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Mineral composition of chicken meat floss produced from broilers fed diets with low energy levels

[1]Umar, A. M. and [2]Mohammed, A.
[1]*Department of Animal Health and Production, Binyaminu Usman Polytechnic, Hadejia, Jigawa State* [2]*Department of Animal Health and Production, Federal Polytechnic, Bauchi*
Corresponding author: auw.umar@gmail.com; +2348164727548 and +2348027374654

Abstract

This study was designed to investigate the mineral composition of floss prepared from broiler chickens fed low energy diets. Three experimental diets comprising three energy levels of 2, 400 (A); 2, 600 (B) and 2, 800 ME Kcal/Kg (C) were formulated and fed to the broiler chickens. The crude protein of the starter and finisher diets were fixed at 24 and 20%, respectively. A total of 270, one-day old Cobb 500 broiler chicks were weighed and randomly allocated to three treatments (A, B and C) of 90 birds per treatment, each treatment having three replications of 30 birds. At the end of eighth week, three birds were randomly taken from each replication for the preparation of meat floss. Triplicate samples of the raw and broiler chicken meat floss were analysed for calcium (Ca), magnesium (Mg), sodium (Na) and potassium (K). The experiment was laid in a Completely Randomized Design. Raw meat of broiler chicken fed diet containing 2, 800 ME Kcal/Kg had the highest values of Ca (50.72 mg/Kg), Na (48.02 mg/Kg) and K (80.96 mg/Kg). Mineral composition of meat floss from broiler chicken fed diet containing 2, 800 ME Kcal/Kg had the highest value of Na (48.69 mg/Kg) and K (78.81 mg/Kg). It is concluded that the raw meat and floss of broiler chickens fed diet containing 2, 800 ME Kcal/Kg had highest values of Na and K.

Keywords: Broiler chicken, meat floss, diets, energy levels and mineral composition

Introduction

In Northern Nigeria, *Tsire, Balangu, Dambun-Nama* (meat floss)*, Kilishi* and *Ragadada* are the commonest meat products. The traditionally processed floss is highly acceptable to consumers because of its soft and tender taste compared to the hard and non-soft *kilishi*. Meat floss is easy to prepare and highly relished by consumers (Omojola *et al.,* 2004). The product is mass consumed fast-food whose consumption is invariant with respect to ethnicity, religion, socio-economic factors or sex.

Meat floss is a Nigerian traditionally spiced, cooked, pounded, shredded and dried meat product which is commonly prepared using chicken meat, beef, chevon, mutton or camel meat and is popularly consumed in the Northern parts of Nigeria. The product appears to have developed as a means of preserving meat in the absence of facilities for refrigerated storage by the early Fulani and Hausa herdsmen (Igene *et al.,* 1990). The growing importance of meat floss as an indigenous fast food makes it necessary to obtain information on its composition and to assess its nutritional contributions (Muhammad and Muhammad, 2007). The study was aimed to examine the mineral composition of chicken meat floss produced from broilers fed diets with low energy levels.

Materials and methods

Description of the study area

The experimental research was sited at the Poultry Demonstration Farm of the Department of Animal Health and Production, Binyaminu Usman Polytechnic, Hadejia, Jigawa State. The area is located in the sudan savannah zone of Nigeria, which lies between 10^0 02' 28"14" E Longitude and 12^0 27' 12.49" N

Latitude. The town is served by Federal roads linking it to Nguru in the east, Kano in the northwest, Katagum in the south and Dutse (capital of the state) in the southwest. The old town has been extended beyond the traditional walls. Hadejia LGA is bordered on the south by Hadejia River, east by Kirikasamma LGA and north to west by Mallam-Madori LGA.

Experimental diets containing varying energy levels

Three experimental diets (A, B and C) containing three energy levels of 2, 400 (A), 2, 600 (B) and 2, 800 MEKcal/kg (C) were formulated and fed to the broiler chickens. The crude protein of the starter and finisher diets were fixed at 24 and 20%, respectively. The ingredients and calculated chemical compositions of the starter and finisher diets were presented in Tables 1 and 2, respectively.

