SENSORY AND MEAT QUALITY EVALUATION OF BROILER CHICKENS FED DIETS CONTAINING GRADED LEVELS OF CORN COB AND SOYBEAN HULL AS A REPLACEMENT FOR WHEAT OFFAL

[*]Fasasi, M.O, [*]Abidola, B.B, [*]Bamgbose, A. M. [**]Raji, M.O, [***]Olayemi, W.A., and [*]Oso, A.O.
*****Department of Animal Nutrition, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria
**Department of Animal Health and Production Technology, Oyo State College of Agriculture and Technology, P.M.B 10, Igboora, Oyo State, Nigeria.
***Department of Agricultural Technology, Yaba College of Technology, Yaba, Lagos, Nigeria.
* Correspondence: mukhulisololade@gmail.com, +2348136314270

ABSTRACT
To determine the meat quality and sensory evaluation of broiler chickens fed corn cob (CC) and soybean hull (SBH) as a replacement for wheat offal (WO), a total of 105 one day-old broiler chickens (Abor acre) were raised at the poultry unit of the Federal University of Agriculture, Abeokuta, Nigeria. Upon arrival, the birds were weighed and randomly allotted into 5 dietary treatments. Each dietary treatment consisted of 3 replicates of 7 birds each. The dietary treatments consisted of the T1/control (100%WO:0% CC+SBH), T2 (75%WO:25%CC+SBH), T3 (50%WO:50% CC+SBH), T4 (25WO%+75% CC+SBH) and T5 (0%WO:100% CC+SBH). Corn cob and soybean hull were included at ratio 1:1. At the 56th day of the experiment, breast meat samples were taken from 3 birds in each replicate and analyzed for meat quality and sensory characteristics. The experiment was laid out in a completely randomized design and data obtained for sensory and meat quality evaluation were subjected to one-way analysis of variance. Results obtained showed that water absorption capacity, cooking loss and refrigeration loss were significantly influenced ($p<0.05$) with birds on 100% CC+SBH recording lowest value for water absorption capacity (0.00%) and highest for refrigeration loss (6.00%). Meaty flavor, saltiness and overall flavor were the sensory parameters that were significantly influenced ($p<0.05$). However, overall acceptability remain unchanged ($p>0.05$) across dietary treatments. The study concluded that replacement of WO with CC and SBH at up to 100% replacement level had little impact on meat quality and sensory evaluation and therefore recommended.
Keywords: Corn cob, Soybean hull, Wheat offal, Broiler and Fibre

INTRODUCTION
The projected increase in human population by 33% by the year 2050 (UNO,2015), there is no doubt that food production would also increase and poor management of the resulting agro-industrial by-products generated could have detrimental effects on the environment. Also, the human competition with animals for conventional feed resources and the adverse effects of climate change on crop yields has resulted in scarcity and soaring cost of conventional feed resources (Anaeto *et al.,* 2009). Wheat offal is one of the primary fibre sources in poultry diets due to its high availability, digestibility and palatability. However the drastic reduction in wheat production due to climate change and insurgency in northern Nigeria where most of the wheats are produced has resulted in sudden surge in price and there is urgent need to look into some non-conventional resources (such as corn cob and soybean hull) which are always in abundance and causing nuisance to the environment. Corn cobs are a by-product of the maize crop, consisting of the central fibrous rachis of the female inflorescence. It was estimated that the US produces about 50 million tons of cobs annually in the 2000s, with most of them being left on the field (Jansen, 2012). Soybean hulls (a by-product of soybean oil and meal production) also suffers the same fate. Whereas some researches have suggested that these by-products are highly digestible (Agrifeeds, 2015) and may contain bioactive substances that improve meat quality. Therefore, this study investigated the meat quality and sensory characteristics of broiler chickens fed diets containing corn cob and soybean hull as a replacement for wheat offal.

