



INFLUENCE OF DIFFERENT SPICES ON MEAT QUALITY AND SENSORY EVALUATION OF SOME MALE CHICKENS

John, J., Muhammad, A. S. and Abubakar, A. A.

Department of Animal Production, Abubakar Tafawa Balewa University Bauchi
Corresponding Author's Email: johnjuliet368@gmail.com; **GSM:** 08039155079

ABSTRACT

The study was carried out to evaluate the impact of different spices on the sensory and nutritional qualities of meat from various chicken breeds in Bauchi Local Government Area, Bauchi State, Nigeria. Eight matured cocks from four breeds (local, broiler, noiler, and brahma) were stabilized for one week on a broiler finisher diet before slaughter. Post-slaughter, the birds were portioned, and each portion was marinated with 4 grams of specific spices (garlic, ginger, turmeric, cloves, and alligator pepper) for 30 minutes. Sensory evaluation conducted by a panel of 50 individuals revealed that garlic consistently enhanced sensory properties across all breeds. The result further indicated that, in local chicken, garlic scored 13 (26%) for flavor, 12 (24%) for aroma, and 15 (30%) for overall acceptability. In broiler meat, garlic scored 14 (28%) for flavor, 13 (26%) for aroma, and 14 (28%) for overall acceptability. Ginger also improved various sensory attributes, scoring 12 (24%) for flavor and 12 (24%) for color in noiler meat, and 12 (24%) for flavor and 12 (24%) for tenderness in brahma meat. Proximate analysis revealed moisture content ranging from 72.5% in local chicken to 74.5% in brahma, with the highest protein content found in local chicken at 22.0%. Fat content varied slightly, with the highest in local chicken at 3.5%. Mineral analysis showed local chicken had the highest calcium content at 15.0 mg/100g and zinc content at 2.0 mg/100g. The study concludes that garlic and ginger significantly enhance the sensory qualities of chicken meat, particularly in terms of flavor and overall acceptability. Additionally, local chicken meat offers superior nutritional benefits compared to other breeds. The study recommends further research on optimal spice combinations and concentrations to maximize consumer preference, as well as breed-specific marketing strategies that emphasize the nutritional advantages of different chicken breeds.

Keywords: Spices, Meat Quality, Chicken Birds, Cocks

INTRODUCTION

Meat is a crucial protein source, particularly in developing countries, but it is also highly perishable due to its biological composition. The nutritional value of meat, rich in quality proteins, essential amino acids, fatty acids, vitamins, and minerals, is well-documented (Bilgili *et al.*, 2019; Jayasena *et al.*, 2023). However, microbial contamination and lipid oxidation can significantly reduce meat quality, safety, and shelf life, making these factors vital for consumer acceptance (Jakobsen and Bertelsen, 2020). Spices have been utilized for centuries not only for their flavor but also for their health-promoting properties. Garlic is known for its antimicrobial and immune-boosting effects (Bayan *et al.*, 2018), ginger for its anti-inflammatory and antioxidant properties (Bode and Dong, 2021), and turmeric for its anti-inflammatory and potential anticancer properties (Aggarwal *et al.*, 2023). Cloves offer antimicrobial and antioxidant benefits (Hussain *et al.*, 2018), while alligator pepper has potential medicinal applications (Irvine, 2021). These spices, when incorporated into chicken diets, may enhance meat quality by improving its sensory attributes and offering potential health benefits to consumers. As the chicken industry seeks sustainable and natural methods to



improve meat quality, this research investigates the effects of garlic, ginger, turmeric, cloves, and alligator pepper on various chicken breeds. By analyzing these spices' impact on meat quality, this study aims to provide insights that could benefit both the chicken production industry and consumer preferences, aligning with the growing trend toward health-oriented and sustainable food practices (Sarica and Yarim, 2019; Ghawi *et al.*, 2022).

MATERIALS AND METHODS

Study Area and Selection of chicken Birds

The study was conducted in Bauchi Local Government Area of Bauchi State, Nigeria. The treatment consists of eight matured cocks obtained from different breeds (2 local, 2 broilers, 2 noilers, 2 brahmas). The birds were allowed to stabilize for one week with a diet of broiler finisher feed. After one week the birds were taken for slaughter at Yankaji in Muda Lawal market, Bauchi where two birds from each breed were slaughtered.

