



Sensory Attribute of Meat and Meat Floss of Broiler Chickens Raised on Free Range System Supplemented with Wheat Sprout

Ijasini, J.A.¹, Jiya, E.Z.², Abdul, S.B.¹ and Bislava, M.B.³

¹Department of Animal Science, Ahmadu Bello University, Zaria, Nigeria.

²Department of Animal Science, Federal University of Technology Minna, Minna, Nigeria.

³Department of Animal Science, University of Maiduguri, Maiduguri, Nigeria

Abstract

The study was conducted to determine the effect of duration on free range on broiler chickens, in relation to sensory characteristics. Two hundred (200) unsexed Arbor broiler chicks were randomly assigned to four treatments. The birds were transferred to the free-range paddock, at 2, 4 and 6 weeks. Some of the birds were reared indoors throughout the rearing period and these served as the control (week 0). The results indicated that the production system had no effect ($p>0.05$) on sensory traits for broiler chickens. Sensory results showed that there was no difference in juiciness, tenderness, flavour and aroma between meats from free ranged and conventionally raised broiler chickens. Meat floss from week 0 broiler chickens had higher ($p<0.05$) sensory ratings for colour, aroma, flavour tenderness and juiciness. Overall acceptability showed that the meat floss from weeks 2, 4 and 6 scored above intermediate (7.2, 7.0, and 6.75, respectively), which indicated that all the products irrespective of the rearing system were acceptable to the panellists. It was evident that meat floss from broiler chickens at week 0 was more preferred by the panellists than the other treatments.

Key words: Broiler, Free range, Meat floss, Sensory attribute

Introduction

Over the past few decades meat and poultry industries have been very active in introducing new meat products, in response to consumers' demand for convenient food products with exciting flavours and texture (Barbut, 2015). The USDA (United States Department of Agriculture) has a minimally defined set of standards for free-range poultry production. To qualify for free-range production, producers must demonstrate that poultry has been allowed access to outdoors (Husak, 2007). Free-range does not mean that the production methods follow certified organic standards as some consumers may perceive (Husak, 2007). Conventionally-raised chickens could be labelled as free-range if it were allowed access to the outdoors (Husak, 2007). It is known that fast-growing broiler chickens are not adapted to free range management systems, but they are commonly

sallyijas@gmail.com

used under free range conditions for economic reasons (Castellini *et al.*, 2006) especially in the USA (Bogosavljević-Bosković *et al.*, 2006). Given the expansion of food service and growing consumer appetite for free range products the market economics will necessitate the use of fast growing strains.

Over the years, there has been increased demand from consumers for chicken products that provide a high-level nutrition with good flavour and rearing techniques that offer good welfare and health for the birds (Owens *et al.*, 2006; Pavlovski *et al.*, 2009). In recent times, consumers have been increasingly interested in products that are perceived to be naturally produced or environmentally friendly. Meat floss is a dried meat product produced mainly by Hausas and Fulanis in northern part of Nigeria (Ogunsola and Omojola, 2008; Eke *et al.*, 2013). Meat floss (*dambun-nama*) is

processed by cooking, pounding and then fried with addition of spices. Due to its low moisture content, meat floss can keep without refrigeration and will not drastically change in room temperature at storage (Liao *et al.*, 2009; Huda *et al.*, 2012). 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). Most meat floss comes from beef, mutton or camel meat. However, the use of meat from poultry and fish is becoming popular among consumers (Eke *et al.*, 2012). This study was conducted as an effort to diversify chicken meat floss product, locally known as “*dambun-nama*” in Nigeria with the utilization of broiler chickens raised on free range system.

Materials and Methods

Experimental location

The study was conducted at the Animal Product Laboratory, Department of Animal Science, Ahmadu Bello University, Zaria. Located within the Northern Guinea Savannah Zone on the latitude 11° 9'45"N and Longitude 7° 38'8"E, at altitude of 610 m above sea level (Ovimaps, 2015).

Sources of experimental birds

Two hundred (200) day old Arbor broiler chicks (mixed sex) were obtained from Ibadan, Oyo state.

Experimental diets and preparation of hydroponic wheat sprouts

Wheat grains used for sprouting were purchased from grain seed dealers in Samaru, Zaria. Wheat grain was sorted to get rid of foreign matters and damage seeds. The Wheat grains were thoroughly rinsed in tap water and soaked in water for 12 hours in a plastic bucket with perforated cover. The sample was rinsed at intervals of 4 hours. After soaking for 12

hours, the grain samples were spread on a perforated tray in a greenhouse for a period of 6 days. The samples were watered three times daily. On the 6th day the hydroponic sprout was measured and offered to the birds in the range area.

Commercial poultry feed ingredients were purchased from commercial poultry feed (Table 1) and grain seed dealers in Samaru, Zaria. In the confined system birds were fed concentrates, while in the free range system, concentrates and wheat sprout were offered as supplements.

