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Research Article

Performance, prime cut and meat quality of broiler chickens on diets supplemented with dried powdered spices and tomato fruit

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Abstract: Improving broiler growth and meat quality remains an important focus in poultry production.This study investigated the effects of dietary supplementation of dried powdered spices and tomato fruit on growth performance, carcass yield and meat quality of broiler chickens. A total of 225 one-day-old Ross chicks were assigned to five dietary treatments: T1, basal diet (BD); T2, BD + black pepper powder (BPP); T3, BD + tomato fruit powder (TFP); T4, BD + ginger powder (GNP); and T5, BD + chili pepper powder (CPP) and fed for six weeks using a completely randomised design experiment. Birds on BD treatment had higher ($P<0.05$) final body weight, greater weight gain and more efficient feed conversion than those on other treatments. Breast meat yield was higher ($P<0.05$) in BD and BPP than in other treatments. BD birds also had higher pH, while water-holding capacity was greater in TFP and CPP than in other treatments. Overall, birds on BPP treatment had superior sensory attributes compared with . In conclusion, supplementing broiler diet with dried powdered spices and tomato fruits significantly enhanced growth performance and meat quality, highlighting the potential of these additives for optimizing poultry nutrition and product quality.

Keywords: Basal diet, spices, performance, meat quality, sensory parameters

1. Introduction

Broiler chickens' response to nutritional supplements highlights the significance and need to maximize both broiler performance and meat quality in poultry production. Research has demonstrated that diet strongly affects growth performance, carcass characteristics, and meat qualitywith the introduction of dry powdered spices and tomato fruit in broiler diets being associated with improved feed efficiency and weight gain (Javier et al., 2023). Furthermore, spices have antioxidant qualities that might improve meat quality by lowering oxidative stress and extending shelf life (Khan et al., 2019). Previous studies of broiler chickens have demonstrated that the inclusion of capsaicin, black pepper and ginger in feed, separately or in mixture, can improve broiler chicken growth performance, improve digestive enzyme activity, and modulate gut microbiota and oxidative status (Al-Khalaifah et al., 2022).

Meat quality is greatly impacted by abdominal fat deposition because too much fat can decrease market value and consumer acceptance. Research shows that using specific dietary supplements can help reduce body fat while increasing lean muscle mass (Fouad & El-Senousey, 2014). Also, diets supplemented with natural antioxidants can lead to lower abdominal fat while supporting a better meat -to -fat ratio (Valeria & Pamela, 2011). Therefore, this study intends to examine the impact of introducing dried powdered spices and tomato fruit into broiler chicken's diets, concentrating on performance parameters, prime cuts yield, abdominal fat content and overall meat quality.

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2. Materials and methods

The Teaching and Research Farm, Kwara State University, Malete served as the site of the field experiment. At 365 meters above sea level, it is situated between latitudes 080 71′ N and 080 96′ N and longitudes 040 44′ E and 040 76′ E. Malete's climate is defined by distinct wet and dry seasons, with an average of 1,150 mm of rainfall per year and temperatures ranging from 25 to 28.9 0C (Ishola et al., 2020).

Table1: Composition of Broiler Starter Diet (%DM)

Ingredient	Composition (%)
Maize	57.50
Soybean meal	20.00
Groundnut cake	16.00
Fish meal	2.00
Bone meal	2.50
Limestone	1.00
Vitamin premix	0.25
Methionine	0.25
Lysine	0.25
Salt	0.25
Total	100.00
Calculated Analysis (%)	
CP %	21.00
Available Phosphorus	0.50
Crude Fibre	3.91
Ether Extract	4.63
Calcium	1.18
Lysine	1.31
Methionine + Cysteine	0 .92
ME Kcal/kg	2900
Determined Analysis (%)	
Carbohydrate	59.15
Crude Protein	22.55
Ether Extract	3.88
Crude Fibre	3.16
Ash	6.12
Dry Matter	3.14
Moisture content	2.00
Metabolisable Energy (Kcal/kg)	2850