MATERIALS AND METHODS

Experimental location and management

The experiment was carried out at the poultry unit of the Directorate of University Farms (DUFARMs), Federal University of Agriculture, Abeokuta, Ogun State, Nigeria. A total of 105 one day-old chickens (Abor acre) were used for the study. The initial weight of the birds were taken and randomly distributed into 5 experimental treatments of 3 replicates each. Each replicate consisted of 7 bird making a total of 21 birds per treatment. Feed and water were supplied *ad libitum* and other standard routine managements for deep litter system were duly kept to throughout the starter and finisher phases of the experiment.

Sourcing of the test ingredients

Corn cob used was procured from Eleekara (a corn processing hub in Oyo town), Oyo State, Nigeria and the Soybean hull was procured in Abeokuta, Ogun State, Nigeria. Collected corn cobs and soybean hulls were cleaned, sorted by removal of foreign substances through hand picking, re-dried to a moisture content of about 10% (measured with digital moisture meter), milled and packed inside an airtight polythene bag till the time of use.

Experimental diets and design

A total of five experimental diets were formulated such that diet 1 (control) contained 100% wheat offal without corn cob or soybean hull while diets 2, 3, 4 and 5 contained 25, 50, 75 and 100% corn cob and soybean hull (ratio 1:1) respectively as a replacement for wheat offal. The experiment was laid out in a completely randomized design. The gross composition of the experimental diets is shown on tables 1and 2.

Table 1: Gross composition (%) of the experimental diets for starter phase (0-4 weeks)

Ingredients	Control 100%WO	25% CC+SBH	50% CC+SBH	75% CC+SBH	100% CC+SBH
Maize	53.00	53.00	53.00	53.00	53.00
Soybean meal	28.00	28.00	28.00	28.00	28.00
Groundnut Cake	6.00	6.00	6.00	6.00	6.00
Fishmeal (72%)	4.00	4.00	4.00	4.00	4.00
Wheat offal	4.00	3.00	2.00	1.00	0.00
Corn cob	0.00	0.50	1.00	1.50	2.00
Soybean hull	0.00	0.50	1.00	1.50	2.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Limestone	1.60	1.60	1.60	1.60	1.60
Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.10	0.10	0.10	0.10	0.10
Toxin binder	0.10	0.10	0.10	0.10	0.10
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Analysis					
ME (Kcal/kg)	2845.44	2842.50	2839.57	2836.63	2833.70
Crude protein (%)	23.35	23.29	23.22	23.15	23.08
Crude fibre (%)	3.59	3.91	4.23	4.55	4.87
Ether extract (%)	3.86	3.88	3.90	3.91	3.93

Data collection

On the 56th day of the experiment, 3 birds per replicate were selected, slaughtered and breast meat samples were taken to the laboratory for sensory evaluation and meat quality analysis. Sensory evaluation was carried out by cooking breast meat samples from each replicate at 70°C for 30 minutes inside water bath. The cooked samples were served to 10 trained panellists to taste and grade (for colour, juiciness, meaty flavour, tenderness, saltiness, overall flavour and overall acceptability) based on the 9 point hedonic scale of Ogunwole *et al.*, 2013.

Meat quality parameters studied includes:

i. **Water absorption capacity** $= Weight\ of\ meat\ sample\ before\ imersion\ into\ water - weight\ after\ immersion$

ii. **Cooking loss** = $Weight\ of\ meat\ sample\ before\ cooking - weight\ after\ cooking$
iii. **Refrigeration loss** = $Weight\ of\ meat\ sample\ before\ refrigeration - weight\ after\ refrigeration$

Statistical Analysis

All data obtained from the study were subjected into One-way Analysis of Variance (ANOVA) in a Completely Randomized Design using the GLM procedure of statistical analysis software SAS® version 2013, means were separated using Duncan Multiple Range Test (DMRT) as contained in the SAS® software.

