WB could replace maize up to 25% in broiler finishers' diets without adverse effects on growth and feed intake. With Ali *et al.* (2008), 30% WB could be incorporated. All these portray WB as a by-product with values reasonable for use in the broiler chicken diet.

The reasons canvassed generally for embarking on fermentation include among others biological enrichment of the substrate in terms of protein and vitamins. In the rumen, there are over 1 billion microbes (Annison and Bryden, 1998) which could cause desirable biochemical changes to fibrous feedstuffs. The rumen liquor is the concentrated liquid obtained when the rumen digesta is sieved. Ndams *et al.* (2009) observed a notable improvement in brewer's dried grain to re-fermentation using rumen liquor. Therefore, this study was aimed at subjecting WB, a cheap feedstuff to fermentation using rumen liquor to ascertain any improvement in quality and to determine its effect on the growth performance, haematology and meat quality of broiler finisher chickens.

MATERIALS AND METHODS

Fermentation of wheat Bran (WB): The WB that was used in this experiment was purchased from a reputable feedmill in Akure, Ondo State, Nigeria. Prior to inoculation, fresh rumen content of cattle was collected after slaughter from the central abattoir in Onyearubulem Market, Akure. This was then mixed with water in a 2:1 ratio (w/w) and filtered through a net. The residue was discarded and filtrate used as inoculum. The quantity of water sufficient to wet a given quantity of WB was determined before inoculation and the ratio was 1:2 (w/w). The inoculation of the WB with inoculum was in the ratio 5:1 (w/w). The inoculum to be used was first introduced into the known quantity of water needed to wet the sample before inoculation. The fermentation was carried out by weighing one kilogramme each of WB into a plastic bowl and mixed with 0.5 kg of water containing 0.2 kg of inoculum. This was then put in polythene bags. The opened ends of the bags were tied and covered up with soil in a pit (60 cm depth by 30 cm diameter) for 3 days. The fermented samples were removed and sun-dried for 3 days.

Feeding trial: The feeding trial was carried out at the Poultry Unit of the Teaching and Research Farm of the Federal University of Technology, Akure. Two hundred and ten day-old Hubbard broiler chicks were brooded using a deep litter system for a 4-week pre-experimental period during which commercial broiler starter diet (23.22% crude protein) was fed *ad libitum*. At the end of the pre-experimental period, the 4 weeks old broiler chicks were weighed and randomly allocated to seven treatments (3 pens/treatment; 10 chicks/pen with a dimension of 1.22m^2). The feeding trial lasted for five weeks with feed and water supplied *ad libitum*. Treatments were: Control diet without WB (CONT), 10% unfermented WB (10%UWB), 10% fermented WB (10%FWB), 20% unfermented WB (20%UWB), 20% fermented WB (20%FWB), 30% unfermented WB (30%UWB) and 30% fermented WB (30%FWB).

The ingredients and calculated analysis of the experimental diets are shown in Table 1. During the feeding trial, data on feed intake and weight gained by birds were recorded weekly. At the end of the 5-week experimental period, the birds were fasted overnight and two birds were randomly selected per replicate for slaughter. Each slaughtered chicken was defeathered after scalding in hot water, dressed, eviscerated and dissected into part as described for turkey by Hahn and Spindler (2002) and weighed. Blood samples were collected for haematological studies as described by Lamb (1981). Cooking loss from three muscle types (thigh, drumstick and breast) obtained from the chickens was measured as:

Cooking loss (%) = [(Initial weight of meat – Final weight of meat) / Initial weight] * 100.

Measurement of the extent of lipid oxidation of the same sets of muscles was done using the thiobarbituric acid (TBA) assay method (Pikul *et al.,* 1989). The proximate composition of the unfermented and fermented wheat bran, and experimental diets were determined according to A. O. A. C. (1995) method.

Statistical analysis: Data generated were subjected to one-way and factorial analysis of variance (ANOVA) as appropriate. Means were separated using the Fisher's test of the Minitab Statistical Package (1991).