Experimental design and birds' management

The weight of the experimental birds were measured on arrival, and recorded as the initial weights. The chicks were brooded in brooding room provided with adequate heat and light and were randomly allotted to 4 experimental treatment groups, with 5 replicates each and 10 birds per replicate in a completely randomized design (CRD). Fifty (50) birds each were sequentially transferred to range paddocks at 2, 4 and 6 weeks (Wk2, Wk4 and Wk6, respectively, while another set of 50 birds were reared indoors (Wk0) and each group served as a treatment. All the necessary treatment and vaccination schedule were duly followed.

Wk0= the birds were raised indoors throughout the experimental period.

Wk2= the birds in this group were raised indoors for two (2) weeks and then spent their last six (6) weeks outdoors.

Wk4= the birds were allowed four (4) weeks indoors and four (4) weeks outdoors.

Wk6= the birds in this treatment spent six (6) weeks indoors and last two weeks outdoors.

The free range area was divided into 3 paddocks. The entire range land was fenced with wire mesh. This is to guard against predators. Each paddock was equipped with perches and water sprayers to control the harsh weather conditions. Each paddock was provided with electric bulbs for lightening and shades that covered 30% of the paddock area. Birds were stocked at densities of 2m²/bird

(paddock) and 10 birds/m²(pen). Birds were allowed to scavenge other feed sources in the soil and remained in the paddocks throughout the experimental period. Feeders and drinkers were adequately distributed in the paddocks. Free range behaviours such as foraging, perching, daily visits and ranging frequency of flocks were recorded. Investigations into ranging behaviour in this study utilized scan sampling methods, counting the number of chickens on the range area at a particular time (Fanatico *et al.*, 2016).

Table 1: Ingredient composition of the commercial broiler starter and finisher diets

Ingredients (%)	Starter	Finisher
Maize	49.00	52.35
Wheat offal	5.00	5.00
Groundnut cake (GNC)	11.00	8.00
Full fat soya	25.00	25.00
Fish meal (local)	4.00	3.00
Lime stone	1.00	1.00
Bone meal	3.00	3.00
Palm		
Oil	1.00	2.00
Table salt	0.30	0.30
Vitamin Mineral Premix	0.25	0.25
L-Lysine	0.20	0.20
D1-Methionine	0.20	0.20
Total	100	100
Calculated Analysis:		
ME (Kcal/kg)	2831	2929
Crude protein (%)	23.17	21.73
Ether Extract (%)	5.66	6.43
Crude Fibre (%)	4.37	4.25
Calcium (%)	1.43	1.37
Avail. Phosphorus (%)	0.68	0.65
Lysine (%)	1.46	1.38
Methionine (%)	0.46	0.46
Methionine + Cystein (%)	0.96	0.91

Meat sample collection

At 8 weeks of age, 10 birds were randomly selected from each treatment for carcass evaluation. The selected birds were starved of feed for 24 hours but allowed *ad-libitum* access to water prior to slaughter. The birds were then taken to Animal Products Laboratory of the Department of Animal Science, Ahmadu Bello University Zaria, for slaughtering. The birds were bled by severing the jugular vein and then scalding in hot water bath to remove the feathers.

The breast meat used for this study were randomly obtained from the broiler chickens that were exposed to free range conditions at different ages (0, 2, 4 and 6 weeks). Breast muscles of each group selected were randomly used for meat and meat floss sensory analysis. The samples were randomized for 30-minute cooking. The separated breast muscles were cut into cubes, and used for the sensory test.

Cooking, shredding and frying of meat samples for meat floss production

The cooking was done in different aluminium pots for each of the treatments to avoid contamination. The cooking recipe was added in the ratio of 1 g of spice to 100 g of meat (Table 2). Water was added to the meat samples and cooked for 35 minutes. After cooking the broth was separated into bowl. The meat samples were allowed to cool to room temperature. Cooking methods were the same across all the treatments.

The shredding and frying were done separately for each of the treatments in separate aluminium frying pans. The cooked meat samples were shredded separately by pounding with a wooden mortar and pestle. The shredding spice was added in the ratio of

5g of spice to 100g of shredded meat (Table 3). These were weighed and added a little at a time as pounding progressed for uniform mixing of the spice. The pounding was intense and consistent until the meat strands disengaged and were beaten to shreds. The shredded breast meats from each treatment were separately fried for 20 minutes in pre-heated groundnut oil (Kassim and Omojola, 2014). The products were poured into a colander after frying and pressure applied to remove excess oil and prevent the final product from sticking together. The dry spongy product from all treatments were poured into separately marked flat containers, and then allowed to cool and separate into strands (Kassim and Omojola, 2013).

