



**Effect of Marination with Ginger (*Zingiber officinale*) and Turmeric (*Curcuma longa*)  
Extracts on the Organoleptic Parameters of Spent Layer Chicken Carcasses**

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**Abstract**

**Short Communication**

*This study was conducted to determine the effect of marination on the organoleptic parameters of spent hen carcasses (Breast and Thigh) using ginger (*Zingiber officinale*) and turmeric (*Curcuma longa*) extracts. The experiment employed a completely randomized design (CRD) with a 2x4 factorial arrangement to evaluate the effects of ginger and turmeric extracts on the organoleptic parameters of spent layers' carcass (breast and thigh). The experiment consisted of four treatment groups: control (T1), Ginger marinade (T2), Turmeric marinade (T3), and Ginger and Turmeric marinade (T4), derived from two factors: marinade type and chicken part. The results showed that T4 (ginger and turmeric combination) significantly improved key sensory qualities such as taste, texture, juiciness, and overall acceptability compared to the other treatments. T4 achieved the highest scores across parameters, with taste (4.13), texture (4.15), and juiciness (4.03), while the control (T1) had the lowest scores (taste: 3.25, texture: 3.45, juiciness: 3.38). T2 and T3 showed moderate improvements, with turmeric (T3) slightly outperforming ginger (T2) in texture and appearance. Although there were some improvements in appearance, color, and aroma, these changes were not statistically significant, with T4 scoring the highest in aroma (4.10) and color (4.05). The results indicated that marination with ginger and turmeric extracts significantly enhanced the quality of spent hens' poultry meat, with the combination of both extracts being the most effective. These findings suggest that ginger-turmeric marination can be utilized for improving the sensory qualities of poultry products, providing a natural alternative to enhance consumer satisfaction. Further research into optimizing marination methods for commercial use is recommended.*

**Keywords:** Marination, Spent Layers, Turmeric, Ginger

**Introduction**

Spent-layers are a significant source of protein in many parts of the world, particularly in Asia and Europe (Kumar *et al.*, 2017). The global poultry industry is growing rapidly, and spent layer chickens are an important part of this industry (Lee *et al.*, 2018). These birds are typically kept in laying farms for about 12-14 months, producing eggs (Kim *et al.*, 2020). After their laying cycle is complete, they are considered spent and are often sold for meat (Kumar *et al.*, 2017). The meat of spent-layer chickens is considered lower in quality than broiler chickens due to its tougher and less tender texture (Kumar *et al.*, 2017). This is

because spent hens have a higher proportion of collagen, a protein that contributes to meat toughness (Lee *et al.*, 2018). Compared to other poultry birds, spent layer chickens have meat quality similar to turkey hens, but lower than that of broiler chickens and ducks (Huang *et al.*, 2019). However, spent layer chickens yield more meat than quails and pigeons (Singh *et al.*, 2020).

Marination, a process of soaking food in a seasoned liquid mixture or rubbing it with a dry mixture, can enhance meat quality (Kumar *et al.*, 2022). Ageing, a natural process that affects meat quality, involves storing meat at a

controlled temperature and humidity to allow natural enzymes to break down the proteins and fats, resulting in improved tenderness and flavor. However, the use of natural preservatives like ginger and turmeric may improve meat quality and shelf life (Kumar *et al.*, 2019). Ginger and turmeric extracts have antioxidant and antimicrobial properties, which can reduce oxidative stress and microbial growth in meat (Kim *et al.*, 2020; Wang *et al.*, 2020). The combination of ginger and turmeric extracts has shown synergistic effects on food quality and safety (Kumar *et al.*, 2022). While spent layer chickens have unique characteristics and meat quality traits, other poultry birds like broiler chickens, turkey hens, ducks, quails, and pigeons also offer valuable sources of meat (Huang *et al.*, 2019; Singh *et al.*, 2020). Understanding the factors affecting meat quality in spent layer chickens can help improve their meat quality and shelf life, making them a more viable option for meat production.

