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Consumer Perception of Chicken Meat from Broilers Fed Natural Pigment Sources

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Abstract

Consumer perception of chicken meat obtained from broiler chickens fed diets containing natural pigment sources was investigated. One hundred and sixty one-day-old Arbor acre broiler chicks were randomly allotted to 5 dietary treatments with 4 replicates and 8 birds per replicate in a completely randomised design. Test ingredients were introduced at day 21(the finisher stage). TA- Control, TB- Roselle calyx, TC- Orange peels, TD- Baobab leaves, TE- Moringa leaves (each at 4% inclusion rates). Two birds per replicate were slaughtered at 8 weeks and physico-chemical and carcass visual and textural attributes were assessed. Results revealed that pH values ($p<0.05$) ranged from 6.49 (Treatments A and E) to 6.25 (Treatment B) while shear force ranged ($p<0.05$) from 1.25 (Treatment B) to 0.53 (Treatment C). No ($p>0.05$) variation was observed on cooking yield and loss in all treatments. Significant differences were observed in carcass assessment scores for all treatments. Treatment E (Moringa) had highest value (6.95) for skin colour which showed a high degree of yellowness while treatment C (Orange peel) had highest score (5.48) for muscle colour (highly pinkish). Treatment B (Roselle calyx) had lowest values for skin (3.13-whitish) and muscle (3.50-whitish) colours. High overall acceptability score was however recorded in orange peel supplemented diet (Treatment C).The study concludes that, orange peels can be incorporated at 4% inclusion level in broiler chicken diet to increase carcass attractiveness and aid increased consumer acceptance.

Keywords: Meat, natural pigment, broiler diet, carcass assessment

Introduction

Research advances in poultry are currently been geared towards improving the efficiency of feed utilisation and increasing desired carcass attributes in response to changing consumer demands (Lesson and Summers, 2008).One of the most important quality criteria of raw chicken meat for consumers is the sensory quality, characterised by colour, texture andflavour (Popov-Raljic *et al.,* 2002).Colour is an indication of meat freshness and directly influences the consumer's final purchase decision (Sirri *et al.,* 2010).The causes of variation in fresh meat colour are associated with differences in muscle morphology, pH and pre-slaughter stress. Carotenoids such as xanthophyll, capsanthin, and canthaxanthin are compounds responsible for skin colour in broiler carcasses (Blanch and Hernández, 2000), they however, cannot be synthesised by the birds and therefore should be supplied in their feed (Breithaupt, 2007). Several natural sources of pigments such as yellow corn and paprika powder have been used in poultry feed (Castañeda *et al.,* 2005). Some leaf powders or extracts from plants can also be used directly to pigment broiler skin and egg yolks, producing a more desirable pigmentation as well as health benefits to the animals (Zhou *et al.*, 2003; Lu *et al.*, 2005).

Therefore, this study was carried out to assess the colour-impacting ability of Roselle calyx, orange peels, baobab and Moringa leaves on the carcass of broiler chickens.

Materials and Methods

The study was carried out at the Poultry unit of the Teaching and Research Farm and Animal Product and Processing Laboratory of the Department of Animal Science, University of Ibadan. One hundred and sixty one-day-old Arbor acre broiler chicks were randomly allotted into five dietary treatments with 4 replicates each and 8 birds per replicate in a completely randomized design. Roselle calyx, Orange peels and leaves of Baobab and Moringa were harvested fresh, air-dried, milled and thereafter included in the broiler finisher diet (from day 21) in replacement of wheat bran, in an 8-week feeding trial. Treatment A was the control, while B to E had Roselle calyx (Treatment B), Orange peels (Treatment C), Baobab leaves (Treatment D) and Moringa leaves (Treatment E) at 4% inclusion rates respectively. Two birds per replicate from each treatment were thereafter slaughtered at the end of the experiment for further analysis.

This was measured by cooking approximately 10g of meat samples, wrapped loosely in polyethylene bags and cooked in pre-heated water (80°C) for 3-5mins. It was calculated as:

$$\text{Cooking loss \%} = \frac{\text{Initial weight of meat} - \text{final weight of meat}}{\text{Initial weight of raw meat}} \times 100$$

Cooking yield was determined by weighing the meat samples before and after cooking (after been cooled to room temperature). It was calculated as shown below:

$$\text{Cooking yield} = \frac{\text{Final weight of meat}}{\text{Initial weight (before cooking)}} \times 100$$

One gram of meat sample was weighed and thoroughly homogenised with distilled water (1:10 w/v). The pH was measured in triplicates by an Electrode probe pH meter (pH meter PHS-3C, by Philips).This was determined using the modified Warner Bratzler Shear Force procedure according to Bouton and Harris (1978). This was carried out as described by Jeong *et al.* (2011). Twenty (20) semi-trained individuals were used as panelists. Carcasses were arranged and coded with random numbers and was assessed independently in a well-lit/ventilated laboratory. A 10-point line scale was used in the assessment for skin colour, muscle colour, lightness/darkness of meat, colour uniformity, Odour attributes (herby, raw, and scented), texture attributes, and overall acceptability.

The experiment was a Completely Randomized Design. All data were subjected to analysis of variance using SAS (1999) and means were separated using Duncan Multiple Range Test.