Sensory evaluation of meat and meat floss

A total of 32 semi-trained panellists from Faculty of Agriculture were used to study the separated the breast muscles and meat floss. Samples were blind coded with two digit numbers and served on a clean saucer. Panellists were familiarized with the sensory terms, the tasting techniques and the hedonic scoring system.

Each panellist was presented the two digit blind coded samples and instructed to score each sample for flavour, tenderness, juiciness, colour and likeness. Panellists were instructed to rinse their palate and swallow water between samples.

Attribute scales were anchored with sensory descriptive terms, flavour, (*1=extremely perceptible and 9=extremely intense*), aroma (*1=extremely perceptible and 9= extremely intense*) tenderness (*1=extremely tough and 9=extremely tender*), juiciness (*1=extremely dry and 9=extremely juicy*) and overall liking using 9 point hedonic scale (*1= extremely*

disliked and 9= extremely liked). (Peryam and Pilgrim, 1957).

Data analysis

The data generated were analysed using quantitative descriptive statistics.

Table 2: Composition of spice used for the cooking of meat

Ingredients (g/100g)	Hausa	Ingredients	
		Scientific/Botanical	Quantity
Table Salt	Gishiri	Sodium chloride	10.00
Seasoning cube	Dunkule		15.00
Thyme	Kayan Kamshi	<i>Thymus vulgaris</i> L.	12.50
Curry	Curry foda	<i>Murraya koenigii</i> (L.) Spreng.	12.50
Onion	Albasa	<i>Allium cepa</i> L. var. <i>cepa</i>	50.00
Total			100.00

Botanical names according to Rehm and Espig (1991)

Table 3: Composition of shredding spices used for meat floss (*dambun-kaza*) production

Ingredients (g/100g)	Hausa	Ingredients	
		Scientific/*Botanical	Quantity
Red pepper	Jan barkono	<i>Piper nigrum</i> L.	35.00
Seasoning cube	Dunkule		30.00
Ginger	Chitta	<i>Zingiber officinale</i> Rosc.	6.00
Garlic	Tafarnuwa	<i>Allium sativum</i> L.	3.00
Curry powder	Curry foda	<i>Murraya koenigii</i> L.	3.50
Thyme	Kayan Kamshi	<i>Thymus vulgaris</i> L.	2.50
Table Salt	Gishiri	Sodium Chloride	5.00
Onions	Albasa	<i>Allium cepa</i> L. var. <i>cepa</i>	16.00
Total			100.00

Botanical names according to Rehm and Espig, (1991)

Results

Sensory attributes of cooked meat from broilers reared under deep litter and free range

The sensory panel (Figure 1) rated Wk 2 high for juiciness, flavour and overall likeness, Wk 4 was rated high for aroma while tenderness was rated high for Wk 0.

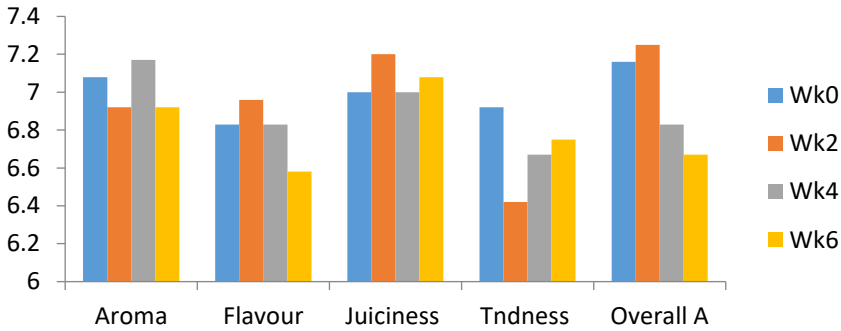


Figure 1: Sensory attributes of cooked meat from broilers on free range

*Tndness = Tenderness * Overall A = Overall acceptability *Wk0 birds reared indoors * Wk2 birds exposed to free range at 2 weeks
 *Wk4 birds exposed to free range at 4 weeks *Wk6 birds exposed to free range at 6 weeks

Sensory evaluation of fresh processed meat floss from broiler reared under deep litter and free range

The results for the sensory characteristics and acceptability of meat floss (*dambun-kaza*) made from broiler chickens exposed to deep litter and free range at different ages are presented in Figure 2. The results from the bar chart revealed that colour, juiciness, tenderness and flavour of the meat floss (*dambun-kaza*) had high ratings in all treatment groups.

