

---

## EVALUATION OF THE NUTRIENT AND SENSORY ATTRIBUTES OF PROCESSED BROILER MEATS MARINATED WITH PLANT EXTRACTS

\*Sampson, S. O., Ekpo, J. S., Ukpanah, U. A., Sam, I. M., Essien, C. A.

Department of Animal Science, Akwa Ibom State University, Obio Akpa Campus

\*Corresponding author: [sampsonokono18@gmail.com](mailto:sampsonokono18@gmail.com)

---

### ABSTRACT

The study was conducted to evaluate the nutrient and sensory attributes of processed broiler meats marinated with extracts of *Zingiber officinale*, *Ocimum gratissimum*, and *Curcuma longa*. Every piece of meat was marinated individually with 10 mL of assigned extract in impervious polythene pouches which could not be destroyed by heat during cooking. Marinating lasted for 30 minutes whereas non-marinated, samples (control) were placed in a cooler prior cooking to avoid the onset of rigor mortis of the muscles. Cooking of meat samples was done by pressure cooking method (cooking in a bath of boiling water) for 15 minutes at 100 °C. Result of proximate composition of the processed meat samples showed significant ( $p < 0.05$ ) differences in all components except metabolizable energy across treatments. Mineral analyses of the meats showed significant ( $p < 0.05$ ) differences across treatments. Assessment of sensory qualities of the meats equally showed significant ( $p < 0.05$ ) differences in colour and other parameters except juiciness and tenderness across treatments.

**Keywords:** Meat marination, sensory qualities, *Zingiber officinale*, *Ocimum gratissimum*, *Curcuma longa*

---

### INTRODUCTION

Balanced diet ensures the intake of all essential nutrients, required by the human body to perform daily life functions (Eze *et al.*, 2017). It has gained immense popularity globally owing to the increasing awareness regarding the maintenance of sound health among the populace. In the light of this, awareness on nutritional composition of food stuffs has become quite significant in having a balanced meal, which in turn ensures good health status of individuals. Nutritional composition refers the comprehensive frame of information regarding vital nutritional components of food items and offers energy values. Nutrients which include both the macro and micronutrients are the elements that provide nourishment necessary for growth and maintenance of life. Macronutrients are those required by the human body in large amounts, and these include proteins, fat and carbohydrate whereas, micro nutrients are those that are required by the body in small amounts and comprising vitamins, minerals and fibre (Kihara *et al.*, 2017). All of these nutrients are supplied by a number of food stuffs including meat.

Meat ranks among the most significant, nutritious, and flavoured food items, constituting a well-balanced diet which aids in fulfilling most of the human's body requirements. It is an excellent source of many essential nutrients and makes an important contribution to a balanced diet (Presswood, 2012). There are different types of meats including poultry meats, the second most widely eaten type of meat in the world, accounting for about 30 % of total meat production worldwide. Poultry provides nutritionally beneficial food containing high-quality protein accompanied by a low proportion of fat. Every type of meat is significant in its value and with little differences in composition (De Smet *et al.*, 2016). Meat consumption varies worldwide, depending on cultural or religious preferences, as well as economic conditions. Vegetarians and vegans choose not to eat meat because of taste preferences, ethical, economic, environmental, religious, or health concerns that are associated with meat production and consumption. According to the analysis of the FAO (2021), meat consumption has been shifting towards poultry and expected to represent 41% of all the protein from meat sources globally in 2030. Poultry meat has increased by 76.6 % per kilogram per capita and pig meat by 19.7 %. Bovine meat decreased from 10.4 kg per capita in 1990 to 9.6 kg per capita in 2009 (Henchion *et al.*, 2014). Food and Agriculture Organization analysis found that 357 million tons of meat were produced in 2021, 53 % more, than in 2000, with chicken meat representing more than half of the increase (FAO, 2023). Meat processing improves the quality and overall acceptability of meats. Meat quality is a generic term used in describing the properties and perceptions of meat (Maltin *et al.*, 2003). Efforts have been made to improve meat quality, among which spicing (addition of spices) is a

popular technique. In Nigeria, meat is usually processed before consumption and spices are commonly used in marinating them. Undoubtedly, qualities of meats may be altered if marinated; overall acceptability of marinated meats by consumers may also be influenced. For an average consumer, sensory evaluation is the only way to decide whether or not to accept processed meats whereas the nutritional qualities and their implications to human health should be prioritized. However, the overall acceptability of meat totally depends on its physical, chemical, and sensory qualities. This study seeks to address some of the issues surrounding healthy meat consumption by evaluating the nutrient and sensory attributes of processed broiler meats marinated with extracts of plant materials commonly utilized in meat processing as spices vis-a-vis Ginger (*Zingiber officinale*), Scent leaf (*Ocimum gratissimum*), and Turmeric (*Curcuma longa*).