Spice Application

Two birds from each breed were cut into five portions of 800g each. Each portion was marinated with 4 grams of the spices: garlic, ginger, turmeric, cloves, and alligator pepper for 30 minutes. This ensures each spice is separately applied to the meats. The marinated portions were separately boiled for 15-20 minutes, drained and finally fried individually. (Ihekoronye and Ngoddy, 1985).

Meat Quality Parameters and Sensory Evaluation

Sensory evaluation was conducted by a panel consisting students and staff of Abubakar Tafawa Balewa University to assess color, flavor, palatability, juiciness, tenderness and acceptability. The products were subjected to sensory evaluation and 50 persons were selected at random to taste the meat. The sensory parameters determined were color, flavor, palatability, juiciness, tenderness and acceptability.

Proximate and Mineral Analysis

Samples of the different processed meat were also taken to the laboratory at National Veterinary Research Institute (NVRI) Jos, Plateau State Nigeria for proximate and mineral composition analysis as per procedures laid down by AOAC (1995)

Statistical Analysis

The data collected during the experiment from sensory evaluation were analyzed using descriptive statistics, including frequencies and percentages

RESULTS AND DISCUSSION

Table 1 presented the result on sensory evaluation of local chicken meat treated with various spices, showing how each spice influences different quality parameters. The result revealed that, garlic and ginger emerged as the most effective spices for enhancing sensory attributes. Garlic received the highest scores for tenderness (28%) and overall acceptability (30%). Ginger also performed well, with notable scores in flavor (22%), juiciness (24%), and color (24%). These findings align with research emphasizing garlic's role in improving meat quality due to its antimicrobial properties and ginger's benefits in enhancing sensory attributes through its anti-inflammatory and antioxidant effects (Bayan *et al.*, 2018; Bode and Dong, 2021). In contrast, turmeric, cloves and alligator pepper scored lower across most parameters. Turmeric's effect was less pronounced, supporting previous findings that it is not as effective in enhancing meat quality compared to more potent spices (Aggarwal *et al.*, 2023). Cloves and alligator pepper also showed lower scores for palatability and tenderness, reflecting their reduced influence on meat attributes, consistent with earlier studies (Hussain *et al.*, 2018; Irvine, 2021).

Table 1: Sensory Evaluation for Local Chicken Meat Treated with Different Spices

| Parameters | Garlic | Ginger | Turmeric | Cloves | Alligator Pepper |
|---------------|---------|---------|----------|--------|------------------|
| Flavour | 13 (26) | 11 (22) | 9 (18) | 8 (16) | 9 (18) |
| Aroma | 12 (24) | 11 (22) | 8 (16) | 9 (18) | 10 (20) |
| Juiciness | 12 (24) | 12 (24) | 9 (18) | 8 (16) | 9 (18) |
| Palatability | 11 (22) | 11 (22) | 8 (16) | 9 (18) | 11 (22) |
| Tenderness | 14 (28) | 10 (20) | 9 (18) | 8 (16) | 9 (18) |
| Colour | 10 (20) | 12 (24) | 9 (18) | 9 (18) | 10 (20) |
| Acceptability | 15 (30) | 10 (20) | 8 (16) | 8 (16) | 9 (18) |

Table 2 presents a results on sensory evaluation of broiler meat treated with various spices, highlighting the impact of each spice on different quality parameters. Based on the result obtained, garlic and ginger notably enhanced the sensory attributes of broiler meat. Garlic achieved the highest scores in flavor (28%) and palatability (30%), while ginger excelled in juiciness (28%) and color (26%). These results are consistent with findings that garlic's potent flavor enhancement and ginger's ability to improve juiciness align with their known properties as effective spices in meat processing (Bayan *et al.*, 2018; Bode and Dong, 2021). Turmeric, cloves, and alligator pepper had less influence on the sensory qualities of broiler meat. Turmeric scored lower in most parameters, indicating that it is less effective at improving meat attributes compared to garlic and ginger, which is supported by previous studies that highlight turmeric's limited impact on meat quality (Aggarwal *et al.*, 2023). Cloves and alligator pepper also recorded lower scores, particularly in palatability and flavor, aligning with earlier research that suggests their effects are less pronounced compared to more potent spices (Hussain *et al.*, 2018; Irvine, 2021).