2.1. Experimental animals, diets and management

A total number of 225 Ross day-old broiler chickens were randomly assigned into five (5) treatments with three (3) replicates per treatment and each treatment has 15 birds each. Routine management and vaccination programmes were strictly adhered to. The broiler chicks were allowed access to feed and water ad libitum throughout the trial. The birds were placed on formulated broiler starter diet containing 21 % CP and 2900 Kcal/kg ME from 0 – 28 days of age and broiler finisher diet containing 17 % CP and 3000 kcal/kg ME, 29 – 42 days of age. The composition and calculated analysis of the experimental diets for both starter and finisher stages are presented in Tables 1 and 2, respectively. The proximate analyses of the diets were carried out in accordance with the procedure outlined by Association of Official Analytical Chemists (AOAC, 2005)

Table 2: Composition of Experimental Finisher Diet (% DM)

Ingredient	Composition%
Maize	56.50
Palm oil	3.00
Wheat offal	2.00
Soybean meal	19.00
Groundnut cake	10.00
Fish meal	1.00
Bone meal	4.00
Oyster shell	3.50
Vitamin premix	0.25
Methionine	0.25
Lysine	0.25
Salt	0.25
Total (Kg)	100.00
Calculated Analysis (%)	
CP	17.00
Available Phosphorus	0.78
Crude Fibre	2.66
Ether Extract	4.64
Calcium	2.75
Lysine	0.93
Methionine + Cysteine	0.47
ME Kcal/kg	3000
Determined Analysis (%)	
Carbohydrate	61.05
Crude Protein	16.55
Ether Extract	3.98
Crude Fibre	2.16
Ash	4.07
Dry Matter	2.14
Moisture content	9.05
Metabolisable Energy (Kcal/kg)	2998.50

2.2. Collection and preparation of spices and tomato fruit

Ripe black pepper, ginger, chili pepper and tomato were collected at Niger River Basin orchid farm at Oke-Oyi, Ilorin East local government area, Kwara State Nigeria. After being cleaned with distilled water, ripe black pepper, ginger, chili pepper, and tomato were oven-dried for 72 hours at 40 degrees Celsius. The dry materials were ground into a fine powder in a blender and then sieved through a 142.56 mm-diameter sieve. Sample extraction was done utilizing the method outlined by Van- acker et al. (2011).

2.3. Extraction and determination of the phenolic compound

A quantity of 50g of each powder sample was extracted using an organic solvent with 400ml of ethanol at room temperature using the solvent extraction method for three hours. The mixture was then decanted to remove any remaining debris, and the extracts were filtered and evaporated to dryness using a rotary evaporator at 60°C under reduced pressure. They were then placed in dark bottles and kept in a refrigerator at 4°C until they were needed. The phenolic content of the extracts was calculated calorimetrically using the Folin-ciocalteu reagent, following the method described by Sultana et al. (2009).

2.4. Experimental design

The birds were placed into five (5) treatments and three (3) replicates with ten (15) birds per replicate using completely randomize design.
The following are the supplemental level of the treatments:

- Treatment one (T1) basal diet (control)
- Treatment two (T2) basal diet with black pepper powder 5g per kilogram of diet
- Treatment three (T3) basal diet with tomato fruit powder 5g per kilogram of diet
- Treatment four (T4) basal diet with ginger powder 5g per kilogram of diet
- Treatment five (T5) basal diet with chili pepper powder 5g per kilogram of diet

2.5. Data collection

Feed and water intake were recorded daily, weight gain was recorded weekly and feed conversion ratio (FCR) calculated.

2.5.1. Carcass traits

At 6 weeks of age, three birds from each replication (without any obvious flaws) were chosen at random, slaughtered, deplumed, and eviscerated in accordance with the MSI 500:2009 Halal procedure (Department of Standards Malaysia, 2009). Following the removal of the intestine and other visceral organs, the carcass weight of each bird was determined. Thigh, drumstick, breast, back, and rib back were among the main cut components that were weighed, recorded, and expressed as a percentage of carcass weight. Internal organs weight was also recorded and expressed as a percentage of live weight.