## MATERIALS AND METHODS

The study was conducted at the Animal Science Teaching and Research Laboratory of the Akwa Ibom State University, Obio Akpa Campus. Obio Akpa is located in Oruk Anam Local Government of Akwa Ibom State, Nigeria. The area lies between latitudes 5°17' and 5° 27' North of the equator and longitudes 7°27' and 7° 58' East with temperature ranging from 24-25C, an average annual rainfall ranging from 3500-5000mm and a relative humidity of between 60-90% (Wikipedia, 2023). Plant materials were purchased from the Uyo urban market. Thigh meats were obtained from six weeks old broiler chickens. Extracts of plant materials vis-à-vis *Zingiber officinale*, *Ocimum gratissimum*, and *Curcuma Longa L.* were obtained via Soxhlet extraction method. Spices were sorted, cleaned, crushed and content completely extracted with distilled water. Five grams of each crushed plant material was weighed out using an electronic balance (Metler Toledo) and content of the weighed portion of plant material exhaustively extracted with 100 mL of distilled water. The broilers were fasted for 12 hours with access to only clean drinking water prior to slaughter. Stunning was done mechanically before bleeding. Scalding and evisceration followed accordingly before disassembling of parts to obtain thigh meat. The meat was cut into smaller pieces of 5 g thereafter grouped into 4 portions (T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, and T<sub>4</sub> respectively). Each portion of meat was then assigned an extract obtained from the plant materials for marinating except for T<sub>1</sub> which was set aside as control. Second portion (T<sub>2</sub>) was marinated with extract of *Zingiber officinale*, T<sub>3</sub> with extract of *Ocimum gratissimum* and T<sub>4</sub> with extract of *Curcuma longa*. Every piece of meat was marinated individually with 10 mL of assigned extract in impervious polythene pouches which could not be destroyed by heat during cooking. Marinating lasted for 30 minutes whereas non-marinated samples (controls) were placed in coolers to avoid the onset of rigor mortis of the muscles prior cooking. Cooking was done by pressure cooking method (cooking in a bath of boiling water) for 15 minutes at 100 °C.

Proximate analysis was done in accordance with the method described by AOAC (2000) to get the moisture, fat, protein, carbohydrate, fibre and ash contents of all samples. Determination of Sodium and Potassium was done using flame spectrophotometer while other mineral elements were determined using atomic adsorption spectrophotometer. Five grams of meat samples were dried, pulverized and digested with perchloric acid to obtain the required digest for the determination of minerals. Analyses of phytochemicals in plant extracts and in meat samples were individually performed using different qualitative tests for Tannins, Saponins, Alkaloids, Flavonoids, Phenols, Glycosides, and Steroids, following standard protocols. Data obtained from different investigations carried out on the meat samples were subjected to a One-Way Analysis of Variance (ANOVA) using the Statistical Analysis Software (SAS, 2016). Means with significant difference were separated using the Duncan's Multiple Range Test of the same software.

## Results and Discussion

The result of proximate composition of processed broiler meats presented in Table 1 showed that moisture and carbohydrate were significantly ( $p < 0.05$ ) increased across samples with highest amount of carbohydrate recorded in broiler meat processed with *Zingiber officinale*. Metabolizable energy also increased in broiler meat processed with *Zingiber officinale* alone, which suggests a positive expression of carbohydrate. Other components significantly ( $p < 0.05$ ) decreased across samples. Decrease in fat and fibre suggests the presence of high levels of similar antioxidants in the extracts which promote breaking down of fat or excess protein, tenderization and increased digestibility of the meats.

Table 1: Proximate Composition of processed broiler Meats marinated with plant extracts

Composition (g/kg)	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	SEM
Moisture	8.23 <sup>c</sup>	12.80 <sup>b</sup>	12.82 <sup>b</sup>	12.90 <sup>a</sup>	0.602
Fat	15.21 <sup>a</sup>	13.23 <sup>c</sup>	13.25 <sup>c</sup>	13.28 <sup>b</sup>	0.256
Protein	45.22 <sup>a</sup>	43.55 <sup>b</sup>	43.83 <sup>b</sup>	43.92 <sup>b</sup>	0.203
Ash	6.54 <sup>a</sup>	2.52 <sup>c</sup>	2.64 <sup>b</sup>	2.65 <sup>b</sup>	0.514
Fibre	5.15 <sup>a</sup>	0.95 <sup>c</sup>	4.22 <sup>b</sup>	0.97 <sup>c</sup>	0.571
Carbohydrate	19.71 <sup>d</sup>	26.95 <sup>a</sup>	23.24 <sup>c</sup>	26.28 <sup>b</sup>	0.867
Energy (kcal/kg)	387.61	399.75	384.21	374.07	6.942

abc = Means with different superscripts along a row were significantly ( $p < 0.05$ ) different; SEM = Standard Error of Mean