Table 1: Gross composition of basal starter and finisher diets (%)

Ingredients	Starter Phase	Finisher Phase
Maize	53.0	54.8
Soyabean meal	35.0	35.0
Fishmeal	4.3	-
Wheat bran	-	4.0
Oil	4.7	3.0
Di-calcium phosphate	0.8	0.8
Limestone	1.5	1.7
Premix	0.2	0.2
Lysine	0.1	0.1
Methionine	0.2	0.2
Salt	0.2	0.2
Total	100.0	100.0
Calculated Nutrient		
Energy (kcal/ME)	3183.74	3031.74
Crude Protein (%)	23.21	20.97
Calcium (%)	1.07	0.91
Phosphorus (%)	0.59	0.56
Methionine (%)	0.61	0.52
Lysine (%)	1.35	1.19
Crude fibre (%)	-	4.19

Results and Discussion

Physicochemical characteristics of fresh broiler chicken meat obtained from birds fed diets containing natural pigments are presented in table 2. Significant differences were observed in pH values of broiler chicken carcass from all treatments. The pH values of treatments A and E were not (p>0.05) different but higher (6.49) while treatment B was (p<0.05) lower (6.25). However, normal range of ultimate pH for fresh broiler meat was obtained as stated by Fletcher *et al.* (2000) in all treatments regardless of natural pigment supplementation. Cooking yield is dependent on the degree of cooking loss and they are inversely proportional. Meat with less cooking loss will invariably give higher yield per unit cut (Aaslyng, 2002). No significant difference was observed in cooking yield or loss in all treatments, thus dietary treatment had no effect on the meat samples upon cooking. This might be as a result of the fact that the natural pigments help maintain the meat water binding capacity. This result is in agreement with reports by Wangang *et al.* (2011) who found out that broiler breast meat showed no significant (p>0.05) variation in cooking loss when natural pigment was used as dietary supplement.

Table 2: Physicochemical characteristics of fresh broiler chicken meat

Parameters	A	B	C	D	E	SEM
pH	6.49^{a}	6.25^{b}	6.46^{a}	6.43^{ab}	6.49^{a}	0.05
Cooking loss (%)	35.00	31.45	30.00	33.33	35.00	1.45
Cooking yield (%)	65.00	68.55	70.00	66.67	65.00	3.11
Shear force (kg/cm^2)	1.23^{a}	1.25^{a}	0.53^{c}	0.80^{b}	0.58^{c}	0.08

^{abc}Means on the same row with same superscripts are not significantly different (p>0.05); A: Control; B: Roselle Diet; C: Orange peel diet; D: Baobab diet; E: Moringa diet

Carcasses with low cooking loss are highly desirable in the meat industry as they would retain more water and give meat products with a higher yield that tend to be juicier and tender. Significantly different shear force values, which signified the degree of tenderness of the chicken carcass was obtained in this study. Least value (0.53) was observed for treatment C (Orange peel) while treatment A (Roselle calyx) had the highest value (1.23).This indicates that carcass from this treatment had the toughest meat while orange peel treatment had the softest meat. Meat colour attributes are mostly associated with acceptability and it determines whether consumers will repeat buying or not (Fletcher, 1999). Skin colour especially determines broiler meat acceptability as most consumers may not feel the texture but depend on the raw odour of fresh meat. Table 3 shows the ratings of consumer evaluation of broiler chicken' carcasses fed diets containing natural pigment sources. Treatment E (Moringa) recorded a ($p<0.05$) high score (6.95) for skin colour which depicts yellowness while treatment B (Roselle calyx) had lowest value (3.13) which denotes a whitish skin colour, closely followed by the control (3.92). Treatment C (Orange peels) had the highest muscle colour score (5.48) which shows a pinkish muscle while treatment B (Roselle) had the least score (3.50). This result shows that pigment in Roselle calyx was not deposited on either the skin or muscle of broiler chickens fed this diet, despite its heavy reddish colour. This could be as a result of non-bioavailabity of the xanthophyll in Roselle calyx. It was however observed that consumers preferred carcass from treatment C (Orange peel) more as shown by its ($p<0.05$) higher score (7.19) which had moderate skin and muscle colours, as well as moderate muscle tenderness.

Table 3: Consumer evaluation of broiler chicken carcasses fed diets containing natural pigment sources

Attributes		A	B	C	D	E	SEM
Visual	Skin colour	3.92^{c}	3.13^{e}	3.70^{d}	4.79^{b}	6.95^{a}	0.36
	Muscle colour	4.00^{d}	3.50^{e}	5.48^{a}	4.96^{c}	5.44^{b}	0.21
	Lightness/darkness	4.80^{c}	3.50^{e}	4.94^{a}	4.67^{d}	4.82^{b}	0.14
	Colour uniformity	4.64^{c}	4.63^{c}	4.59^{d}	4.67^{b}	4.82^{a}	0.02
Odour	Herby	4.64^{b}	4.63^{b}	3.89^{d}	4.33^{c}	5.74^{a}	0.16
	Rawness	4.00^{d}	5.25^{a}	4.96^{d}	5.08^{c}	5.15^{b}	0.06
	Scented	4.00^{d}	4.63^{c}	4.78^{b}	4.63^{c}	4.85^{a}	0.08
Texture	Hardness of muscle	4.76^{d}	5.33^{a}	4.33^{a}	4.96^{c}	5.22^{b}	0.10
Overall acceptability		6.64^{b}	6.46^{c}	7.19^{a}	5.83^{e}	6.04^{d}	0.13

^{abc}means on the same row with same superscripts are not significantly different ($p>0.05$); A: Control; B: Roselle diet; C: Orange peel diet; D: Baobab diet; E: Moringa diet

Conclusion

The use of the selected natural pigment sources in broiler chicken diets improved the skin and muscle pigmentation of the broiler chickens to varying degrees. However, the carcass of broiler birds on Orange peel supplemented diet had highest overall acceptability score. Therefore, orange peel at 4% inclusion level could be incorporated in broiler chicken diets to aid consumer acceptance of its carcass.

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