The dressing percentage was calculated as the ratio of the carcass weight to the live weight of each chicken as shown in the equation below.

$$Dressing\ \% = \frac{CW}{LW} X100$$

CW = Carcass weight, LW = Live weight

2.5.2. Physical properties of the broiler chicken's meat

The carcass dressed on day zero, after which 15 g of pectoralis major muscle was dissected from the outer surface of the breast meat of each of the chicken per replicate using the procedure described by Ishola et al. (2017) and divided into 3 equal parts. The first part and second part (50 g) were vacuum packaged (Petri dish) and stored in refrigerator at 4 ± 1 °C for meat quality (water holding capacity and colour coordinates) determination.

2.5.3. Water holding capacity of the broiler chickens

Drip loss was measured as described by Sabow et al. (2015). The initial weight (W1) was determined by weighing the fresh meat samples taken from the pectoralis muscle on day zero. After being weighed, the samples were labeled, packed in polyethylene plastic bags, and kept at 4 °C. After two, four-, and six-days postmortem, the samples were taken out of the bags, carefully blotted, dried, weighed, and marked as W2. A percentage of the difference between the sample's initial and final weight after storage, divided by the sample's initial weight, was used to assess drip loss, as given in the equation below:

$$\text{Drip loss } \% = [W1 - W2/W1] \times 100$$

2.5.4. Colour coordinates (lightness, redness and yellowness) of the broiler chickens

The colour coordinates were determined in triplicate using Colour Flex Spectrophotometer (Hunter Lab Reston, VA, USA). The meat colour coordinates of pectoralis muscle samples from the treatments were determined using the American Meat Science Association's (AMSA, 2012) method, as described by Sabow et al. (2015). Using a Colour Flex spectrophotometer with a D 65 illuminant and 10 degrees standard, a 1.0 cm high by 1.0 cm wide by 2.0 cm long piece of breast meat from each of the five treatments was cut and placed at the base of the colour flex cup. Tri stimulus values were obtained for reflectance at a particular wavelength (400–700 nm) for lightness (L*), redness (a*), and yellowness (b*) in accordance with the International Commission on Illumination (CIE) (X, Y, Z). L*, a*, and b* values were measured in triplicate for every sample, and the results were averaged.

2.5.5. *Sensory evaluation of the broiler chickens*

According to Meilgaard et al. (2006), a consumer-type sensory evaluation was conducted. For each treatment, 20 grams of breast meat was trimmed of fat, labeled, and cooked in a water bath at 80 °C for 10 minutes. The meat samples were individually wrapped in aluminum foil and numbered. A consumer type sensory evaluation was conducted using twenty (20) assessors consisting of staff and students of Kwara State University, Malete, Nigeria. Assessors were taught on the sensory protocol and given characteristics to score using a 9-point hedonic scale (tenderness, juiciness, flavour, and overall acceptability) (Meilgaard et al., 2006). A score of nine denoted intense liking, while a score of one indicated extreme dislike.

2.6. *Statistical data analysis*

Data obtained from growth performance and carcass yield parameters were subjected to ANOVA using the IBM SPSS STAT (21). Duncan multiple range were used to separate the means at p>0.05 significant level. While meat quality parameters analysis was subjected to ANOVA using the PROC UNIVARIATE SAS (2014) package and Tukey HSD test at P< 0.05 significant level was used to separate the means.

3. Results and discussion

3.1. *Performance*

The final body weight (FBW) and weight gain (WG) of birds on basal diet (BD) control were significantly higher (p<0.05) than those birds on dietary supplemented chili pepper (CHP). The FBW and WG of birds on dietary supplemented black pepper powder (BPP) and tomato fruit powder (TFP) were similar but significantly higher (p<0.05) than those birds on dietary treatment ginger powder (GNP). However, birds on diet supplemented with GNP were significantly lower (p>0.05) in FBW and WG compared with birds on other treatments. The feed intake (FI) of birds on dietary supplemented BPP was significantly higher (p<0.05) than those birds on diet supplemented with GNP, which in turns were significantly higher (p<0.05) than those birds on diet supplemented with CHP. However, the birds on diet supplemented with CHP has higher (p<0.05) FI values compared with those birds on basal diet (control), which in turn were significantly higher (p<0.05) compares with birds on diet supplemented with TFP. Birds on diet supplemented with TFP were significantly lower (p>0.05) compared with birds on other treatments including control treatment. The feed conversion ratio (FCR) values of birds on diet supplemented with GNP was significantly higher (p<0.05) than those birds on diet supplemented with BPP, TFP and CHP. There were similarities in the FCR of birds on dietary treatments BPP, TFP and CHP but were significantly higher (p<0.05) compared with those birds on dietary treatment BD.