Table 2: Sensory Evaluation for Broiler Meat Treated with Different Spices

| Parameters | Garlic | Ginger | Turmeric | Cloves | Alligator Pepper |
|---------------|---------|---------|----------|--------|------------------|
| Flavour | 14 (28) | 12 (24) | 8 (16) | 8 (16) | 8 (16) |
| Aroma | 13 (26) | 13 (26) | 7 (14) | 9 (18) | 8 (16) |
| Juiciness | 12 (24) | 14 (28) | 7 (14) | 8 (16) | 9 (18) |
| Palatability | 15 (30) | 10 (20) | 9 (18) | 8 (16) | 8 (16) |
| Tenderness | 13 (26) | 12 (24) | 8 (16) | 8 (16) | 9 (18) |
| Colour | 12 (24) | 13 (26) | 8 (16) | 9 (18) | 8 (16) |
| Acceptability | 14 (28) | 11 (22) | 9 (18) | 8 (16) | 8 (16) |

Table 3 showed result of the sensory evaluation of noiler meat treated with different spices, indicating how each spice affects various quality parameters. Garlic and ginger were found to significantly enhance the sensory attributes of noiler meat. Garlic and ginger both achieved high scores in flavor (24%) and juiciness (24% and 26%, respectively). Ginger, in particular, scored highest in palatability (28%) and acceptability (28%), highlighting its effectiveness in improving these key sensory attributes. These findings are consistent with the literature that recognizes garlic's and ginger's beneficial effects on meat quality (Bayan *et al.*, 2018; Bode and Dong, 2021). Turmeric, cloves, and alligator pepper had less impact on the sensory qualities of noiler meat. Turmeric's scores were lower across most parameters,

suggesting limited effectiveness compared to garlic and ginger. This aligns with research indicating turmeric's modest influence on meat attributes (Aggarwal *et al.*, 2023). Cloves and alligator pepper also performed relatively poorly, particularly in flavor and palatability, which corroborates previous findings that their effects on meat quality are less pronounced (Hussain *et al.*, 2018; Irvine, 2021).

Table 3: Sensory Evaluation for Noiler Meat Treated with Different Spices

| Parameter | Garlic | Ginger | Turmeric | Cloves | Alligator Pepper |
|---------------|---------|---------|----------|--------|------------------|
| Flavour | 12 (24) | 12 (24) | 9 (18) | 8 (16) | 9 (18) |
| Aroma | 13 (26) | 11 (22) | 8 (16) | 9 (18) | 9 (18) |
| Juiciness | 12 (24) | 13 (26) | 8 (16) | 8 (16) | 9 (18) |
| Palatability | 14 (28) | 11 (22) | 8 (16) | 8 (16) | 9 (18) |
| Tenderness | 12 (24) | 12 (24) | 8 (16) | 9 (18) | 9 (18) |
| Colour | 11 (22) | 12 (24) | 8 (16) | 9 (18) | 10 (20) |
| Acceptability | 11 (22) | 14 (28) | 8 (16) | 8 (16) | 9 (18) |

Results of the sensory evaluation of Brahma meat treated with different spices, showing how each spice affects various quality parameters is presented in Table 4. Garlic and ginger were the most effective in enhancing the sensory attributes of Brahma meat. Both spices received high scores for flavor and aroma, each achieving 24%. Ginger also performed well in juiciness (22%) and acceptability (24%), though it was slightly less effective compared to garlic. These results are consistent with studies that highlight the benefits of garlic and ginger in improving meat quality (Bayan *et al.*, 2018; Bode and Dong, 2021). Turmeric, cloves, and alligator pepper had less impact on Brahma meat's sensory properties. Turmeric's scores were notably lower across all parameters, indicating a limited effect on enhancing meat quality, which aligns with previous research on turmeric's modest influence (Aggarwal *et al.*, 2023). Cloves and alligator pepper similarly showed lower effectiveness, particularly in flavor and palatability, consistent with literature suggesting their less pronounced impact on meat attributes (Irvine, 2021).

Table 4: Sensory Evaluation for Brahma Meat Treated with Different Spices

| Parameter | Garlic | Ginger | Turmeric | Cloves | Alligator Pepper |
|---------------|---------|---------|----------|--------|------------------|
| Flavour | 12 (24) | 12 (24) | 9 (18) | 8 (16) | 9 (18) |
| Aroma | 12 (24) | 12 (24) | 8 (16) | 9 (18) | 9 (18) |
| Juiciness | 13 (26) | 11 (22) | 8 (16) | 9 (18) | 9 (18) |
| Palatability | 14 (28) | 11 (22) | 8 (16) | 9 (18) | 8 (16) |
| Tenderness | 12 (24) | 12 (24) | 8 (16) | 9 (18) | 9 (18) |
| Colour | 12 (24) | 11 (22) | 8 (16) | 9 (18) | 10 (20) |
| Acceptability | 12 (24) | 12 (24) | 8 (16) | 9 (18) | 9 (18) |

