

Colorimeter and total volatile nitrogen base assessments of *Kebabs* produced from meat of broiler fed cloves and garlic as additives in diet

Olayemi Rashidat Awodoyin,* Blessing Ololade Adekunle and Peter Kehinde Ojolo

University of Ibadan, Faculty of Agriculture, Department of Animal Science, PMB 200284, Ibadan, Nigeria

Abstract

The poultry industry has recently geared towards the incorporation of natural additives into diets in order to improve the quality of meat products. One-day-old 308 Ross broiler chicks (n= 200; r = 5, 10 birds/r) were randomly allotted to four diets: T1 (Basal Diet (BD), T2 (BD + 0.25 % garlic), T3 (BD + 0.15 % cloves) and T4 (BD + 0.25 % garlic + 0.15 % cloves (GC). On 42 day, 3birds/replicate were randomly selected, euthanized, defeathered and meat excised from primal cuts and ground. Minced meat (each treatment) was used to produced chicken kebabs. Colorimetric assessment (L* a* b*) and Total Volatile Basic Nitrogen (TVBN (mg/100g)) on days 0 and 7 were assessed following standard procedure. No significant differences (P>0.05) in colour parameters, L*(1.13-1.85), a* (1.04-1.32) and b* (1.50-1.71). On day 7, TVBN (7.48) in kebabs from cloves fed broiler was lower (P>0.05) than 7.94 (garlic), 7.65 (GC) and 8.15 (BD). Garlic and cloves inclusion in broiler diet improved the quality of the meat which is reflected in the shelf stability of chicken kebabs.

Keywords: Antioxidants, natural additives, kebabs, protein oxidation, shelf stability

Introduction

Poultry meat particularly broiler meat is highly perishable due to its high moisture and nutrient contents, which provide favorable conditions of biochemical deterioration and microbial proliferation during processing and storage (Katiyo et al., 2020). This is usually addressed by incorporating additives in the diet the aim of enhancing the overall production efficiency as well as producing safe and quality meat and meat products (Al-Baadani et al., 2023). However, the recent campaign and consumer interest in natural products has made producers to shift their interest towards the use of natural plant-based additives in broiler diets as alternatives to synthetic additives. Garlic (*Allium sativum*) and cloves (*Syzygium aromaticum*) contains some bioactive compounds particularly allicin and eugenol respectively which are known for their antimicrobial and antioxidant potentials (Tareq et al., 2018). Although, there has been scientific reports on the use of garlic and cloves as additives in broiler production, however, there is limited information on the quality attributes of ready- to- meat products produced from meat of broiler chickens fed these additives. Therefore, this study evaluated the colourimetric characteristics and Total Volatile Basic Nitrogen (TVBN) qualities of chicken kebabs produced from meat of broiler chickens fed garlic and cloves either singly or in combination in their diets.

Materials and Methods

Test ingredients

Garlic and cloves were procured from a market within the University of Ibadan environs and processed into powder using standard procedures and kept in air tight container until further use.

Experimental Birds and Management

One-day-old 308 Ross broiler chicks procured from a reputable hatchery in Ibadan were randomly allotted (n=200, r- 5, 10 birds/r) to four diets: T1= Basal diet (BD) only; T2= BD + 0.25 % Garlic; T3= BD + 0.15 % cloves, T4= BD+0.25 % Garlic + 0.15 % Cloves. The chicks were reared on a deep litter at the Poultry Unit, Teaching and Research Farm, University of Ibadan, fed *ad libitum* with water and feed for a period of six weeks. All vaccination schedules and routine management were carried out effectively.

Production of chicken kebabs

On day 42, three birds from each replicate were randomly selected euthanized, defeathered and meat was excised carefully from all primal cuts and ground. Minced meat was then mixed with other *kebabs* ingredients and then make into kebabs following Ekhlasi et al. (2023) procedures.

Data collected

Colorimeter assessment of kebabs

Colorimeter assessment of chicken kebab was carried out in accordance to Sedaroglu et al. (2018) procedures using a colorimeter Model LS 173

Total Volatile Basic Nitrogen (TVBN)



Protein degradation in kebabs during storage was assessed using the titrimetric procedure (Bekhit et al., 2021) and expressed as TVBN/mg/100g.