The higher weight gain and final body weight observed in the control treatment BD, could be due to phytochemical compounds present in the spices and tomato fruit some of which might have inhibited the growth and development of beneficial microbes in the guts of the broiler chickens which could have aided in the metabolism and subsequent absorption of nutrients into the tissue of the birds. Hence, birds on control treatment utilised their feed more efficiently (lower FCR) than birds on other treatments. The result in this study is consistent with the observation of Thayalini et al. (2011) who concluded that there was no improvement in the overall performance of birds fed either Zingiber officinale rhizome or Cymbopogon citratus leaf

Table 3: Effect of dietary supplementation of dried spices and tomato fruit powder on growth Performance of broiler chicken

Parameters	Treatments BD (control)	BPP	TFP	GNP	CHP	Mean	P-value
IBW	45.01	44.76	44.83	44.9	44.92	44.88	
FBW	2384^{a}	2232^{c}	2200^{c}	2130^{d}	2258^{b}	2240.8	**
WG	55.69^{a}	52.07^{c}	51.31^{c}	49.65^{d}	52.69^{b}	52.3	**
FI	72.56^{d}	76.3^{a}	72.24^{e}	74.37^{b}	73.64^{c}	73.82	**
FCR	1.30^{c}	1.46^{b}	1.41^{b}	1.5^{a}	1.4^{b}	1.41	*

^{abcd} Means on the same row with different superscript are significantly different (p<0.005)
Note: Black pepper powder (BPP), Ginger (GNP), Tomato (TFP), Chili pepper powder (CHP)
Initial body weight (IBW), Final body weight (FBW), Weight gain (WG), Feed intake (FI), Feed conversion ratio (FCR).
*** Means highly significantly different (p<0.005)

supplements when compared to the birds fed the control feed.

3.2. Carcass traits (prime cuts)

The breast prime cut parts of broiler chickens on dietary treatments BD and BPP were similar but significantly higher ($p<0.05$) compared with broiler chickens on dietary treatments TFP, GNP and CHP. However, broiler chicken on diet supplemented with CHP were significantly lower ($p>0.05$) than those birds on other treatments including the control. The wings of broiler chickens on dietary treatment CHP were significantly higher ($p<0.05$) than those birds on treatment TFP which in turn were significantly higher ($p<0.05$) than birds on BD and GNP. Broiler chickens on dietary treatments BD and GNP were similar but significantly higher ($p<0.05$) in the wings value than those birds on dietary treatment BPP. The back prime cut parts of broiler chickens on dietary treatments BPP and CHP were similar but significantly higher ($p<0.05$) compared with broiler chickens on dietary treatments BD, TFP and GNP. However, broiler chicken on diet supplemented with BD, TFP and GNP were similar but significantly lower ($p>0.05$) than those birds on treatments BPP and CHP. The thigh of broiler chickens on dietary treatment CHP were significantly higher ($p<0.05$) than those birds on treatments BD and TFP which were similar but significantly higher ($p<0.05$) than birds on GNP. Broiler chickens on dietary treatments GNP were significantly higher ($p<0.05$) in the thigh value than those birds on dietary treatment BPP. However, the thigh of broiler chickens on dietary treatment BPP were significantly lower ($p>0.05$) compared with those birds on other treatments including the control. The drumstick prime cut parts of broiler chickens on dietary treatments BPP, TFP and GNP were similar but significantly higher ($p<0.05$) compared with broiler chickens on dietary treatments CHP and BD. The broiler chickens on dietary treatment CHP were significantly higher ($p<0.05$) in drumstick value than those birds on treatment BD. However, broiler chicken's drumstick value on diet supplemented with BD were significantly lower ($p>0.05$) than those birds on other treatments.

The abdominal fat of broiler chickens on dietary treatment BD were significantly higher ($p<0.05$) than those birds on treatment TFP which in turn were significantly higher ($p<0.05$) than birds on BPP and CHP. Broiler chickens on dietary treatments BPP and CHP were similar but significantly higher ($p<0.05$) in the abdominal fat value than those birds on dietary treatment GNP. However, the abdominal fat value of broiler chickens on dietary treatment GNP were significantly lower ($p>0.05$) compared with those birds on other treatments.