The objectives of this study were to evaluating the effect of marination (ginger and turmeric) on the organoleptic parameters of spent layer chickens, as well as the interaction effect of marination their breast and thigh meats. The correlation coefficients between the organoleptic parameters was also determined

## Materials and Methods

This study was conducted at the Teaching and Research Farm, Animal Science Department, Kaduna State University (KASU), located at the Kafanchan Campus in Kaduna. The materials used in the experiment included sensory evaluation forms, bottled water, paper towels, crackers, pens/pencils, a griller, measuring cups and spoons, as well as spent layer chicken (breast and thigh). Additionally, ginger extract, turmeric extract, and spices were sourced locally from Kafanchan, Kaduna State, Nigeria. The experiment employed a completely randomized design (CRD) with a 2x4 factorial arrangement, aimed at evaluating the impact of ginger and turmeric extracts on the organoleptic properties of the chicken carcass (both breast and thigh). Four treatment groups were used: Control (T1), Ginger Marinade (T2), Turmeric Marinade (T3), and Ginger + Turmeric Marinade (T4). These treatments were derived from two key factors: the type of marinade and the part of the chicken being tested.

The marinade was prepared by mixing the ginger and turmeric extracts with other ingredients such as oil, lemon juice, salt, and spices (e.g., black pepper) using the following proportion (Table 1).

**Table 1: Marinade ingredients and their quantity used**

Ingredient	Quantity	Reference
Ginger extract and Turmeric extract	10 ml	Srivastava <i>et al.</i> (2011)
Oil	50 ml	Patel <i>et al.</i> (2012)
lemon juice	20 ml	Kirtikar and Basu (2001)
Black pepper	1g	Patel <i>et al.</i> (2012)

Meat samples were collected from the chicken breast and thigh region, due to their muscular structure and composition, which affects the marinade penetration and the tenderness of meats. The chicken breast and thighs were cut into small pieces, approximately 1-inch x 1-

inch x 0.5 inches (2.5 cm x 2.5 cm x 1.3 cm) in size (Srivastava *et al.*, 2011) before carrying out marination. The meats from the breast and thigh were marinated using ginger and turmeric, along with other ingredients such as oil, black pepper, salt, oil and lemon. The

marinated meat samples were then divided into four groups: control (T1), Ginger marinade (T2), Turmeric marinade (T3), and Ginger and Turmeric marinade (T4), and aged for 24 hours in a refrigerator at a temperature of 4°C. Sensory analysis was carried out in the Animal Products Laboratory to assess a range of organoleptic qualities, including taste, texture, flavor, juiciness, appearance, color, aroma, and overall acceptability. A panel of 20 semi-trained evaluators from Kaduna State University participated in this process. The group consisted of both male and female participants, aged between 21 and 35 years, providing a diverse yet focused sample of individuals to assess the meat samples. The meat samples were carefully grilled at a precise temperature of 275°C for 20 minutes to ensure uniform cooking before being served to the panelists. To evaluate the samples, a 5-point hedonic scale was employed, where ratings ranged from 1 (Unacceptable) to 5 (Excellent), with intermediate scores indicating varying levels of quality, such as 2 for “Need Modification,” 3 for “Good,” and 4 for “Very Good.” To maintain accuracy and prevent lingering flavors from influencing subsequent evaluations, panelists were provided with plain biscuits and water to cleanse their palates between samples, following the established protocol by Bosman et al. (1997).

### Statistical Analysis

The data generated was subjected to Analysis of variance (ANOVA) using general linear model procedure of SAS (2002). The mean separation was done using Duncan’s Multiple Range Tests (DMRT).