RESULTS AND DISCUSSION

Chemical composition of WB

The chemical composition of WB before and after fermentation with rumen liquor is presented in Table 2. The unfermented WB had 90.07% dry matter (DM), 15.33% crude protein (CP), 6.25% crude fibre (CF) and 5.37% ether extract (EE). After 3 days of fermentation, the DM reduced to 89.49%, CP and CF increased to 16.82% and 6.89% respectively.

The resultant decrease in DM after fermentation is in consonance with the findings of Ndams *et al.* (2011). Fermentation is carried out to improve the nutritive value of feedstuffs (Hardini, 2010). This should translate to an increase in CP and a decrease in CF of a fibrous feedstuff like WB. The increase in CP of fermented WB (FWB) is in agreement with the findings of Eiman *et al.* (2008), they observed an increase in the CP of WB when fermented with 2% dry yeast and Ndams *et al.* (2009), when brewer's dried grain was fermented with rumen liquor.

The success of a fermentation process depends on the nature of the feed and environment (Ndams *et al.,* 2011). The inoculum should provide suitable microflora that would degrade the feed over a period of time (Mould *et al.,* 2005). Bacteria in the rumen that digests fibre are anaerobic. Therefore, anaerobiosis is neccessary for the proper growth of microbes that would degrade the fibrous component of WB. The slight increase in CP is attributable to the low microbial activities of microbes needed to synthesize microbial protein. The increase in CF of FWB negates expectations as fermentation is expected to reduce the CF content although Oseni and Ekperigin (2007) and Eiman *et al.* (2008) published similar reports. Perez-Hidalgo *et al.* (1997) attributed such increase to the formation of resistant starch with condensed tannin-protein complex and Eiman *et al.* (2008) attributed it to the reproduction of yeasts on the feedstuff. The anaerobic condition needed for fibre degradation might have been compromised during inoculum preparation such that the reproduction of yeasts were favoured to use up the oxygen and the anaerobes remained in the lag phase of growth.

Table 1: Gross composition and calculated analysis of experimental diets

Ingredients (kg)	Diets			
	1 (CONT)	2/3 (10% WB)	4/5 (20% WB)	6/7 (30% WB)
Maize	52.00	46.87	41.73	36.61
Wheat bran	0.00	10.00	20.00	30.00
Soyabean meal (44% CP)	18.00	13.07	8.14	3.20
Groundnut cake	13.25	13.25	13.25	13.25
Brewer's dried grain	11.70	11.70	11.70	11.70
Palm oil	1.50	1.50	1.50	1.50
Oyster shell	0.25	0.25	0.25	0.45
Bone meal	2.20	2.20	2.20	2.00
Lysine	0.10	0.16	0.21	0.26
Methionine	0.25	0.25	0.27	0.28
Premix*	0.25	0.25	0.25	0.25
Salt	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00
Calculated analysis**				
Crude protein (%)	20.31	19.48	18.64	17.81
Metabolizable energy (kcal/kg)	2974.20	2852.03	2729.51	2607.42
Phosphorus (%)	0.46	0.47	0.49	0.47
Calcium (%)	0.99	0.99	0.99	0.99
Ether extract (%)	4.21	4.18	4.15	4.12
Crude fibre (%)	5.21	5.64	6.07	6.49
Lysine (%)	1.05	1.05	1.04	1.03
Methionine (%)	0.56	0.55	0.55	0.55
Energy: Protein	146.44	146.41	146.43	146.40

WB= Wheat bran *2.5kg premix contains Vitamin A (8,000,000 I.U);Vitamin D3 (2,000,000 I.U); Vitamin E (5,000mg); Niacin (15,000mg); Vitamin B1 (1,500mg); Vitamin B2 (8,000mg); Vitamin B6 (1,500mg); Vitamin B12 (10mg); Vitamin K3 (2,000mg); Calpan (5,000mg); Biotin (20mg); Folic acid (500mg); Antioxidant (125,000mg); Choline chloride (200,000mg); Cobalt (200mg); Copper (5,000mg); Iodine (1,200mg); Iron (40,000mg); Manganese (80,000mg); Selenium (200mg); Zinc (60,000mg).

