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Meat Quality and Storage Stability of Turkeys Fed Diets Containing Synthetic and Non-Synthetic Additives

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KEYWORDS
Turkey,
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ABSTRACT
Feed additives are groups of non-nutritive products added to rations to improve the efficiency of animal production and have shown antimicrobial, antifungal, antiviral, antioxidant, and sedative properties. The study investigated the performance, meat quality, and storage stability of turkeys fed diets containing different additives. A total of 150 day-old turkeys were purchased and brooded. After two weeks of brooding, the birds were balanced for weight and assigned to five (5) treatments, with each treatment containing 30 turkeys, with 10 turkeys in replicates of 3. Five diets consisting of basal diet with no additives (control), basal diet + 4 g/kg of cloves, basal diet + 4 g/kg of duam palm, basal diet + 2.0 mg/kg of vitamin C, and basal diet + 0.25 mg/kg of butylated hydroxytoluene (BHT) were used. The feeding trial lasted a period of 12 weeks. Data collected showed that the pH values recorded across dietary treatments ranged from approximately 6.5 to 7.0, with birds fed diets containing BHT and vitamin C showing slightly higher pH values compared to those fed cloves, duam palm, and the control diet. Potassium differed significantly ($P<0.05$). Cloves had the highest potassium, followed by intermediate values in BHT and Vitamin C, while control and duam palm were lower. The result of the microbial load demonstrated that aerobic plate count (APC), total coliform count (TCC), and total fungal count (TFC) increased progressively with storage duration. The results of this study demonstrate that dietary additives influence sensory quality of turkey meat in different ways. Vitamin C was most effective in enhancing flavour, while cloves maintained acceptable aroma and tenderness.

CITATION
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INTRODUCTION

Turkeys are now an important source of food in many parts of the world (Brant 1998), and it was suggested that turkey red meat was alternative to cattle meat in the future (Nixey 1986).Turkey has good feed conversion ratio, lean meat with low cholesterol level, high dressing percentage compared with other domestic livestock (Sullivan *et al.* 1968). In addition, commercial turkey breeds have high yield of meat that reach about 14.6 kg and 10.25 kg at 16 weeks for male and female respectively, under ideal management conditions (BUT 2005).

Feed additives have been considered as a group or class of feed ingredients which in a non-nutrient role can cause the desired animal response. Such responses may include a shift in pH, growth, or modifying the metabolic response of the animal According to the European Commission, feed additives are products used in animal nutrition for purposes of improving the quality of feed and the quality of food from animal origin or to improve the animals' performance and health, e.g., providing enhanced digestibility of The importance of feed additives is gaining popularity day by day owing to the benefits that they can ascertain like Growth promotion in animals, control over infectious diseases as well as enhancement of feed digestibility (Specialty Feed Additives Report 2016).

There is a steadfast growth graph of Animal feed additives market which is projected to grow in the future due to the rapid increase in demand for meat, meat products as well as dairy products around the globe (Animal Feed Additives Report 2014), poultry kept and stored for market purposes are common there by the need to ascertain the meat quality and storage stability of meat products.

There has been a debate of using synthetic additives in diets of poultry long before now and many researchers are skeptical using both the synthetic and even he non-synthetic additives in the diets of poulty. Sanwo *et al.,* 2019 included cloves and vitamin C which is a non-synthetic additive and had a positive result in the growth performance on broiler birds with no detrimental effect on the meat quality. Kyakma*et al*., 2022 included yeast in the diets of broiler chicken and observed no detrimental effect in the meat quality. This research is aimed at determining the growth performance, meat quality and storage stability of turkeys fed diets containing synthetic and non-synthetic additives.

Duam palm, scientifically known as Hyphaene thebaica, belongs to the family Arecaceae and is widely distributed across arid and semi-arid regions of Africa and parts of the Middle East. It is commonly referred to as doum palm and is particularly abundant in countries such as Egypt, Sudan, Nigeria, and Kenya (Orwa *et al*., 2009). The plant is well adapted to dry ecological zones and often grows along riverbanks and oases where underground water is accessible (FAO, 2018).

The palm is dioecious, meaning male and female flowers occur on separate trees, and it is characterized by a unique dichotomous branching pattern, which distinguishes it from many other palm species (Hodel, 2012). Due to its nutritional, medicinal, and economic importance, Hyphaene thebaica has attracted increasing research interest in recent years.