Table 1: Composition (%) of poultry chicken starter experimental diets-

Ingredients	Dietary Energy Levels (ME Kcal/kg)		
	A	B	C
Maize	22.00	33.00	44.00
Soybean Meal	24.00	26.00	29.00
Ground nut cake	15.00	16.00	16.00
Wheat Offal	33.00	19.00	5.00
Bone Meal	3.00	3.00	3.00
Limestone	2.00	2.00	2.00
Common Salt	0.30	0.30	0.30
*Premix	0.25	0.25	0.25
Methionine	0.25	0.25	0.25
Lysine	0.20	0.20	0.20
Total	**100.00**	**100.00**	**100.00**
Calculated Analysis			
ME(Kcal/kgDM)	2417	2613	2810
Crude Protein (%)	24.00	24.00	24.10
Lysine (%)	1.40	1.40	1.40
Methionine (%)	0.60	0.60	0.60
Calcium (%)	1.60	1.60	1.60
Phosphorus (%)	0.70	0.70	0.70
Crude Fibre (%)	5.60	4.80	4.00
Ether Extract (%)	3.80	3.90	3.90

*Starter Premix provided per kg diet: Vitamin A 10,000mg, Vitamin D3, 20,000mg, Vitamin E 23,000mg, Vitamin K3 2,000mg, Vitamin B1 1,800mg, Vitamin B2 5,500mg, Niacin 27,500mg Pantothenic acid 7,500mg, Vitamin B6 3000mg, Vitamin B12 1500mg, Folic acid 750mg, Biotin H2 600mg, choline Chloride 500,000mg, Cobalt 200,000mg, Copper 3,000mg, Iodine 1000mg, Iron 20,000mg, Manganese 40,000mg, Sel enium 200mg, Zinc 30,000mg, Antioxidant 1,250mg.

Table 2: Composition (%) of poultry chicken finisher experimental diets

Ingredients	Dietary Energy Levels (ME Kcal/kg)		
	A	B	C
Maize	33.00	40.00	50.50
Soybean Meal	18.00	17.00	20.00
Groundnut Cake	7.00	10.00	11.80
Wheat Offal	39.00	27.00	11.70
Bone Meal	3.00	3.00	3.00
Limestone	2.00	2.00	2.00
Common Salt	0.30	0.30	0.30
*Premix	0.25	0.25	0.25
Methionine	0.25	0.25	0.25
Lysine	0.20	0.20	0.20
Total	**100.00**	**100.00**	**100.00**
Calculated Analysis			
ME(Kcal/kgDM)	2430	2602	2816
Crude Protein (%)	19.80	19.70	20.20
Lysine (%)	1.20	1.10	1.20
Methionine (%)	0.50	0.50	0.50
Calcium (%)	1.60	1.60	1.60
Phosphorus (%)	0.70	0.60	0.60
Crude Fibre (%)	5.40	4.70	3.90
Ether Extract (%)	3.60	3.70	3.70

*Finisher Premix provided per Kg diet: Vitamin A 8,500iu, Vitamin D3 1,500iu, Vitamin E 10,000mg, Vitamin K3 1,500mg, Vitamin B1 1,600mg, Vitamin B2 4,000mg, Niocin 20,000mg, Pantothenic Acid 5000mg, Vitamin B6 1,500mg, Vitamin B12 1000mg, Folic Acid 500mg, Biotin H2 750mg, Choline Cloride 175,000mg, Cobalt 200mg, Copper 3000mg, Iodine 1000mg, Iron 20,000mg, Manganese 40,000mg, Selenium 200mg, Zinc 30,000mg, Antioxidant 1,250mg.

Experimental animals and their management

A total of 270, One day-old broiler chicks of Cobb 500 strain were purchased from a reputable distributor. The chicks on arrival were weighed and randomly allotted to three treatments coded A, B and C containing 90 birds per treatment, each treatment had three replications of 30 birds. The birds were managed under deep litter system with wood shaving as litter materials. The chickens were vaccinated against Newcastle disease and Gumboro. The pen was cleaned and disinfected using recommended disinfectant (7% Tar Acid Phenol and 2% Cresylic Creosote) to avoid microbial contamination.

Routine management was carried out as described by Oluyemi and Roberts (2000). Experimental feed and fresh clean water were provided *ad-libitum*. The feeding trial lasted for eight weeks (17th February to 13th April, 2016). At the end of the production, 27 birds (three birds per replication) were slaughtered for the preparation of meat floss.