**Based on composition of unfermented wheat bran.

Table 2: Proximate composition of wheat bran used in the study (%)

	Dry Matter	Crude Protein	Crude Fibre	Ether Extract
Unfermented WB	90.07	15.33	6.25	5.37
Fermented WB	89.49	16.82	6.89	4.92

WB= Wheat bran

Growth performance and carcass characteristics

The live weights, feed intake, weight gain and feed conversion ratio were not influenced (P > 0.05) by the dietary treatments (Table 3). These results are consistent with results obtained by Ali *et al.* (2008) when WB was included at levels up to 30% in broiler finisher diets. In the current study, the final live weight and total weight gain reduced numerically with increasing level of WB. Iyayi and Fayoyin (2004) reported that the physical texture of a diet could affect the performance of birds. Therefore, as the level of the WB increases in the diet, the coarseness of the diet increases, this is due to the fibrous nature of WB. In addition, fermented WB has a dark colour, which may influence the appearance and palatability of diets. This phenomenon explain the better feed consumption and weight gain in birds fed the unfermented WB compared to birds fed the fermented WB.

Table 3: Performance of broiler-chicken finishers fed fermented wheat bran-based diets

Diets		**Initial live weight (g/bird)**	**Final live weight (g/bird)**	**Total weight gain (g/bird)**	**Total feed intake (g/bird)**	**Feed conversion ratio**
CONT	0	563.30±56.90	2212.00±236.00	1649.00±180.00	4120.00±165.20	2.51±0.18
10UWB	10	546.67±15.28	2036.00±342.00	1489.00±334.00	5130.00±537.00	3.51±0.46
10FWB	10	560.00±81.90	1999.00±311.00	1439.00±325.00	5047.00±762.00	3.75±1.57
20UWB	20	548.30±33.30	1848.10±146.00	1299.80±161.50	4993.00±681.00	3.86±0.47
20FWB	20	560.00±79.40	1895.00±188.00	1335.00±204.00	4920.00±535.00	3.73±0.62
30UWB	30	570.00±43.60	1826.70±63.60	1256.70±20.20	4900.00±60.80	3.90±0.10
30FWB	30	538.30±27.50	1663.20±76.40	1124.90±103.10	4397.00±746.00	3.96±0.99
Statistical significance		NS	NS	NS	NS	NS
Mean separation						
Level of wheat bran effect						
	10	553.30±53.20	2017.00±293.00	1464.00±296.00	5088.00±591.00	3.63±1.04
	20	554.20±54.80	1871.70±152.80	1317.50±165.60	4957.00±549.00	3.80±0.50
	30	554.20±36.90	1745.00±109.40	1190.80±98.10	4648.00±548.00	3.93±0.63
Wheat bran treatment						
Unfermented		555.00±30.60	1903.50±213.30	1348.50±214.30	5008.00±446.00	3.76±0.38

Fermented	552.80±59.60	1852.50±238.20	1299.70±242.20	4788.00±667.00	3.81±0.98

Mean ± Standard deviation; WB = Wheat bran; NS = Not significant (P>0.05);
UWB= Unfermented wheat bran; FWB= Fermented wheat bran
Levels of dietary WB are 0, 10, 20 and 30%

The percentage eviscerated weight and the relative weights of back, chest, drumstick and thigh (g/kg live weight) were not different (P > 0.05) between treatments (Table 4). Also, the mean separation based on level of inclusion of WB and fermentation did not show any specific trend across the variables measured. Birds fed the 10% WB-based diet (fermented and/or unfermented) had highest values for back, chest and drumstick. Birds fed the 30% WB-based diet had highest value for thigh which was just slightly higher than the weight measured for birds fed 10% WB-based diet. The relative weights of the muscles measured did not follow any specific trend as regards the inclusion of unfermented or fermented WB in the dietary treatments. It can be deduced from these that all the experimental diets promoted similar muscle growth and carcass development although best at 10% level of both fermented and unfermented WB inclusion. This is as evident in the development of the chest and thigh muscles which are the major chicken muscles of economic importance (Awoniyi *et al.,* 2003).