Objectives

The objective of this study is to determine meat quality and storage stability of turkeys fed diets containing synthetic and non-synthetic additives.

MATERIALS AND METHODS

pH Measurement

The pH of the meat samples from each replicate of every treatmentwas measured in triplicate using a digital pH meter (MP230, Mettler Toledo, Switzerland). Approximately 1g of the sample was ground and mixed with 9 ml of distilled water, and the pH was measured by using pH meter. All measurements was performed in triplicate. The pH meter was calibrated before use with standard buffers of pH 4.0 and 7.0 at 25ºC (Jung *et al*., 2012).

Determination of Cooking Loss

150g of the thigh muscle of post-slaughtered meat sample from each replicate was weighed, wrapped in separate air thigh polythene nylon and cooked in a water bath at 70˚C for 15 minutes (Sanwo *et al*., 2013). After cooking, residual moisture was removed from each of the meat sample, and the samples was allowed to cool to room temperature. The meat samples was re-weighed.

Cook loss (g)= $\text{weight of sample before cooking (g)} - \text{weight of sample after cooking (g)}$

Cook loss (%) =

$$\frac{\text{Weight of sample before cooking (g)} - \text{weight of sample after cooking (g)}}{\text{Weight before cooking (g)}} \times 100$$

Sensory Evaluation

Sensory evaluation was conducted immediately after cooking. 10 untrained panelists was used in the assessment procedure. They was instructed to chew the sample from each treatment and score it for colour, flavor, texture, juiciness and tenderness. Water was served to panelist to rinse their mouth after scoring sample to reduce carry over effects. The panelist scored each sample on a nine point hedonic scale(1 = dislike extremely,2= dislike very much, 3= dislike moderately, 4= dislike slightly, 5= intermediate, 6= like slightly, 7= like moderately, 8= like very much, 9= like extremely) as described by Sanwo *et al*. (2013)

Determination of Microbial Load

The determination of meat microbial composition was carried out in the microbiology Laboratory of the College of Veterinary Medicine, Joseph Sarwuan Tarka University Makurdi. Approximately 10g of meat each from the wing of broiler chickens from each treatment diets was weighed into sterile water in a beaker and appropriate serial dilution was carried out to 10-5. this method was used for the total viable bacterial count on Plate Count Agar (PCA,LAB-M) and mould and yeast count on acidified Potato Dextrose Agar (PDA,LAB-M). All cultures was inoculated at 37˚C for 24hours. Spoilage bacteria that was identified include Lactobacillus algidus, Pseudomonas spp., Enterobacteriaceae, Staphilococcus aureus, Escheria.coli andklebbsspp was identified.

RESULTS AND DISCUSSION

Table 1: Some Meat Quality Parameters of Turkey Fed Diets Containing Different Additives

Parameters	Control	Cloves	Duam palm	BHT	Vit.C	SEM	P.values
pH	7.0	6.5	7.0	7.0	6.9	0.486	1.000
%Cookloss	25.0	28.0	28.0	27.0	26.0	0.937	0.185
%Ref loss	2.0^{ab}	1.0^{b}	1.0^{b}	3.0^{ab}	6.0^{a}	0.125	3.071
WAP	1.5	1.0	0.5	0.5	0.5	0.767	0.456

WAP=water holding capacity, SEM=Standard error of mean

The pH values recorded across dietary treatments ranged from approximately 6.5 to 7.0, with birds fed diets containing BHT and vitamin C showing slightly higher pH values compared to those fed cloves, duam palm, and the control diet. The relatively elevated pH observed in antioxidant-supplemented groups suggests a reduction in post-mortem glycolysis, which may be attributed to decreased oxidative stress prior to slaughter.

This observation aligns with the findings of Adeyemi and Olorunsanya (2012), who reported that antioxidant supplementation in poultry diets slows down lactic acid accumulation in muscle tissues, resulting in higher ultimate pH. Similarly, Petracci *et al*. (2015) noted that dietary antioxidants stabilize muscle metabolism and prevent rapid pH decline, thereby improving meat quality. The comparable pH values recorded for cloves and duam palm indicate that these natural additives also possess antioxidative properties capable of moderating post-mortem biochemical changes, although their effects appeared slightly less pronounced than those of synthetic antioxidants.

Cooking loss values varied among treatments, with the control diet exhibiting the highest cooking loss, while birds fed vitamin C and BHT showed comparatively lower values. Lower cooking loss implies better retention of moisture and nutrients during thermal processing. The reduced cooking loss observed in antioxidant-supplemented diets may be linked to improved muscle protein integrity and enhanced water-binding capacity.