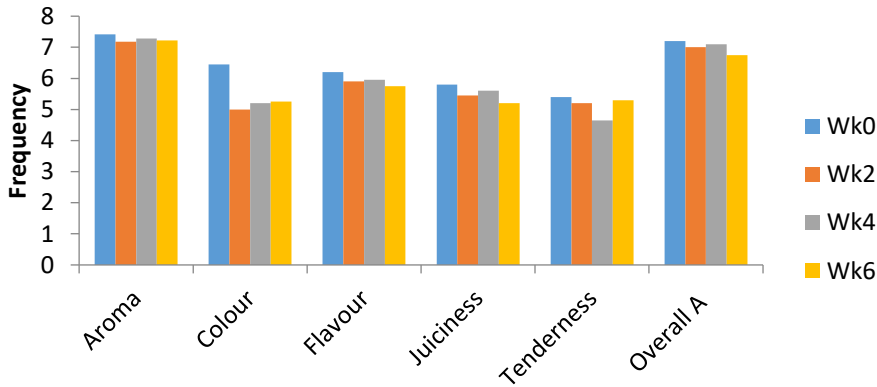


Figure 2: Sensory profile of freshly processed meat floss

*Tndness = Tenderness * Overall A = Overall acceptability *Wk0 birds reared indoors * Wk2 birds exposed to free range at 2 weeks
 *Wk4 birds exposed to free range at 4 weeks *Wk6 birds exposed to free range at 6 weeks

Discussion
Sensory attributes of cooked meat from broilers reared on deep litter and free range

The sensory panel (Figure 1) did not detect differences between the conventional and the free range breasts for chicken aroma, flavour, juiciness and tenderness. Lei and Van Beek (1997) suggested that physical activity had

little effect on sensory quality of broilers. Farmer *et al.* (1997) revealed that decreased stocking density and increased age caused consistent, but no increase in flavour of chicken meat. Kishowar *et al.* (2005) concluded that when comparing organic, free-range and indoor chickens' breasts, reported that majority of the panellists could only distinguish between tenderness, only a few set of participants within the panel, could distinguish between aroma and flavour. While other authors, Farmer *et al.* (1997) and Husak *et al.* (2008) reported tenderness in broiler breast meat on free range, findings in this study observed no effect of the rearing system on broiler meat tenderness. No effect of the rearing system on sensory parameters assessed. This could be as a result of the assessors' inability to differentiate between sensory parameters of the products.

The desirable colour in meat floss (*dambun-kaza*) is golden brown, which is contributed by the ingredients and frying temperature (Lin *et al.*, 1999). The colours of meat floss (*dambun-kaza*) made from broiler chickens in Wk 0 were more acceptable to the panellists than other groups. This might be as a result of the production system whose meat appeared to be brighter than other treatments, because during preparation, similar ingredients were used before frying.

The eating quality, which is a combination of tenderness, flavour and juiciness is one of the most important characteristics by which consumers judge meat quality (Grunert *et al.*, 2004, Ihekoronye and Ngoddy, 1985) and one of the attributes that is most difficult to evaluate before purchase because it is not visible and highly variable (Verbeke *et al.*, 2010).

Aroma and flavour are quite subjective characteristics of meat that are difficult to evaluate by the panellists compared to many other traits like tenderness and pH that are measurable in more exact way (Polawsk *et al.*, 2011). Aroma perception is usually mediated by the olfactory sense while flavour is perceived by the sense of taste and usually felt in the mouth. The aroma from meat floss (*dambun-kaza*) of the treatment groups was appealing to the panellists with high ratings for Wk 0, the characteristic odour is easily perceived. Tenderness of meat products together with juiciness, flavour and colour are the main eating quality characteristics that influenced the consumer's overall judgment of quality (Wood *et al.*, 1995). Tenderness as a trait consists of elements such as ease of shearing or cutting during mastication and one of the main meat quality attributes important for its acceptability and purchasing intention of consumers (Risvik, 1994; Cooper and Horbańczuk, 2002). It was expected that the meat floss (*dambun-kaza*) from broiler chickens in group Wk 2, Wk 4 and Wk 6 will be tenderer because of the free range rearing system but was not the case when the panellists rated Wk 0 high. The flavour of meat floss (*dambun-kaza*) from broiler chickens in Wk 0 were more preferable to the panellists, with the score rating higher than Wk 2, Wk 4 and Wk 6. This might be attributed to the fact that it has high fat content because the flavour of a product is fat dependent.

The juiciness of Wk 0 was rated high numerically by the panellists. This might be attributed to the presence of high level of fat in the raw breast meat of Wk 0 as a result of the intensive production system of the birds. With regards to overall acceptability, the meat floss (*dambun-kaza*) from the four groups were scored above intermediate (7.2, 7.0, 6.75),

from which indicated that all the products irrespective of the rearing system were accepted to the panellists.

Conclusion

This study concluded that;

1. Meats produced from birds exposed to free range at 2 weeks (Wk 2) were

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more preferred by the panellists with high ratings for overall likeness compared to other treatment groups.

2. Meat floss made from birds raised without exposure to free range (Wk 0) was rated higher by the panellists for flavour and juiciness than the other groups.

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