Results as presented in Table 5 revealed the proximate composition of spiced meat from various chicken breeds, including local chicken, broiler, noiler, and Brahma, and reveals differences in moisture, protein, fat, ash, and carbohydrate content. Local chicken exhibited the

highest protein content (22.0%) among the breeds, followed by noiler (21.8%), broiler (21.5%), and Brahma (21.0%). This higher protein content in local chicken aligns with findings from previous studies emphasizing its nutritional superiority over other breeds (Bilgili *et al.*, 2019). The moisture content was highest in Brahma meat (74.5%), with broiler (74.0%) and noiler (73.2%) also showing high levels, indicating the influence of breed and spice treatment on moisture retention (Jakobsen and Bertelsen, 2020). Fat content was slightly higher in local chicken (3.5%) compared to broiler (3.0%) and noiler (3.2%), while Brahma had a similar fat level (3.3%). The ash content was highest in local chicken (1.2%) and lowest in both broiler and Brahma meat (1.0%), suggesting variations in mineral content and overall meat composition (Jayasena *et al.*, 2023). Carbohydrate content was notably highest in local chicken (0.8%) and lowest in Brahma (0.2%), reflecting differences in the energy profile of the meats (Ghawi *et al.*, 2022).

Table 5: Proximate Composition of Spiced Meat from Different Chicken Breeds

| Component | Local Chicken | Broiler | Noiler | Brahma |
|-------------------|---------------|---------|--------|--------|
| Moisture (%) | 72.5 | 74.0 | 73.2 | 74.5 |
| Protein (%) | 22.0 | 21.5 | 21.8 | 21.0 |
| Fat (%) | 3.5 | 3.0 | 3.2 | 3.3 |
| Ash (%) | 1.2 | 1.0 | 1.1 | 1.0 |
| Carbohydrates (%) | 0.8 | 0.5 | 0.7 | 0.2 |

Table 6 provides information on the mineral composition of spiced meat from various chicken breeds, including local chicken, broiler, noiler, and Brahma, highlighting calcium, phosphorus, iron, and zinc content. Local chicken displayed the highest calcium content (15.0 mg/100g) compared to broiler (14.5 mg/100g), noiler (14.8 mg/100g), and Brahma (14.2 mg/100g). This higher calcium level supports findings that local chicken meat often has superior mineral content compared to other breeds (Aggarwal *et al.*, 2023). Phosphorus content was also highest in local chicken (200.0 mg/100g), with noiler (198.0 mg/100g) and broiler (195.0 mg/100g) showing slightly lower levels, and Brahma having the least (192.0 mg/100g). This variation indicates breed-specific differences in phosphorus concentration, which is crucial for bone health and metabolic functions (Jayasena *et al.*, 2023). Iron content was highest in local chicken (1.5 mg/100g), which is consistent with previous research suggesting that certain chicken meats can be better sources of iron (Bayan *et al.*, 2018). The broiler meat contained slightly less iron (1.2 mg/100g) compared to noiler (1.3 mg/100g) and Brahma (1.1 mg/100g). Zinc levels were highest in local chicken (2.0 mg/100g) and lowest in Brahma (1.7 mg/100g), reflecting differences in mineral bioavailability and composition across breeds (Jakobsen and Bertelsen, 2020).

Table 6: Mineral Composition of Spiced Meat from Different Chicken Breeds

| Mineral | Local Chicken | Broiler | Noiler | Brahma |
|----------------------|---------------|---------|--------|--------|
| Calcium (mg/100g) | 15.0 | 14.5 | 14.8 | 14.2 |
| Phosphorus (mg/100g) | 200.0 | 195.0 | 198.0 | 192.0 |
| Iron (mg/100g) | 1.5 | 1.2 | 1.3 | 1.1 |
| Zinc (mg/100g) | 2.0 | 1.8 | 1.9 | 1.7 |



CONCLUSION AND RECOMMENDATIONS

The study concludes that garlic and ginger significantly enhance the sensory qualities of chicken meat, particularly in terms of flavor and overall acceptability. Additionally, local chicken meat offers superior nutritional benefits compared to other breeds. Based on the result of this study, it can be recommended that further research on optimal spice combinations and concentrations to maximize consumer preference, as well as breed-specific marketing strategies that emphasize the nutritional advantages of different chicken breeds

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