Table 4: Carcass characteristics of broiler-chicken finishers fed fermented wheat bran-based diets

Diets		Eviscerated weight (%)	g/kg live weight			
			Back	Chest	Drumstick	Thigh
CONT	0	80.80±11.85	149.29±15.41	195.38±17.29	106.84±8.78	106.36±5.44
10UWB	10	82.32±11.24	164.41±9.25	204.32±16.11	106.64±7.99	120.51±11.59
10FWB	10	83.87±4.25	159.85±16.75	191.87±15.52	124.50±32.10	123.10±23.35
20UWB	20	83.59±5.26	157.50±26.30	191.20±36.20	107.78±5.95	104.89±13.87
20FWB	20	83.15±3.73	154.35±21.27	185.73±23.65	113.90±13.94	116.32±6.77
30UWB	30	84.60±1.34	149.10±13.87	192.90±24.60	112.06±5.53	120.18±15.54
30FWB	30	84.57±1.74	151.17±9.37	185.16±19.79	112.19±9.23	125.34±12.92
Statistical significance		NS	NS	NS	NS	NS
Mean separation						
Level of wheat bran effect						
	10	83.10±8.14	162.13±13.12	198.10±16.43	115.57±24.15	121.81±17.63
	20	83.37±4.36	155.77±22.47	188.22±28.52	110.84±10.71	110.61±12.00
	30	84.58±1.48	150.13±11.34	189.05±21.69	112.12±7.25	122.76±13.89
Wheat bran treatment						
Unfermented		83.50±6.84	156.97±17.42	196.45±25.21	108.83±6.63	115.20±14.95

Fermented	83.86±3.27	155.12±15.97	187.59±18.98	116.86±20.39	121.59±15.45

Mean ± Standard deviation; WB = Wheat bran; NS = Not significant (P>0.05); UWB= Unfermented wheat bran; FWB= Fermented wheat bran

Levels of dietary WB are 0, 10, 20 and 30%

Haematological variables

The haematological variables most commonly used in nutritional studies include haemoglobin concentration (Hb) and packed cell volume (PCV) (Adeyemi *et al.,* 2000). The haematological variables measured in this study (Hb, red blood cell (RBC) count and PCV were not influenced (P > 0.05) by the treatments (Table 5). The values obtained for Hb and PCV fell within the ranges presented by Mitruka and Rownsley (1977) and Ross *et al.* (1978) which implies that the chickens were able to tolerate the experimental diets health-wise. Birds fed diets containing fermented wheat bran had lower PCV, RBC and Hb values than those fed diets with unfermented wheat bran. This may suggests inadequate intake of nutrients (Apata, 2010) or the presence of some metabolites in the fermented WB which depressed these values.

Table 5: Haematological variables of broiler-chicken finishers fed fermented wheat bran-based diets

Diets		**Wheat bran treatment**	**PCV (%)**	**RBC (10^6mm^3)**	**Hb (g/100ml)**
CONT	0		26.33	1.90	8.73
10UWB	10	Unfermented	25.67	1.77	8.53
10FWB	10	Fermented	24.00	1.63	8.00
20UWB	20	Unfermented	28.00	2.03	9.30
20FWB	20	Fermented	24.67	1.69	8.20
30UWB	30	Unfermented	26.33	1.87	8.73
30FWB	30	Fermented	25.67	1.83	8.53
Statistical significance			NS	NS	NS
Mean separation					
Level of wheat bran effect					
	10		24.83	1.70	8.27
	20		26.33	1.86	8.75
	30		26.00	1.85	8.63
Wheat bran treatment					
	Unfermented		26.67	1.89	8.86
	Fermented		24.78	1.72	8.24

Mean ± Standard deviation; WB = Wheat bran; NS = Not significant (P>0.05); PCV= Packed cell volume, RBC= Red blood cell, Hb= Haemoglobin

Levels of dietary WB are 0, 10, 20 and 30%

Meat quality

There was no difference (P > 0.05) in cooking loss due to dietary treatments although, it was significantly (P < 0.05) influenced by muscle type (Table 6). The chest muscle had the highest value across the treatments, different (P < 0.05) from that of the thigh and drumstick. Also, there was a slight numeric increase (P > 0.05) in cooking loss with FWB. The higher cooking loss values are associated with reduced water holding capacity (Lee *et al.,* 2007).