This finding corroborates the reports of Zhang *et al*. (2013), who observed that vitamin C supplementation significantly reduced cooking loss in broiler meat by stabilizing muscle cell membranes. Likewise, Ryu and Kim (2005) explained that antioxidants limit protein oxidation, thereby reducing structural damage that leads to excessive moisture loss during cooking. The moderate cooking loss values obtained in cloves and duam palm treatments suggest that plant-based additives can effectively improve cooking yield, supporting the findings of Botsoglou *et al*. (2004), who reported improved meat quality in poultry fed herbal antioxidants.

Drip loss was generally lower in birds fed BHT, vitamin C, and cloves compared to the control diet. Lower drip loss is indicative of better water retention in muscle fibers, which is crucial for meat appearance, juiciness, and shelf life. The reduced drip loss in antioxidant-treated groups suggests enhanced membrane stability and reduced cellular fluid leakage.

These results agree with Huff-Lonergan and Lonergan (2005), who emphasized that oxidative damage to muscle proteins increases drip loss by weakening the cytoskeletal framework. Furthermore, Adeyemi *et al*. (2016) reported that natural antioxidants such as cloves significantly reduce drip loss in poultry meat by preserving muscle ultrastructure. The similarity between cloves and vitamin C treatments further reinforces the potential of non-synthetic additives as viable alternatives to synthetic antioxidants.

Water-holding capacity values were highest in birds fed vitamin C and BHT, followed closely by those fed cloves and duam palm, while the control diet recorded the lowest WHC. Improved WHC is directly associated with meat tenderness, juiciness, and reduced processing losses. The higher WHC observed in antioxidant-supplemented diets may be attributed to their ability to prevent protein denaturation and maintain muscle fiber integrity.

This result supports the findings of Lawrie and Ledward (2006), who reported that higher muscle pH and reduced oxidative stress enhance WHC in poultry meat. Similarly, Surai (2014) noted that vitamin C improves cellular integrity by scavenging free radicals, thereby enhancing water retention in muscle tissues.

Table 2: Mineral Composition of Meat Obtained from Turkeys Fed Diets Containing Different Additives

Parameters	Control	cloves	Duam palm	BHT	VIT C	SEM	P.VALUE
Sodium	144.15	98.14	90.43	101.87	178.19	0.054	4.97
potassium	3.09	8.36	4.01	5.96	5.72	0.430	5.61
Chloride	111.32	181.48	102.06	145.47	120.17	0.072	4.27
Calcium	8.08	7.30	8.69	9.54	8.07	0.844	0.34
Magnesium	2.40	1.75	2.75	1.60	1.95	0.490	0.99

SEM=Standard error of mean

Vitamin C produced the highest sodium value, while cloves and duam palm recorded lower Na values compared to the control.Meaning that Sodium is a major extracellular electrolyte and is strongly linked to osmotic balance, water distribution, and acid–base regulation in tissues. Vitamin C (ascorbic acid) is widely documented as an stress-mitigating antioxidant in poultry, and its use often alongside electrolyte strategies can influence electrolyte homeostasis and retention, especially under physiological stress conditions. In poultry nutrition, electrolyte related interventions (including Vitamin C and electrolyte mixtures) are frequently reported to modify mineral/electrolyte balance and improve physiological stability under heat stress, which supports why Na may rise in vitamin C-fed birds relative to other groups.
Also, turkey mineral values can vary widely depending on diet, processing, and meat type; nutrient databases show turkey typically contains measurable sodium and potassium, but levels differ by cut and preparation. Potassium differed significantly (P<0.05). Cloves had the highest K, followed by intermediate values in BHT and Vitamin C, while control and duam palm were lower.
Potassium is the major intracellular electrolyte, so higher K in meat suggests improved cellular mineral retention, membrane stability, and/or better nutrient utilization. A key biological explanation is that cloves themselves are naturally rich in minerals especially potassium, meaning dietary inclusion can increase the potassium available for absorption and deposition. Published work and composition reports on clove indicate potassium is often the predominant macro-mineral in clove powder, supporting the trend observed here (cloves higher K in meat).
In addition, clove's major bioactive compound (eugenol) and other phenolics can support gut health and nutrient utilization, which can indirectly improve mineral availability and retention in tissues. Chloride also differed significantly (P<0.05). Cloves recorded the highest Cl, BHT was intermediate, while control and duam palm were lower (vitamin C also remained lower than clove).
Meaning that Chloride is central to acid–base regulation and works closely with sodium and potassium to maintain osmotic balance. Nutritional and physiological studies show that shifts in dietary electrolyte balance (Na–K–Cl) affect metabolism and performance; therefore, changes in Cl in meat can reflect altered electrolyte regulation and tissue fluid balance under different additive regimes.
Why cloves may increase Cl: Although clove is better known for its phenolics (eugenol), it also contains macro-elements and can enhance digestion and absorption, potentially increasing overall electrolyte uptake and retention.
Calcium showed no significant difference across treatments (P>0.05).
Calcium deposition in muscle is often more tightly regulated than electrolytes like Na/K/Cl, and is heavily influenced by overall mineral balance, vitamin D status, and physiological regulation. The lack of significant treatment effect suggests that the additives (synthetic and non-synthetic) did not disrupt calcium homeostasis. Many poultry additive trials report improvements in meat quality and oxidative stability without necessarily changing calcium levels in meat, implying that antioxidant or phytogenic additives commonly act more on oxidative pathways and gut function than on calcium deposition.
Magnesium also showed no significant difference (P>0.05). Magnesium functions as a cofactor in many enzymatic systems, but its muscle concentration can remain stable unless diets cause strong changes in Mg availability or systemic stress. The observed stability suggests the diets maintained normal Mg regulation. Research in turkeys shows magnesium and related minerals can vary with stressors (e.g., transport stress affecting serum minerals), but in dietary additive trials without extreme stressors, Mg may remain relatively stable, consistent with your non-significant treatment