T<sub>1</sub> = Broiler meat (Control) T<sub>2</sub> = Broiler meat + *Zingiber officinale*

T<sub>3</sub> = Broiler meat + *Ocimum gratissimum*

T<sub>4</sub> = Broiler meat + *Curcuma longa*

Table 2: Sensory qualities of processed broiler meats marinated with plant extracts

Parameters	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	SEM
Colour	6.67 <sup>b</sup>	6.33 <sup>b</sup>	6.83 <sup>b</sup>	8.33 <sup>a</sup>	0.208
Flavour	6.83 <sup>ab</sup>	7.50 <sup>a</sup>	7.00 <sup>ab</sup>	6.17 <sup>b</sup>	0.170
Juiciness	6.67	7.00	7.00	6.67	0.161
Tenderness	6.17	6.17	6.00	5.50	0.181
Overall acceptability	7.83 <sup>a</sup>	6.33 <sup>b</sup>	6.50 <sup>b</sup>	7.67 <sup>a</sup>	0.218

abc = Means with different superscripts along a row were significantly ( $p < 0.05$ ) different; SEM = Standard Error of Mean

T<sub>1</sub> = Broiler meat (Control)

T<sub>2</sub> = Broiler meat + *Zingiber officinale*

T<sub>3</sub> = Broiler meat + *Ocimum gratissimum*

T<sub>4</sub> = Broiler meat + *Curcuma longa*

Result of sensory qualities of processed broiler meats, presented in Table 2 indicated that all the three extracts had equal effect on tenderness and juiciness of the broiler meat samples which did not significantly ( $p > 0.05$ ) differ from the control. However, broiler meat processed with *Curcuma longa* which recorded less preference on flavour still scored highest in overall acceptability after control and this could be linked to its outstanding preference on colour.

## CONCLUSION

The study indicated that meat qualities may be altered if marinated and that overall acceptability of marinated meats by consumers is undoubtedly dependent on its sensory qualities. Sensory evaluation remains a way for an average consumer to decide whether or not to accept processed meats but more efforts should be put into sensitizing the public on the nutritional qualities of plant materials used as spices in meat processing and their implications to human health should be prioritized.

## REFERENCES

- AOAC: Association of Official Analytical Chemist. (2000). *Official Methods of Analysis*. Vol.2 AOAC Inc., Virginia, USA. Helrich, K. (ed.). 17<sup>th</sup> edition.
- De Smet S., Vossen E. Meat: The balance between nutrition and nutritive role in the human diet. *Meat Science*. 2013Mar 1; 93 (3): 586 - 592
- Eze N. M., Maduabum F. O., Onyike N. G., Anyaegunam N. J., Ayogu C. A., Ezeanwu B. A., Eseadi C. Awareness of food nutritive value and eating practices among Nigerian bank workers: *Implications for nutritional counselling and education*. *Medicine*. 2017 Mar; 96 (10)
- FAO: Food and Agricultural Organization (2023). *World Food and Agriculture' Statistical Yearbook 2023*. Rome. <https://doi.org/10.4060/cc8166en>. retrieved Dec.13, 2023.
- Henchion M., McCarthy, M., Resconi, V. C., Troy, D. (2014). Meat consumption: Trends and quality matters. *Meat Science*, 98(3):561 - 568. doi: 10.1016/j.meatsci.2014.06.007.hdl:11019/767. PMID25060586.

- Kihara J., Sileshi G. W., Nziguheba G., Kinyua M., Zingore S., Sommer R. (2017). Application of secondary nutrients and micronutrients increases crop yields in sub-Saharan Africa. *Agronomy for Sustainable Development*. 2017 Aug 1; 37 (4): 25.
- Maltin C. Balcerzak D., Tilley R. and Delday M. (2003). Determinants of meat quality. Tenderness: *Proceeding of the Nutrition Society*. 62: 337 - 347.
- Presswood H. (2012). Lipid stability of dehydrated beef strips stored in two packaging types. *Department of Food Science. Faculty of Natural Resources and Agricultural Sciences. Uppsala, Sweden*.
- Resurreccion, A. V. (2004). Sensory aspects of consumer choices for meat and meat products. *Journal of Meat Science*, 66: 11 - 20.
- SAS, 2016. Statistical Analysis Institute Inc. (SAS) User's guide. Version: 9<sup>th</sup> edition *Statistical Analysis System Institute, Inc. Cary, N. C. USA*.
- Wikipedia (2023). Akwa Ibom State. <https://en.wikipedia.org/wiki/AkwaIbomState>. Accessed March 8, 2023