The oxidative stability of frozen meat expressed as concentration of malondialdehyde (MDA) in meat was not influenced (P > 0.05) by the treatments (Table 6). In consonance with Onibi (2006), the thigh muscle had the highest value having oxidized the most due to its high lipid content. Meat from birds fed diets that contained unfermented WB had numerically higher value than those fed diets that contained fermented WB which suggests that fermentation of WB reduced fat accumulation in the muscles.

Table 6: Mean separation for cooking loss and oxidative stability of meat from broiler-chicken finishers fed fermented wheat bran-based diets

		Cooking loss (%)	Oxidative stability (mg MDA/kg muscle)
Level of WB effect	10	27.26±5.34	1.01±0.37
	20	27.81±4.96	0.99±0.35
	30	26.84±5.80	1.11±0.33
WB treatment effect	Unfermented	27.14±4.75	1.12±0.30
	Fermented	27.46±5.87	0.96±0.38
Muscle type effect	Thigh	25.09±3.71[b]	1.16±0.35
	Drumstick	23.71±2.59[b]	1.00±0.35
	Chest	33.11±3.49[a]	0.96±0.33
Level of WB * WB treatment effect			
10	Unfermented	28.18±3.94	1.22±0.28
	Fermented	26.34±6.56	0.80±0.33
20	Unfermented	26.83±4.85	1.05±0.24
	Fermented	28.78±5.15	0.94±0.44
30	Unfermented	26.42±5.68	1.09±0.36
	Fermented	27.27±6.23	1.14±0.32
Level of WB * Muscle type effect			
10	Thigh	24.61±4.59	1.12±0.42
	Drumstick	24.50±2.48	1.09±0.37
	Chest	32.66±4.13	0.83±0.31
20	Thigh	27.99±2.06	1.06±0.45
	Drumstick	23.03±3.61	0.95±0.29
	Chest	32.40±3.67	0.98±0.34
30	Thigh	22.67±2.00	1.29±0.07

	Drumstick	23.59±1.51	0.98±0.44
	Chest	34.28±2.88	1.08±0.34
WB treatment * Muscle type effect			
Unfermented	Thigh	25.92±3.23	1.30±0.06
	Drumstick	23.11±2.29	1.06±0.39
	Chest	32.40±2.55	1.00±0.27
Fermented	Thigh	24.25±4.15	1.01±0.46
	Drumstick	24.31±2.86	0.94±0.32
	Chest	33.83±4.26	0.92±0.39

WB = Wheat bran; Mean ± Standard deviation

[ab]Means with different superscripts (ab) along the same column for the same parameter are significant ($p<0.001$)

CONCLUSION

The results obtained from this study showed that fermentation of WB with rumen liquor marginally increased the crude protein content of the wheat bran. Although, birds fed WB-based diets had lower total weight gain than the birds in control diet, their carcass characteristics showed that the nutrients got was effectively used for muscle accretion. Inclusion of wheat bran in broiler diet could help increase the shelf life of broiler meat. Fermentation of WB did not produce any substance that would hamper the growth of broiler chickens. While the slight increase in the crude protein content of fermented wheat bran highlights its potentials for inclusion in broiler chicken rations at high levels up to 30%, the fermentation technique employed in this study did not properly improve its qualities and as such, other methods of processing wheat bran in a farmer friendly way to better harness its nutritional potentials should be considered.

REFERENCES

A. O. A. C., 1995, Association of Official Analytical Chemists. Official methods of analysis (16th edition), Washington DC.

Adeniji, C.A., 2005, Performance and carcass characteristics of broiler chicken fed high fibre sunflower seed cake diets. ***Nigerian Journal of Animal Production***, 32 (2): 198-203.