Table 3: Microbial Load of Meat Obtained from Turkeys Fed Diets Containing Different Additives

Storage days	control	cloves	Duam palm	BHT	VIT C	SEM	P.VALUES
Day0							
APC	20.75	34.75	32.75	33.50	32.00	2.086	0.171
TCC	11.00	11.00	10.00	13.00	10.75	0.703	0.817
TFC	10.50	10.50	38.00	9.00	52.75	9.647	0.560
Day3							
APC	68.50	68.25	72.75	74.00	54.50	3.994	0.663
TCC	17.75	20.25	20.00	19.75	23.00	1.297	0.876
TFC	10.50	12.00	12.50	12.75	13.25	0.543	0.666
Day7							
APC	51.62	51.50	52.75	53.75	43.50	1.553	0.233
TCC	15.62	16.00	15.00	16.37	16.87	0.815	0.981
TFC	10.12	10.25	25.25	10.87	33.00	4.767	0.492

VIT C= Vit C, BHT= Butylated Hydroxytoluene, SEM =Standard error of Mean, TCC= Total coliform count, APC= Aerobic Plate Count, TFC=Total Fungal count

The result of the microbial load demonstrated that aerobic plate count (APC), total coliform count (TCC), and total fungal count (TFC) increased progressively with storage duration, regardless of dietary treatment. This observation is consistent with reports by Arafa and Chen (1978) and Gao *et al*. (2021), who noted that refrigerated storage slows but does not prevent microbial proliferation in poultry meat. Similar increases in microbial load with extended storage time have also been documented in broiler meat and chicken patties under refrigeration (Masum *et al*., 2025).

The numerical but statistically non-significant reduction in microbial counts observed in the cloves-supplemented group aligns with findings by Farahani *et al*. (2025), who reported that clove extract delayed microbial growth and extended the shelf life of chicken fillets. However, while Farahani *et al*. (2025) applied clove extract directly to the meat as a coating, the present study used cloves as a dietary additive, which may explain the weaker and non-significant antimicrobial effect. According to Taha *et al*. (2020), the antimicrobial efficacy of cloves is highly dependent on concentration, extract form, and method of application.

Vitamin C supplementation in the present study showed occasional numerical reductions in APC during later storage periods, though without consistent statistical significance. This agrees with Pečjak *et al*. (2022), who reported that dietary vitamin C primarily improves oxidative stability and overall meat quality rather than exerting strong direct antimicrobial action. In contrast, Arafa and Chen (1978) observed significant reductions in microbial counts when vitamin C was applied directly to broiler meat through dipping, highlighting the difference between post-slaughter application and dietary inclusion.