Preparation of spice mixtures for meat floss production

Two spice mixtures (cooking recipe and shredding recipe) were formulated as shown in Tables 3 and 4. The ingredients used for the formulations were purchased from a local spice market within the study area. Each spice was dried and ground separately using a table top grinder (Model BLSTMG. PN133093-002) and the coarse particles removed using a sieve of 1.0 mm mesh diameter. The cooking and shredding recipes were separately stored in airtight polyvinyl chloride containers for subsequent use.

Table 3: Composition of cooking recipe used for broiler chicken meat floss production (g/100g)

Ingredients /seasoning	Botanical names	Quantity
Common Salt	Sodium Chloride	10.00
Thyme	Thymus vulgaris L.	12.50
Curry	Murraya koenigii (L.) Spreng.	12.50
Onions	Allium cepa L. var. cepa	50.00
Maggi Cube	*Maggi	15.00
Total		**100.00**

Source: Omojola *et al*., 2014

* Trade name

Table 4: Composition of shredding recipe used for broiler chicken meat floss production (g/100g)

Ingredients	Botanical names	Quantity
Red Pepper	*Piper nigrum* L.	35.00
African Nut Meg	*Monodora myristica* (Gaertn.) Dunal	2.50
Ginger	*Zingiber officinale* Rosc.	4.00
Garlic	*Allium sativum* L.	3.00
Cloves	*Syzygium aromaticum* (L.) Merr. et L.M. Perry	2.50
Curry Powder	*Murraya koenigii* L.	3.50
Thyme Leaves	*Thymus vulgaris* L.	2.50
Salt	Sodium Chloride	5.00
Onions	*Allium cepa* L. var. *cepa*	12.00
Maggi Cube	*Maggi	30.00
Total		**100.00**

Source: Omojola *et al.* (2014)

* Trade name

Cooking of meat

After slaughtering and dressing of the birds, the bones and the muscles were separated; lean meat was cut into pieces of approximately 4 cm by 2.5 cm dimension, washed with clean water and mixed with spices. Each meat type was cooked on an adjustable Pifco Japan Electric Hot Plate (Model Number ECP 2002). The cooking recipe was added in the ratio of 1 g of spice to 100 g of meat. Four medium-sized (500 g) onions (approximately 50 g of onions on Dry Matter basis) were thinly sliced and added. Water was added at the ratio of 1.5 liters to 1.0 kg of meat. The meat samples were cooked to an internal temperature of 72 ºC and the broth was allowed to dry with the meat. The meat samples were removed and allowed to equilibrate to room temperature and weighed.

Meat shredding

The cooked meat samples were pounded into shreds using a mortar and pestle. The shredding recipe was added in the ratio of 1:20 (50 g of spice to 1000 g of meat), while 120 g onion on dry matter basis was added to every 100 g of spice used. These were weighed and added a little at a time as pounding progressed for uniform mixing of the recipe.

Frying of meat to form meat floss

The shredded meat from each meat type was separately shallow fried using stainless steel pot in Soy bean oil (Grand®) which was pre-heated to 70 ºC. The ratio of oil to meat was 1 liter to 500 g of meat. The meat samples were fried at 70 strokes per minute (Farouk *et al.,* 2015) until a golden brown colour was obtained (20 minutes). **Figure 1** demonstrates chicken meat floss production (Eke *et al*., 2012).

Oil draining

The products were poured into a colander after frying and pressure applied to remove excess oil and prevent the final product from sticking. The dry spongy product from each meat type was poured into separately marked flat containers, allowed to cool and separated into strands.

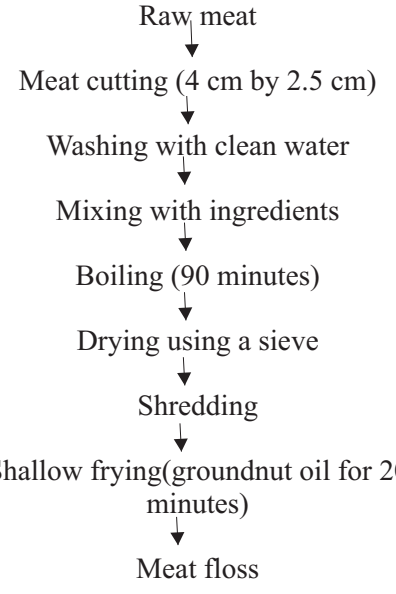

Figure 1: Chicken meat floss preparation. Source: Eke *et al*., 2012

Sample analyses

Triplicate samples of the raw and chicken meat were analysed. One gram from each of the three different treatments was inoculated in a vacuum plastic container which was immediately transported to the laboratory for the mineral analysis. After wet digestion, the mineral determined were Ca and Mg using Atomic Absorption Spectrophotometer (Buck Scientific Model 210 VGP), while Na and K using Flame Photometer.