## Results and Discussion

### Effect of marination using ginger and turmeric on the organoleptic parameters of spent layers’ carcass

The results showed that the combination of ginger and turmeric (T4) significantly

enhanced the sensory qualities of spent layer meat, outperforming other treatments in taste, texture, juiciness, and overall acceptability. T4 achieved the highest taste score (4.13) while the control (T1) had the lowest (3.25). Texture (4.15) and juiciness (4.03) were also best in T4, attributed to the synergistic effects of ginger’s proteolytic enzymes and turmeric’s antioxidants (Anwar *et al.*, 2018; Al-Juhaimi *et al.*, 2020). Although appearance, color, and aroma showed no significant differences across treatments, T4 retained a high level of consumer acceptability. These results align with Ahmed *et al.* (2019) and Smith *et al.* (2021), demonstrating the effectiveness of ginger and turmeric in improving meat quality and consumer satisfaction.

### Interaction Effect between Marination Treatment of Chicken Breast and Thigh Parts On the Organoleptic Parameters

Table 2 presents the interaction effects of marination using ginger and turmeric on the organoleptic properties of spent layer chicken breast and thigh regions, assessed on a 5-point hedonic scale ranging from 1 (Unacceptable) to 5 (Excellent). Taste, texture, flavor, juiciness, appearance, color, aroma, and overall acceptability showed varying results across treatments. Treatment 4 (T4) consistently performed the best in several parameters, scoring the highest in taste (4.50), flavor (4.30), juiciness (4.30), and overall acceptability (4.40). This indicates that ginger-turmeric marination significantly enhances these qualities, consistent with studies by Al-Juhaimi et al. (2020), Ranjan *et al.* (2022), Kandeepan *et al.* (2022), Shah *et al.* (2019), and Naveena *et al.* (2020). Texture also improved notably, with T3 scoring 4.40 due to the tenderness-enhancing effects of turmeric, followed by T4 (4.25). T1 and T2 scored lower across most parameters, with T2 particularly underperforming in taste (3.05) and juiciness (2.95). The proteolytic enzyme zingibain in

ginger likely contributed to tenderness improvements (Mendiratta et al., 2019). While appearance and color showed slight improvements, they were not statistically significant. T3 led in appearance (3.85) and T4 in color (4.05), with turmeric imparting a subtle golden hue (Ahmed and Taha, 2020). Aroma scores were also slightly higher in T4 (4.10), suggesting ginger and turmeric effectively masked off-odors, despite no significant differences. Overall, T4's superior performance across most sensory parameters highlights the effectiveness of ginger-turmeric marination in enhancing spent poultry quality, aligning with prior research on marination's impact on flavor, texture, and moisture retention.

### Conclusion

This study showed that marination with ginger and turmeric extracts significantly improved the sensory qualities of spent layer carcasses, particularly in the breast and thigh regions. Treatment 4 (a combination of ginger and turmeric) consistently yielded the highest scores in key organoleptic parameters such as taste, texture, juiciness, and overall acceptability, indicating the synergistic effects of these natural ingredients. Although improvements in appearance and aroma were observed, they were less pronounced, emphasizing the primary role of taste, texture, and juiciness in consumer preference.

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**Table I: Effects of treatments on the organoleptic properties**

Parameters	Treatments				P-value
	1	2	3	4	
Taste	3.25±0.19 <sup>b</sup>	3.65±0.18 <sup>ab</sup>	3.95±0.21 <sup>a</sup>	4.13±0.19 <sup>a</sup>	0.0038*
Texture	3.75±0.14 <sup>ab</sup>	3.65±0.13 <sup>b</sup>	4.15±0.13 <sup>a</sup>	4.15±0.08 <sup>a</sup>	0.0051*
Flavour	3.73±0.24	3.40±0.27	3.98±0.15	3.95±0.17	0.1108 <sup>NS</sup>
Juiciness	3.38±0.25 <sup>ab</sup>	3.35±0.23	3.93±0.19 <sup>ab</sup>	4.03±0.09 <sup>a</sup>	0.0135*
Appearance	3.98±0.18	3.48±0.19	3.78±0.17	3.78±0.15	0.4021 <sup>NS</sup>
Colour	3.80±0.19	3.78±0.25	3.75±0.11	4.10±0.14	0.1929 <sup>NS</sup>
Aroma	3.64±0.28	3.35±0.23	3.90±0.15	3.95±0.11	0.1114 <sup>NS</sup>
Overall acceptability	3.88±0.21 <sup>ab</sup>	3.55±0.16	4.03±0.18 <sup>ab</sup>	4.30±0.11 <sup>a</sup>	0.0062*