Table 4: Effect of dietary supplementation of dried spices and tomato fruit powder on carcass traits of broiler chickens

Parameter	Treatments						
	BD	BPP	TFP	GNP	CHP	Mean	P value
Lw (g)	2384 ± 14.00^{a}	2230 ± 11.14^{bc}	2198 ± 7.64^{c}	2173 ± 37.86^{c}	2259 ± 51.52^{b}	2249.07	**
Bw (g)	2307 ± 15.01^{a}	2204 ± 11.14^{b}	2114 ± 7.64^{c}	2139 ± 37.86^{c}	2517 ± 32.01^{b}	2193.33	**
Dfw (g)	2180 ± 11.00^{a}	2078 ± 11.14^{b}	2028 ± 7.64^{b}	2061 ± 37.86^{b}	2133 ± 51.73^{a}	2096.27	**
CW (g)	1604 ± 11.00^{a}	1588 ± 11.14^{a}	1522 ± 7.64^{b}	1577 ± 37.86^{a}	1565 ± 35.59^{ab}	1571.33	**
D (%)	67.28 ± 0.07^{d}	71.20 ± 0.14^{b}	69.25 ± 0.11^{c}	72.26 ± 0.45^{a}	69.25 ± 0.07^{c}	69.85	**
B (%)	36.03 ± 0.01^{a}	36.22 ± 0.01^{a}	35.03 ± 0.00^{ab}	34.68 ± 0.33^{b}	32.13 ± 0.01^{c}	34.53	**
W (%)	11.74 ± 0.03^{c}	10.84 ± 0.03^{d}	12.07 ± 0.09^{b}	11.66 ± 0.29^{c}	12.69 ± 0.14^{a}	11.8	**
Back (%)	21.28 ± 0.20^{b}	22.76 ± 0.06^{a}	21.41 ± 0.12^{b}	21.06 ± 0.51^{b}	22.85 ± 0.60^{a}	21.87	**
Thigh (%)	16.15 ± 0.14^{b}	14.11 ± 0.09^{d}	15.76 ± 0.12^{b}	14.72 ± 0.35^{c}	17.01 ± 0.46^{a}	15.55	**
DS (%)	14.21 ± 0.22^{c}	15.52 ± 0.09^{a}	15.62 ± 0.06^{a}	15.73 ± 0.38^{a}	14.96 ± 0.21^{b}	15.21	**
Heart (%)	0.01 ± 0.00^{a}	0.01 ± 0.00^{e}	0.01 ± 0.00^{b}	0.01 ± 0.00^{d}	0.01 ± 0.00^{c}	0.01	**
SPL (%)	0.01 ± 0.00^{c}	0.01 ± 0.00^{c}	0.01 ± 0.00^{b}	0.01 ± 0.00^{c}	0.01 ± 0.00^{a}	0.01	**
GZD (%)	0.03 ± 0.00^{a}	0.02 ± 0.00^{c}	0.02 ± 0.00^{b}	0.01 ± 0.00^{d}	0.02 ± 0.00^{b}	0.02	**
JJ (%)	0.01 ± 0.00^{c}	0.12 ± 0.00^{a}	0.13 ± 0.00^{c}	0.14 ± 0.00^{b}	0.01 ± 0.00^{d}	0.13	**
DD (%)	0.01 ± 0.00^{a}	0.01 ± 0.00^{c}	0.01 ± 0.00^{b}	0.01 ± 0.00^{a}	0.01 ± 0.00^{c}	0.01	**
Ilium (%)	0.01 ± 0.00	0.11 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	0.01	
AF (%)	0.81 ± 0.02^{a}	0.54 ± 0.04^{c}	0.61 ± 0.02^{b}	0.17 ± 0.02^{d}	0.53 ± 0.02^{c}	0.53	**