Results

Colorimeter assessment of kebabs

The results showed that there were no significant differences ($p > 0.05$) in all the colour parameters (Table 1) measured. The values were 1.13-1.85 (L* Lightness), 1.04-1.29 (a* redness) and 1.50-1.71 (b* yellowness).

Total Volatile Basic Nitrogen in kebabs during storage

On the first day of storage (zero), the TVBN (5.21 mg/100g) in kebabs produced from meat of broilers fed cloves and those fed combined additives (5.19 mg/100g) were significantly lower ($P < 0.05$) while on the 7th day of storage, kebabs produced from meat of broiler chickens fed only cloves exhibited significantly ($P < 0.05$) the lowest (7.48 mg/100g) TVBN value.

Table 1: Colourimetric assessment of chicken *kebabs* produced from meat of broiler supplemented with garlic, cloves and their combination in the diet

Parameters	Control	Garlic	Cloves	GC	SEM	P-Value
L	1.45	1.85	1.13	1.58	0.38	0.62
a*	1.29	1.04	1.08	1.32	0.13	0.38
b*	1.71	1.50	1.51	1.68	0.21	0.83

Means with same superscripts on the same row are not significantly different ($p > 0.05$)

L* = lightness; a* = redness; b* = yellowness; GC = garlic and cloves combination

Table 2: Interaction effect of dietary inclusion of garlic and cloves in broiler diets and storage duration on Total Volatile Basic Nitrogen of chicken *kebabs*

Storage Day	Treatment	TVBN (mg/100g)	P-value
7	Control	8.15 ^a	<.0001
7	Garlic	7.94 ^b	<.0001
7	GC	7.65 ^c	<.0001
7	Cloves	7.48 ^d	<.0001
0	Control	7.03 ^e	<.0001
0	Garlic	6.83 ^f	<.0001
0	Cloves	5.21 ^g	<.0001
0	GC	5.19 ^g	<.0001

^{a,b,c,d} Means with different superscripts on the same column are significantly different ($p < 0.05$)

GC: garlic and cloves combination

Discussion

Colour is a critical physical property shaping consumer acceptance and directly impact their purchasing decisions (Kyakma et al., 2023). The insignificant in the colour parameters of all the *kebabs* implied that the inclusion of garlic and cloves either singly or in combination broiler diet will not impart any undesirable colour on the raw meat that will subsequently affect the appearance of the chicken *kebabs* produced from it.

The concentration of volatile basic nitrogenous compounds serves as an important indicator of protein breakdown and microbial spoilage in meat products (Zhang et al., 2022). This implied that addition of cloves and garlic to the broiler diet probably enhanced the muscle tissue by slowing down the rate of protein degradation which translates into lower formation of volatile amines as reflected in the kebabs produced from such meat. These lower TVB-N values suggests better freshness and stability of the product which could be attributed to reduced microbial activity which is a major factor in protein degradation (Bekhit et al., 2021) in these *kebabs*. This may be linked to the antimicrobial potentials of cloves and garlic (Batiha et al., 2020; El Faqer et al., 2022) which inhibit microbial growth thus reduces the microbial activities in the kebabs thereby preventing protein degradation and subsequently inhibiting the formation of volatile nitrogenous bases (Ahmed et al., 2022).

Conclusion

Garlic and cloves either singly or in combination in broiler diets enhanced the quality of the raw meat which is further reflected in the improved shelf stability of kebabs produced from these meats. This highlights the efficacy of natural feed additives as effective strategy in reducing dependence on synthetic additives thus prioritizing food safety and improving meat products quality.



Declarations

Ethical Approval Certificate

The experimental procedures of this study were approved by the University of Ibadan Animal Care and Use Research Ethics Committee (UIACUREC) approved on 31/07/2025 with number UI-ACUREC/090-0525/29.

Author contribution statement

Olayemi Awodoyin: Project administration, supervision, conceptualization, investigation methodology, writing the final draft, reviewing and editing.

Blessing Adekunle: Data collection, formal analysis, and writing the original draft.

Peter Ojolo: Data collection and formal analysis.

Conflict of Interest

The authors declare no conflict of interest in the study.

Acknowledgments

The authors acknowledge the contributions of the laboratory staff of the Product and Processing unit of the Department of Animal Science

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