Adeyemi, O. A., Fasina, O. E. and Balogun, M. O., 2000, Utilization of full-fat Jatropha seeds in broiler diet. Effect on haematological parameters and blood chemistry. In: Proceedings of the 25th Conference of Nigerian Society for Animal Production. held at Michael Okpara Univ. of Agric., Umudike. March 19-23. pp 108-109.

Ali, M.N., Abou Sekken, M.S. and Mostafa, K.M.El., 2008, Incorporation of wheat bran in broilers diets. ***International Journal of Poultry Science***, 7 (1): 6-13.

Annison, E.F. and Bryden, W.L., 1998, Perspectives on ruminant nutrition and metabolism. ***Nutrition Research Reviews***, 11: 173-198**.**

Apata, D.F., 2010, Effects of treatment methods on the nutritional value of cotton seed cake for laying hens. *International Journal of Poultry Science*, 9 (6):602-605.

Awoniyi, T.A.M., Aletor, V.A. and Aina, J.M., 2003, Performance of broiler - chickens fed on maggot meal in place of fishmeal. ***International Journal of Poultry Science***, 2 (4): 271-274.

Cavalcanti, B.W. and Behnke, C.K., 2004, Effect of wheat bran phytase subjected to different conditioning temperatures on phosphorus utilization by broiler chicks based on body weight and toe ash measurements. ***International Journal of Poultry Science***, 3 (3): 215-219**.**

Christopher, G.I., Offfiong, S. and Idiong, I.C., 2007, Effect of the replacement of maize with wheat offal in broiler finisher diets on growth performance and feed cost. ***Central European Journal of Agriculture***, 8 (1): 33-38.

Eiman, G.H., Amir, M.A. and Abdel Moniem, I.M., 2008, Effect of fermentation and particle size of wheat bran on the anti-nutritional factors and bread quality. ***Pakistan Journal of Nutrition***, 7 (4): 521-526.

Hahn, G. and Spindler, M., 2002, Method of dissection of turkey carcasses. ***World Poultry Science Journal***, 58 (2): 179-197.

Hardini, D. 2010, The nutritive evaluation of fermented rice bran as poultry feed. ***International Journal of Poultry Science***, 9 (2): 152-154.

Iyayi, E.A. and Fayoyin, F.K., 2004, Expanding rural poultry production through the use of low cost cassava fruit coat as alternative fibre source for broilers. A paper presented during the Conference on International Agricultural Research for Development. Deutscher Tropentag, Berlin, October 5-7. Pp 8.

Lamb, G.N., 1981, Manual of veterinary laboratory techniques. CJBA-Geigy, Kenya. pp 92-109.

Lee, E.S., Dadgar, S., Kim, C.J. and Shand, P.J., 2007, Effect of raw meat L* -value, pH and marination on cooked meat quality of broiler thigh meat. *CMSA News*. pp 30-32.

Minitab Statistical Software, 1991, v.10.2 Minitab Inc. P.A. U.S.A.

Mitruka, B.M. and Rownsley, M., 1977, Clinical biochemical and haematological reference values in normal experimental animal. Mason, NY.

Mould, F.L., Kliem, K.E., Morgan, R. and Mauricio, R.M., 2005, In vitro microbial inoculum: A review of its function and properties. ***Animal Feed Science and Technology,*** 123-124: 31-50

Ndams, S. S., Tegbe, T.S.B., Ogundipe, S.O. and Sheyin, Z., 2011, Determination of the optimum inoculum concentration and fermentation period and their effect on nutrient composition of brewers' dried grains. ***Science World Journal,*** 6 (1): 13-19.

Ndams, S.S., Tegbe, T.S.B. and Ogundipe, S.O., 2009, Effects of feeding graded levels of re-fermented brewers' dried grains on performance and carcass characteristics of broiler chickens. *Journal of Agricultural Research*, 1: 37-45.

Oluyemi, J.A. and Roberts, F.A., 2000, Poultry production in warm wet climates (2nd Ed). Spectrum books limited, Ibadan, Oyo State, Nigeria. pp 244.