^{a,b,c} means having different superscripts along the same row are significantly different Black pepper powder (BPP), Ginger powder (GNP), Tomato fruit powder (TFP), Chilli pepper powder (CHP), Liveweight (LW), Bled weight (BW), Defeathered weight (DFW) Carcass weight (CW), Dressing percentage (D%), Breast (B%), Wings (W), Drumstick (DS) Spleen (SPL), Gizzard (GZD), Jejunum (JJ), Duodenum (DD), Abdominal fat (AF)

The breast yield was much pronounced in birds on both BD and BPP treatments. Whereas the wings, back and thigh yield of birds on treatment CHP were better. This observation could be due to capacity of the birds to deposit more muscles in those parts than birds on other treatments. This result is consistent with the observation of (Zhang et al., 2009) who found that ginger significantly ($P<0.05$) increased carcass yield compared to broiler chickens on control treatment. The abdominal fat content of birds on CHP treatment was very much insignificant. This could be attributable to the content of Capsicum chinense which is responsible not only in hydrolysing sodium content in the blood but also aid in the oxidation of lipids in the tissue of birds thereby reducing the content of fat that could be deposited in the tissues. This result is consistent with the observation of (Ishola 2023), who observed that soybean meal (SBM) in the broiler chicken's diet replaced with 80% soybean waste (SBW), had lower abdominal fat weight compared with other treatments.

3.3. Physicochemical properties

The pH of bird's meat on dietary basal diet (BD) control were significantly higher ($p<0.05$) than those bird's meat on diet supplemented with black pepper powder (BPP). Whereas bird's meat on diet supplemented with BPP was partly similar with bird's meat on diet supplemented with tomato fruit powder (TFP) which in turn were significantly higher ($p<0.05$) in pH value than bird's meat on diet supplemented with ginger powder (GNP) and chili pepper powder (CHP). However, bird's meat on diet supplemented with GNP were significantly lower ($p>0.05$) in the pH value compared with other treatments including the control. The cooking loss of bird's meat on diet supplemented with GNP were significantly higher ($p<0.05$) than those bird's meat on diet supplemented with CHP. Whereas bird's meat on diet supplemented with CHP were significantly higher ($p<0.05$) in cooking loss value than bird's meat on diet supplemented with BD and TFP which were in turn similar but significantly higher ($p<0.05$) in cooking loss than those bird's meat on treatment BPP. However, bird's meat on diet supplemented with BPP were significantly lower ($p>0.05$) in the cooking loss value compared with other treatments including the control. The drip loss of bird's meat on diet supplemented with CHP were significantly higher ($p<0.05$) than those bird's meat on diet supplemented with TFP. Whereas bird's meat on diet supplemented with TFP were significantly higher ($p<0.05$) in drip loss value than bird's meat on diet supplemented with BPP which in turn were significantly higher ($p<0.05$) in drip loss compared with treatment BD. However, bird's meat on diet supplemented with GNP were significantly lower ($p>0.05$) in the drip loss value compared with other treatments including the control. The water holding capacity (WHC) of bird's meat on diet supplemented with TFP and CHP were similar and significantly higher ($p<0.05$) than those bird's meat on diet supplemented with BPP. Whereas bird's meat on diet supplemented with BPP were significantly higher ($p<0.05$) in WHC value than bird's meat on diet supplemented with BD which in turn were significantly higher ($p<0.05$) in WHC compared with treatment GNP. However, bird's meat on diet supplemented with GNP were significantly lower ($p>0.05$) in the WHC value compared with other treatments including the control. The highest pH was observed in the control (5.4) relative to supplemented treatments, indicating reduced spoilage of meat because of supplementation with plant extracts. Supporting the results of this study, different researchers also reported a decline in the pH of meat because of the addition of phytogenics such as pomegranate by-products and 2% garlic acid (Puvača et al., 2015; Ahmed et al., 2015). The high cooking loss of broiler chicken's meat on diet supplemented with GNP might be due to the presence of piperloguimine in ginger, which play a role in increasing cooking loss. This result is correlated with the findings of (Berg and Allee 2001); (Maddock et al., 2002), who found that the pectoralis muscle of chickens fed supplemented piperloguimine had a substantial impact on the animal's cooking and drip loss. The high WHC of broiler chicken's meat in diet supplemented with CHP could be due to Capsicum chinense which tend to reduce water retention in the muscle of the birds. The result observed in this study contradicts the findings of (Džinić, et al. 2015) who reported the lowest WHC, cooking and drip-loss of broiler chicken's meat supplemented with chili pepper extract.