Table 2: Gross composition (%) of the experimental diets for finisher phase (4-8weeks)

Ingredients	Control 100%WO	25% CC+SBH	50% CC+SBH	75% CC+SBH	100% CC+SBH
Maize	57.00	57.00	57.00	57.00	57.00
Soybean meal	19.00	19.00	19.00	19.00	19.00
Groundnut Cake	8.00	8.00	8.00	8.00	8.00
Fishmeal (72%)	2.00	2.00	2.00	2.00	2.00
Wheat offal	8.00	6.00	4.00	2.00	0.00
Corn cob	0.00	1.00	2.00	3.00	4.00
Soybean hull	0.00	1.00	2.00	3.00	4.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Limestone	2.10	2.10	2.10	2.10	2.10
Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.10	0.10	0.10	0.10	0.10
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Analysis					
ME (Kcal/kg)	3034.12	3028.25	3022.38	3016.51	3010.63
Crude protein (%)	19.81	19.76	19.62	19.49	19.35
Crude fibre (%)	3.51	4.15	4.79	5.43	6.07
Ether extract (%)	3.84	3.87	3.91	3.95	3.98

CC= Corn cob ; SBH= Soybean Hull; WO= Wheat offal

Table 3: Meat quality and sensory characteristics of broiler chickens fed diets containing corn cob and soybean hull as a replacement for wheat offal

Parameters	Control	25%	50%	75%	100%	SEM	P-value
Meat quality (%)							
Water absorption capacity	3.33^{b}	3.28^{b}	4.92^{a}	3.28^{b}	0.00^{c}	0.043	0.03
Cooking loss	12.80^{a}	10.00^{b}	9.74^{b}	12.00^{a}	9.60^{b}	0.418	0.02
Refrigeration loss	3.00^{c}	$5.00a^{b}$	3.94^{b}	4.20^{b}	6.00^{a}	0.298	0.00
Sensory evaluation							
Colour	6.00	5.53	5.20	6.17	5.17	0.127	0.07
Juiciness	5.67	5.43	4.37	4.67	4.07	0.225	0.08
Meaty flavour	5.90^{ab}	6.50^{a}	4.90^{b}	5.50^{ab}	6.10^{a}	0.167	0.00
Tenderness	6.10	6.20	5.00	5.20	4.40	0.268	0.15
Saltiness	4.80^{b}	4.70^{b}	6.10^{a}	5.30^{ab}	4.80^{b}	0.169	0.01
Overall flavour	5.90^{a}	5.70^{a}	5.27^{b}	5.17^{b}	5.13^{b}	0.092	0.00
Overall acceptability	6.00	6.60	6.17	5.80	5.20	0.165	0.07

SEM- Standard error of mean;
Means on the same column having different superscript differ significantly at $P < 0.05$

RESULTS AND DISCUSSION

Table 3 shows the result of meat quality and sensory evaluation of broiler chickens fed corn cob and soybean hull as a replacement for wheat offal. Water absorption capacity, cooking loss and

refrigeration loss were all significantly influenced ($p<0.05$) by the replacement of wheat offal with corn cob and soybean. Meat samples from the birds on 100% corn cob+soybean hull showed the least water absorption capacity (0.00%), this could be as a result of the high collagen in the alternative fibre sources that made the intramuscular bond to be stronger to reduce shear force. Also, the lower values recorded for cooking loss in birds fed 25, 50 and 100% corn cob+soybean hull could be as a result of the body weight of the birds used. As Paul (1975) stated that as the weight of the bird increases the percentage moisture loss reduces. This observation is in line with findings of Iyayi *et al*. (2005). Colour, Juiciness, Tenderness and overall acceptability were sensory parameters that appeared not to be significantly affected ($p>0.05$) by the inclusion of corn cob and soybean hull. However, meaty flavor, saltiness and overall flavor showed significant variation ($p<0.05$) in birds fed corn cob+soybean hull and those on 100% wheat offal. The inconsistence in the trend of results for meaty flavor, saltiness and overall flavor could be attributed to the age of the birds as these parameters have been reported to be more manifested in poultry birds as they grow older (Ramaswamy and Richards, 1982). Meanwhile, it's worth noting that the alternative fibre sources inclusion did not create off flavor in poultry meat as shown by the non-significant difference observed in overall acceptability.

CONCLUSION AND RECOMMENDATION

It can be concluded from this study that inclusion of corn cob and soybean hull as a replacement for wheat offal did not negatively impact meat quality and sensory characteristics of broiler chickens. Therefore, it is recommended that wheat offal should be replaced with corn cob+soybean hull up to 100% replacement level for reduction in feed cost and lower environmental pollution.

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