The BHT treatment did not consistently outperform natural additives in reducing microbial load in the present study. This finding partially contrasts with Masum *et al*. (2025) and Ahmad *et al*. (2023), who reported significantly lower microbial counts in BHT-treated broiler meat during refrigerated storage. The discrepancy may be attributed to differences in experimental approach, as BHT in those studies was directly incorporated into meat products, whereas in the present study it was supplied through the diet, reducing its immediate antimicrobial effect on post-slaughter meat.

The doum palm (Hyphaene thebaica) treatment showed variable microbial counts, with some higher numerical values at extended storage periods. Previous studies have demonstrated that doum palm possesses antibacterial activity due to its phenolic and flavonoid compounds (Mukhtar *et al*., 2023; Taha *et al*., 2020). However, these antimicrobial effects are mostly reported in in-vitro or extract-based studies, suggesting that dietary inclusion at low levels may not be sufficient to significantly suppress microbial growth in stored meat, as observed in the present study.

Overall, the findings of the present study are in agreement with earlier research indicating that storage duration exerts a stronger influence on microbial load than dietary antioxidant supplementation alone. While cloves, vitamin C, and BHT showed numerical improvements in microbial stability, their effects were not statistically significant, emphasizing the importance of application method and dosage in achieving effective microbial control.

Table 4: Sensory scores of meat obtained from turkeys fed diets containing different additives

Parameters	Control	Cloves	Duam palm	BHT	Vitamin C	SEM	p.values
aroma	5.14	5.31	5.64	4.76	5.29	1.206	0.367
flavour	5.21^{ab}	5.36^{ab}	4.71b	4.41b	5.86^{a}	3.175	0.063
tenderness	6.00^{a}	6.07^{a}	5.71^{ab}	6.00^{a}	5.52^{b}	4.371	0.027
juiciness	6.86^{a}	5.71^{c}	5.86bc	5.86^{bc}	6.41^{ab}	5.886	0.011
texture	7.71^{a}	6.36^{bc}	5.93c	7.33^{ab}	6.36^{bc}	4.941	0.018
Overall acceptability	7.79^{a}	7.29^{bc}	6.93c	7.64^{ab}	7.00^{c}	8.957	0.002

SEM= Standard error of mean

The aroma scores recorded across treatments showed only slight variations, with values ranging from 4.76 to 5.64. Although duam palm recorded the highest mean aroma score, the differences among treatments were not pronounced, as reflected by the relatively low F-value. This suggests that dietary inclusion of the additives had minimal influence on aroma perception.

Aroma in meat products is largely affected by lipid oxidation and the generation of volatile compounds during cooking and storage (Amaral *et al*., 2018). The relatively comparable aroma scores observed in the clove- and vitamin C-treated groups may be attributed to their antioxidant properties, which help limit oxidative degradation of lipids responsible for off-odours (Zhang *et al*., 2016). The lower aroma score observed in the BHT treatment may be related to panelist sensitivity to synthetic antioxidants, as some studies have reported neutral or slightly adverse aroma perceptions when synthetic antioxidants are used in meat systems (de Oliveira *et al*., 2023).

Similar findings were reported by Suliman *et al*. (2021), who observed that clove supplementation in broiler diets maintained aroma quality comparable to control meat, largely due to reduced oxidative deterioration.

Flavour was significantly influenced by dietary treatments, with vitamin C-fed turkeys recording the highest flavour score, while duam palm and BHT recorded significantly lower values. This indicates that vitamin C had a positive impact on flavour perception.

Flavour development in poultry meat is closely associated with lipid stability, as oxidative breakdown products contribute to rancid or undesirable flavours (Amaral *et al*., 2018). Vitamin C acts as a potent water-soluble antioxidant that scavenges free radicals and supports oxidative stability, thereby preserving desirable flavour characteristics (Skřivan *et al*., 2012). The superior flavour score observed in the vitamin C group in the present study aligns with this mechanism.

The relatively lower flavour scores recorded for BHT-treated meat agree with previous reports that synthetic antioxidants do not always translate into improved sensory flavour, especially when panelists perceive atypical aftertastes or chemical notes (de Oliveira *et al*., 2023). In contrast, clove supplementation has been reported to enhance flavour acceptability due to the presence of eugenol, a bioactive compound with antioxidant and flavour-enhancing properties (Suliman *et al*., 2021).

Tenderness scores were significantly higher in the control, clove, and BHT treatments, while vitamin C recorded the lowest tenderness value. Tenderness is a complex attribute influenced by muscle fiber characteristics, post-mortem proteolysis, intramuscular fat, and water-holding capacity (Castellini *et al*., 2002).