The lightness (L*) parameter of the colour coordinates of bird's meat on diet supplemented with BPP were partly similar to treatment GNP but significantly higher ($p<0.05$) than those bird's meat on diet supplemented with CHP. Whereas bird's meat on diets supplemented with GNP and CHP were partly similar but significantly higher ($p<0.05$) in L* compared with bird's meat on diet supplemented with BD and TFP. However, bird's meat on diet supplemented with BD and TFP were similar but significantly lower ($p>0.05$) in the L* value compared with other treatments including the control. The redness (a*) parameter of the colour coordinates of bird's meat on diet supplemented with TFP were significantly higher ($p<0.05$) than those bird's meat on diet supplemented with BD, BPP, GNP and CHP. Whereas bird's meat on diets supplemented with BD, BPP, GNP and CHP were similar but significantly lower (p>0.05) in a* compared with bird's meat on diet supplemented with TFP. The yellowness (b*) of bird's meat on diet supplemented with BPP were significantly higher (p<0.05) than those bird's meat on diet supplemented with BD. Whereas bird's meat on diet supplemented with BD were significantly higher (p<0.05) b* value than bird's meat on diet supplemented with TFP and GNP which were in turn similar but significantly higher (p<0.05) in b* than those bird's meat on treatment CHP. However, bird's meat on diet supplemented with CHP were significantly lower (p>0.05) in b* value compared with other treatments including the control. Redness (a*) of meat is a very important colour parameter for the assessment of meat oxidation (Mancini and Hunt, 2005). The customer first appraisal of meat quality is based on its colour, and this could be linked to both perceived and actual values (Barbut, 2001). The colour assessment of the meat is related to the oxidation of myoglobin and the decreased metmyoglobin reducing activity (MRA) which eventually leads to metmyoglobin accumulation in the meat (Mancini and Hunt, 2005). This change reduces the redness and makes the meat unpleasant for consumers (Mancini and Hunt, 2005). This study shows that broilers fed with diets supplemented with BPP and TFP had greater accumulation of metmyoglobin at the pectoralis muscle part of the bird than other treatments. This agrees with the results of (Mancini and Hunt, 2005; Bischof et al., 2024;), who stated that a reduction in redness was due to myoglobin oxidation, especially when meat pH is above 6.

Lower pH on pectoralis muscles in hens has been linked to lighter colour (L*) and reduced water retention capacity (Fletcher, 2002). Meat quality features (low pH, WHC, and lighter coloration (L*) of the meat) were more prominent in dietary supplemented with TFP (18.47) treatments, indicating that phenolic chemicals responsible for increasing meat quality had been deeply incorporated. The findings of this study agree with those of Džinić et al. (2015), who looked at the colour properties of chicken flesh provided dietary supplemented with plant extract.

The appearance parameter in sensory evaluation of bird's meat on diet supplemented with BPP were significantly higher (p<0.05) than those bird's meat on diets supplemented with BD, TFP and CHP. Whereas bird's meat on diet supplemented with BD, TFP and CHP were similar but significantly higher (p<0.05) in appearance than bird's meat on diet supplemented with GNP. However, bird's meat on diet supplemented with GNP were significantly lower (p>0.05) in appearance compared with other treatments including the control. The taste in sensory evaluation of bird's meat on diet supplemented with BD and BPP were similar but significantly higher (p<0.05) than those bird's meat on diets supplemented with TFP, GNP and CHP. However, bird's meat on diet supplemented with TFP, GNP and CHP were similar but significantly lower (p>0.05) in taste compared with other treatments including the control. The aroma parameter in sensory evaluation of bird's meat on diet supplemented with BPP were significantly higher (p<0.05) than those bird's meat on diets supplemented with BD and CHP. Whereas bird's meat on diet supplemented with BD and CHP were similar but significantly higher (p<0.05) in aroma than bird's meat on diet supplemented with TFP and GNP. However, bird's meat on diet supplemented with TFP and GNP were similar but significantly lower (p>0.05) in aroma compared with other treatments including the control. The overall acceptability parameter in sensory evaluation of bird's meat on diet supplemented with BPP were significantly higher (p<0.05) than those bird's meat on diets supplemented with BD, TFP and CHP. Whereas bird's meat on diet supplemented with BD, TFP and CHP were similar but significantly higher (p<0.05) in overall acceptability than bird's meat on diet supplemented with GNP. However, bird's meat on diet supplemented with GNP were significantly lower (p>0.05) in overall acceptability compared with other treatments including