Onibi, G.E., 2006, Dietary oil quality and vitamin E supplementation II: Effect on carcass and meat quality of broiler chickens. ***Bowen Journal of Agriculture***, 3 (1): 106-115.

Oseni, O.A. and Ekperigin, M., 2007, Studies on biochemical changes in maize wastes fermented with ***Aspergillus niger. Biokemistri,***19 (2): 75-79.

Perez-Hidalgo, M.A., Guerra-Hernendez, E. and Garcia-Villanova, B., 1997, Dietary fiber in three raw legumes and processing effect on chick peas by an enzymatic-gravimetric method. ***Journal of Food Composition and Analysis,*** 10: 66-72. In: Oseni, O.A. and Ekperigin, M., 2007, Studies on biochemical changes in maize wastes fermented with ***Aspergillus niger. Biokemistri,***19 (2): 75-79.

Pikul, J., Leszczynski, D.E. and Kummerow, F.A., 1989, Evaluation of three modified TBA methods for measuring lipid oxidation in chicken meat. ***Journal of Agriculture and Food Chemistry***, 37: 1309-1313.

Reddish, P.M. and Scarr, M.J., 1987, Subsiding industries for the livestock subsector. Proceedings of the 11th Conference of Nigerian Society for Animal Production, Ahmadu Bello University Zaria, Nigeria. pp. 12-23.

Ross, J., Christie, G., Halliday, W. and Gade Jone, R.M., 1978, Haematological and blood comparison value for clinical pathology in poultry. ***Veterinary Record,*** 102: 29-31.

Steiner, T., Mosenthin, R., Zimmermannb, B., Greiner, R. and Roth, S., 2007, Distribution of phytase activity, total phosphorus and phytate phosphorus in legume seeds, cereals and cereal by-products as influenced by harvest year and cultivar. ***Animal Feed Science Technology,*** 133: 320-334.

Yao, J.H., Han, J.C., Wu, S.Y., Xu, M., Zhong, L.L., Liu, Y.R. and Wang, Y.J., 2007, Supplemental wheat bran and microbial phytase could replace inorganic phosphorus in laying hen diets. ***Czech Journal of Animal Science***, 52 (11): 407-413.

Zeisel, S.H., Mar, M.H., Howe, J.C. and Olden, J.M., 2003, Concentration of choline-containing compounds and betaine in common foods. ***Journal of Nutrition***, 133: 2918-2919.

دراسة لأداء النمو وقيم الدم ونوعية اللحوم في فراخ اللحم المغذى على عليقة تحتوي على نخالة القمح المعالجة بعصارة الكرش.

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ملخــص

تمت هذه الدراسة بهدف التقييم التركيبي لنخالة القمح المعالجة بعصارة الكرش وتأثيرها على أداء الفراخ اللاحم ونوعية لحومها. حيث تم معالجة النخالة بعصارة الكرش كمصدر للميكروبات لمدة ثلاثة أيام. وتم خلط ما نسبة 0% و20% و30% من النخالة المعالجة وغير المعالجة في عليقة الفراخ، حيث تم اختبار 220 صوصا بطريقة عشوائية. لقد أظهرت النتائج أن النخالة غير المعالجة تحتوي على 15,33% بروتين خام بينما النخالة المعالجة لمدة ثلاثة أيام تحتوي على 16,82% بروتين خام. وعند مقارنة الأوزان النهائية، والزيادة في الأوزان والتحويل العلفي لم تظهر التحاليل أية فروق معنوية بين المجموعتين، كما أن المعالجة لم تظهر أي تغيير على نوعية اللحوم أو في قيم الدم، أو في نمو وتطور الصوص. وقد أشارت الدراسة بأنه يمكن استعمال النخالة بعصارة الكرش دون أي تأثيرات سلبية على نوعية اللحوم وأداء الفراخ.

الكلمات الدالة: نخالة القمح، التخمر، عصارة الكرش، الأداء، نوعية اللحوم، فراخ اللحم.

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