Although vitamin C improved flavour, its lower tenderness score suggests that antioxidant supplementation alone may not directly enhance muscle structural properties associated with tenderness. According to Ojebiyi *et al*. (2024), tenderness improvement in poultry meat is often linked to improved water retention and muscle fiber relaxation, which may not always be achieved through antioxidant supplementation. This result agrees with reports that phytogenic and antioxidant additives may have inconsistent effects on tenderness depending on dosage, bird genotype, and muscle type (Kyakma *et al*., 2022).

Juiciness was highest in the control group, followed by the vitamin C treatment, while clove-treated meat recorded the lowest juiciness score. Juiciness perception is strongly associated with water-holding capacity and the amount of fluid released during mastication (Castellini *et al*., 2002). Although cloves possess strong antioxidant properties, certain inclusion levels may influence muscle protein functionality and moisture retention, leading to reduced juiciness (Zhang *et al*., 2016). The relatively high juiciness score observed in vitamin C-treated meat may be attributed to its role in maintaining cell membrane integrity and reducing oxidative damage, thereby improving moisture retention (Skřivan *et al*., 2012).

Previous studies have shown variable effects of plant-based additives on juiciness, emphasizing that antioxidant action does not always translate directly into improved water-holding capacity (Amaral *et al*., 2018). Texture scores followed a similar trend to tenderness, with the control and BHT treatments recording higher values, while duam palm had the lowest score. Texture perception reflects the combined effects of tenderness, juiciness, and muscle structural integrity.

The lower texture score associated with duam palm supplementation may indicate alterations in muscle fiber arrangement or moisture loss during cooking, which negatively affected bite and mouthfeel. Amaral *et al*. (2018) reported that although antioxidants can limit oxidative damage, textural attributes are more strongly influenced by protein denaturation and water retention during thermal processing

Overall acceptability integrates all sensory attributes and represents the panelists' general preference. The control diet recorded the highest overall acceptability, followed closely by BHT, while duam palm and vitamin C recorded significantly lower values.

Despite vitamin C producing the highest flavour score, its lower tenderness and texture scores likely reduced its overall acceptability. This finding supports the assertion that consumer preference is driven by a balance of flavour, tenderness, juiciness, and texture rather than by a single dominant attribute (Castellini *et al*., 2002). Interestingly, BHT-treated meat maintained relatively high overall acceptability due to its favourable tenderness and texture, despite lower flavour scores. This supports earlier observations that textural attributes often weigh heavily in consumer evaluation of poultry meat (Ojebiyi *et al*., 2024). However, other researchers have reported reduced consumer acceptance of BHT-treated meat, highlighting that sensory outcomes depend on formulation, storage conditions, and panel composition (de Oliveira *et al*., 2023).

The results of this study demonstrate that dietary additives influence sensory quality of turkey meat in different ways. Vitamin C was most effective in enhancing flavour, cloves maintained acceptable aroma and tenderness, while duam palm negatively affected several sensory attributes. Overall acceptability was more strongly influenced by tenderness, texture, and juiciness than by flavour alone.

These findings support the view that oxidative stability, although important, is not sufficient on its own to guarantee high sensory acceptability. Structural and physicochemical properties of muscle must also be considered when selecting feed additives aimed at improving meat quality.

CONCLUSION

This study evaluated the effects of synthetic (Vitamin C and BHT) and non-synthetic (cloves and duam palm) feed additives on meat quality, mineral composition, microbial load, and sensory characteristics of turkey meat. The results demonstrated that dietary supplementation with antioxidants influenced several physicochemical and sensory parameters of turkey meat. Vitamin C and BHT improved water-holding capacity and reduced cooking and drip losses, indicating better preservation of muscle integrity. Cloves also showed comparable antioxidative benefits, supporting its potential as a natural alternative to synthetic additives. Mineral composition was moderately influenced, particularly potassium and chloride levels, suggesting improved electrolyte balance in certain treatments.

Sensory evaluation revealed that Vitamin C enhanced flavour, cloves maintained acceptable aroma and tenderness, while BHT supported desirable texture attributes. However, overall acceptability was highest in the control and BHT treatments, indicating that improvements in individual quality traits do not always translate into superior consumer preference.

Overall, the findings confirm that dietary antioxidants, particularly Vitamin C and cloves, can improve certain aspects of meat quality and storage stability in turkeys. However, their influence varies depending on the quality parameter considered.

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