Table 5: Effect of dietary spices and tomato fruit supplementation on meat quality and Physicochemical properties of broiler chicken's meat

Parameters	Treatments						
	T1	T2	T3	T4	T5	SEM	P value
pH	5.4^{a}	5.2^{b}	5.15^{bc}	4.85^{d}	5.00^{cd}	0.03	0.0005
Cooking loss (%)	19.50^{c}	19.00^{d}	19.50^{c}	21.00^{a}	20.50^{b}	2.40	0.6705
Drip loss (%)	19.08^{d}	20.03^{c}	21.30^{b}	18.55^{e}	21.51^{a}	0.74	0.1012
WHC	25.10^{c}	26.20^{b}	26.80^{a}	24.20^{d}	26.80^{a}	0.64	0.1004
Colour coordinates							
Lightness (L*)	20.03^{c}	38.23^{a}	18.47^{c}	34.62^{ab}	22.52^{bc}	2.733	0.001
Redness(a*)	2.82^{b}	1.22^{b}	5.19^{a}	1.97^{b}	1.95^{b}	0.904	0.001
Yellowness(b*)	3.33^{b}	3.67^{a}	3.12^{c}	3.11^{c}	2.33^{d}	0.827	0.105

^{a,b,c} means having different superscripts along the same row are significantly different (P< 0.05)

Table 6: Effect of dietary spices and tomato fruit supplementation on sensory evaluation of broiler chicken's meat

Parameters	Treatments					SEM	P value
	BD (control)	BPP	TFP	GNP	CHP		
Appearance	8.00[b]	8.50[a]	8.00[b]	7.25[c]	8.00[b]	1.70	<0.01
Taste	8.00[a]	8.30[a]	7.00[b]	7.00[b]	7.25[b]	1.58	<0.01
Texture	7.00	7.80	7.50	7.00	7.50	1.56	>0.2
Aroma	7.50[b]	8.30[a]	6.50[c]	6.50[c]	7.75[b]	1.56	<0.01
Overall	7.60[b]	8.50[a]	7.5[b]	6.9[c]	7.6[b]	1.58	<0.01

[a,b,c] means having different superscripts along the same row are significantly different (P< 0.05) Note: Black pepper powder (BPP), Ginger (GNP), Tomato (TFP), Chili pepper powder (CHP), BD (Basal diet). Hedonic scale of 1= dislike extremely, 2= dislike very much, 3= dislike moderately, 4= dislike slightly, 5= neither like or dislike, 6= like slightly, 7= like moderately, 8= like very much and 9= like extremely

the control. The panelists' perceptions of appearance, taste, aroma, and overall acceptability in broiler chicken's meat fed diet supplemented with BPP were all high in this study. This could be due to the presence of aroma-producing phytochemicals in the diet supplemented with BPP, which could stimulate the olfactory sensual response to the boiled meat. The result obtained from this study is consistent with (Zdunczyk et al., 2010), who found that adding 30 mg/kg of Macleaya cordata plant extracts, which belongs to the same alkaloid family as black pepper, to breast flesh resulted in a strong smell without any peculiar odour.

4. Conclusion and recommendation

The final body weight and weight gain of broiler chickens on BD treatment were higher due to feed conversion efficiency of the birds. The muscle of the broiler chicken's breast cut on BD and BPP diets were better deposited. The wing, back, thigh cuts and the drumstick cut parts on BD, BPP diets, CHP, and BPP, TFP, GNP diets respectively, were better deposited. The physicochemical properties of bird's meat on BD and CHP were better enhanced and the perception of all the sensory parameters of bird's meat on BPP diet were better than other treatments. Poultry farmers should be encouraged on the practical application of the use of spices and tomato fruit powder in the diet of the birds, including its cost-effectiveness and potential benefits of using natural supplements in chicken's diets.

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