Data analyses

Data obtained were subjected to analysis of variance using the General Linear Model Univariate Procedure of SPSS 17.0 and significant differences of means were compared using LSD at 5% level of probability.

Results

The results of the macro mineral composition of raw broiler chicken meat fed low energy levels are presented in Table 5. The raw meat of broiler chicken fed diet

containing 2, 800 ME Kcal/Kg had the highest values of Ca, Na and K. There was significant difference (P<0.05) between treatments for Ca, Mg and K. The results of the mineral composition of meat floss from broiler chicken fed low energy levels are presented in Table 6. The meat floss from broiler chicken fed diet containing 2, 800 ME Kcal/Kg had the highest values of Na and K. The values of Ca, Na and K were lowest in birds fed 2, 600 ME Kcal/Kg. Ca, Mg and Na recorded significant difference (P<0.05) between the treatments.

Table 5: Mineral composition of raw broiler chicken meat fed diets with low energy levels

	Energy Levels (ME Kcal/Kg)			
Minerals (Mg/Kg)	2, 400	2, 600	2, 800	SE(±)
Ca	43.43^{b}	23.67^{c}	50.72^{a}	1.27
Mg	22.00^{a}	18.32^{b}	16.72^{c}	1.34
Na	30.16^{b}	30.60^{b}	48.02^{a}	1.17
K	32.22^{c}	41.82^{b}	80.96^{a}	1.18

Means with different superscript differ significantly (P<0.05)

Table 6: Minerals composition of meat floss produced from broiler chicken fed diets with low energy levels

	Energy Levels (ME Kcal/Kg)			
Minerals (Mg/Kg)	2, 400	2, 600	2, 800	SE(±)
Ca	102.92^{a}	56.76^{c}	80.05^{b}	1.70
Mg	38.84^{b}	55.73^{a}	27.58^{c}	1.50
Na	44.42^{b}	40.63^{c}	48.69^{a}	1.24
K	65.24^{b}	64.67^{b}	78.81^{a}	1.36

Means with different superscript differ significantly (P<0.05)

Discussion

Broiler chickens derived the mineral required for normal growth and metabolism from their diets. The biological availability of a mineral from the diet is manifested by the efficiency with which the body utilises and retains the dietary mineral. The retention will be influenced by a number of dietary factors, including diet or ingredient type, source of mineral and, levels and relative proportions of various minerals (Thomas and Ravindran, 2017). Ogunwole *et al*. (2014) reported Ca range in raw chicken meat between 29.12 to 33.08 mg/kg which were within the range found in this research. The work of Eniola *et al*. (2017) who reported significant differences in Ca and Fe between treatments in the raw meat of domesticated and Wild Grass-cutter agrees with this finding. Ca, Mg and Na values of raw meat obtained in this research is in line with the finding of Yasmine (2009). The significant differences (P<0.05) in Ca and Mg values as reported by Ogunwole *et al*. (2013) were similar to what was reported in this study. The same authors reported Ca values (33.00 to 35.58 mg/kg) which agrees with the findings of this work. Umar and Muhammad (2011) reported highest values of K as 71.75 for raw meat, 60.44 for *Tsire* and 78.06mg/Kg for *Balangu* which was similar to this report . The Ca value of meat floss obtained from birds fed 2, 400 ME Kcal/Kg is relatively similar to what was reported by Jokanovic *et al.* (2014). The K content of broiler chicken meat floss in all the treatments is relatively the same with the findings of Umar and Muhammad (2011) who reported 60.44 and 78.06 mg/Kg for *Tsire* and *Balangu*, respectively.

Conclusion

Raw meat and floss of broiler chickens fed diet containing 2,800 ME Kcal/Kg had highest values of Na and K.

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