<sup>ab</sup>Means in the same row bearing different superscripts differ significantly (P<0.05). \*= Significant at 5%, NS= Not significant.  
5-point hedonic scale, 1 = Unacceptable, 2 = Need modification, 3 = Good, 4 = Very good, and 5 = Excellent

**Table 2. Interaction effects between treatments × parts on the organoleptic properties**

Parameters	1		2		3		4		P-value
	Breast	Thigh	Breast	Thigh	Breast	Thigh	Breast	Thigh	
Taste	3.40±0.20 <sup>bc</sup>	3.90±0.22 <sup>abc</sup>	3.05±0.20 <sup>c</sup>	3.45±0.22 <sup>bc</sup>	4.50±0.23 <sup>a</sup>	3.40±0.20 <sup>bc</sup>	4.40±0.23 <sup>ab</sup>	3.85±0.24 <sup>abc</sup>	0.0036 <sup>*</sup>
Texture	3.60±0.15 <sup>bc</sup>	3.90±0.16 <sup>abc</sup>	3.50±0.14 <sup>c</sup>	3.80±0.15 <sup>abc</sup>	4.40±0.12 <sup>a</sup>	3.90±0.11 <sup>abc</sup>	4.25±0.12 <sup>ab</sup>	4.05±0.10 <sup>abc</sup>	0.0461 <sup>*</sup>
Flavour	3.25±0.25	4.20±0.26	3.15±0.25	3.65±0.25	4.30±0.23	3.65±0.23	4.30±0.25	3.60±0.24	0.0560 <sup>NS</sup>
Juiciness	2.95±0.20 <sup>b</sup>	3.80±0.24 <sup>ab</sup>	3.05±0.23 <sup>b</sup>	3.65±0.24 <sup>ab</sup>	4.30±0.23 <sup>a</sup>	3.55±0.20 <sup>ab</sup>	4.00±0.23 <sup>ab</sup>	4.05±0.24 <sup>ab</sup>	0.0140 <sup>*</sup>
Appearance	3.80±0.23	4.05±0.24	3.45±0.24	3.50±0.26	3.85±0.24	3.70±0.26	3.70±0.26	3.85±0.26	0.8896 <sup>NS</sup>
Colour	3.50±0.22	4.10±0.24	3.25±0.24	3.90±0.23	3.70±0.24	3.80±0.24	4.05±0.23	4.15±0.24	0.4930 <sup>NS</sup>
Aroma	3.15±0.23	4.13±0.25	3.10±0.24	3.60±0.25	4.10±0.25	3.70±0.22	4.10±0.26	3.80±0.24	0.0529 <sup>NS</sup>
Overall acceptability	3.55±0.19 <sup>ab</sup>	4.20±0.10 <sup>b</sup>	3.25±0.19 <sup>b</sup>	3.85±0.20 <sup>ab</sup>	4.40±0.19 <sup>a</sup>	3.65±0.19 <sup>ab</sup>	4.40±0.20 <sup>a</sup>	4.20±0.20 <sup>a</sup>	0.0030 <sup>*</sup>

<sup>abc</sup>Means in the same row bearing different superscripts differ significantly (P<0.05), \* = Significant at 5%, NS = Not significant.  
5-point hedonic scale, 1 = Unacceptable, 2 = Need modification, 3 = Good, 4 = Very good, and 5 = Excellent