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MEAT QUALITY CHARACTERISTICS OF CHICKENS FED WITH DIETARY SUPPLEMENTATION OF VITAMIN E AND SELENIUM IN THE TROPICS

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ABSTRACT

Climate change has created a pronounced heat-stress challenge to the poultry industry in the tropics with resultant effect on the quality of meat produced, therefore it becomes vital to seek methods in alleviating this problem. The objective of this research was to determine the impact of dietary vitamin E and selenium (VE+Se) on quality characteristics of meat. A total of 150-day old broiler chickens were fed diet containing VE+Se at 0,100 mg VE+ 0.05 mg Se, 200 mg VE+ 0.1 mg Se, 300 mg VE+0.15 mg Se and 400 mg VE+0.2 mg Se Kg of feed. At the 49th day of age, birds were slaughtered for meat evaluation. Data generated on meat quality: carcass characteristics, sensorial profile, water holding capacity (WHC), water absorption capacity (WAC), colour and proximate composition, were arranged in a One-way ANOVA. The highest ($p<0.05$) dressing (%) and prime cuts (thigh, drumstick and breast) were observed from the 400 mg VE + 0.2 mg Se feeding. Highest flavour and tenderness were recorded from the 400 mg VE + 0.2 mg Se feed while juiciness and overall flavour were highest in control and 400 mg VE + 0.2 mg Se diet. Dietary VE+Se had significant ($p<0.05$) effect on meat colour, highest ($p<0.05$) b*(yellowness) intensity was observed from 100 mg VE + 0.05 mg Se and 400 mg VE+0.2 mg Se diets, a*(redness) in 0 mg and lightness in the VE+Se supplemented groups. These findings showed dietary supplementation of VE+Se up to 400 mg Ve + 0.2 mg Se in poultry diets influenced prime cuts (thigh, breast and drumstick) and improved consumer perception and meat colour.

KEYWORDS: Meat quality attributes, antioxidants, selenium, vitamin E, sensorial response, poultry meat

INTRODUCTION

Meat plays a significant role in diets of people because of its appealing flavour, texture and high nutritional worth. However, there are numerous factors limiting the quality and acceptability of meat and meat products to the consuming populations. Aside from microbiological hazards and probable contaminants inherent in the food industries, oxidation of lipids, muscle myoglobin and protein are major causes of deterioration of quality of muscle foods. Oxidation of lipids leads to discolouration, drip losses, off-odour and off-flavour development in meat;

likewise decreases in the nutritional quality and safety by the formation of secondary reaction products in foods after cooking and processing (Morrissey *et al.,* 1998).

Quality is defined as the sum of demands of the consumer concerning foodstuffs (Woodward and Wheelock, 1990), therefore the anticipation of every consumer of meat is that it should be healthy, rich in protein and exhibit no off-flavour.

Several management practices and dietary modifications have been employed in improving performance, health and products from animals. Inclusion of vitamin E and Selenium in diets is essential for the integrity and optimal function of the productive, muscular, circulatory, nervous, and immune systems in animals. Addition of vitamin E to bird diets improves birds' health and productivity and also provides a source of vitamin E that is useful for human nutrition and health. The use of VE+Se in diets may provide a possible option in combating quality loss in meat from the farm before been processed into other meat products (Kim et al., 2010). It is therefore conceivable to improve the antioxidant capacity by supplying antioxidants in the diet such as vitamin E and enzyme precursors (selenium) since vitamin E and selenium supplementation in poultry diets results in an increase of vitamin E concentration in the tissue, leading to an increase in the stability of meat (Grau *et al.,* 2001, Ryu et., 2005). Therefore, lowering these oxidations can enhance the shelf-life stability of meat and meat products.

The use of antioxidants has been put forward and cited as means of mitigating against stress with positive effect on animal health and its products (Surai et al., 2019a, b; Surai, 2020). . Different nutritional approaches for supplementing broiler chicken diets with vitamin E have been explored to delay the onset of lipid oxidation and improve the quality of poultry meat. The dietary supplementation with vitamin E has been reported to improve the oxidative stability of poultry meat (Goñi *et al.,* 2007) and reduction of lipid peroxidation and improving the colour stability and quality of poultry meat (Zhang *et al.,* 2020). Selenium supplementation has been opined to positively improve the antioxidant activity in plasma and tissue, growth performance, decrease lipid oxidation and improve meat quality and chemical composition of meat ([Markovic´ *et al.,* 2018). In addition, the combination of selenium with vitamin E has been revealed to have synergistic effects in reducing lipid oxidation in breast meat of broilers under stress (Habibian *et al.* (2016).

Despite the extensive information on the effect of vitamin E on broiler chicken, little information is available on extra supplementation of VE+Se on quality characteristics of broiler chicken meat in the tropics. Hence this study was conducted ~~is~~ to determine the influence of dietary supplementation of VE+Se on quality characteristics of broiler chicken meat

MATERIALS AND METHODS

The research was conducted at the Poultry Unit of the Teaching and Research Farms Directorate (TREFAD), Federal University of Agriculture, Abeokuta, Ogun State, Nigeria (latitude 7^{o} 10' N, longitude 3^{o} 2' E).

One hundred and fifty (150) day-old broiler chicken (Ross308) were allotted to five dietary treatments containing 0 mg VE + 0 mg Se,100 mg VE + 0.05 mg Se, 200 mg VE + 0.1 mg Se, 300 mg VE + 0.15 mg Se and 400

mg VE + 0.2 mg Se Kg. The Vitamin E and Selenium were supplemented in the basal feed/diet (Table I) respectively in a completely randomized design. Each treatment group consisted of three replicates with ten (10) birds each. A basal diet was formulated (Table 1) and was subsequently supplemented at the varying levels of VE+Se (0 mg VE + 0 mg Se,100 mg VE + 0.05 mg Se, 200 mg VE + 0.1mg Se, 300 mg VE + 0.15mg Se and 400 mg VE + 0.2mg Se) per Kg of feed. The nutrient composition of the basal diet was determined using AOAC International (2005). The supplemented feed were given throughout the 49-day trial. Feed and water were provided without restriction to birds.

Table 1: Gross composition and Nutrient Level (%) of Basal Diet

Ingredient	**Amount (%)**
Maize	47.00
Groundnut cake	15.00
Soybean meal	23.00
Wheat offal	8.00
Bone meal	6.00
Limestone	3.00
Lysine	0.25
Methionine	0.25
*Premix	0.25
Salt	0.25
Total	**100**
Determined Analysis	
Metabolizable Energy (kcal/kg)	2713.00
Protein (%)	20.00
Crude Fat (%)	3.90
Crude Fibre (%)	3.70

*Premix provided per kilogram of diet: transretinyl acetate, 3.44 mg; cholecalciferol, 0.075 mg; menadione, 1.3 mg; thiamin, 2.2 mg; riboflavin, 8 mg; vitamin E; 11IU, nicotinamide, 40 mg; choline chloride, 400 mg; calcium pantothenate, 10 mg; pyridoxine·HCl, 4 mg; biotin, 0.04 mg; folic acid, 1 mg; vitamin B12 (cobalamin), 0.013 mg; Fe (from ferrous sulfate), 80 mg; Cu (from copper sulphate), 8.0 mg; Mn (from manganese sulphate), 110 mg; Zn (from zinc oxide), 60 mg; I (from calcium iodate), 1.1 mg, Selenium; 0.23mg.

At the 49th day of experiment, birds nearest to the average weight of the birds from each replicate were selected and slaughtered for meat quality evaluation. The final weight in each treatment group were 2066.87, 2136.38, 2175.09, 2220.20, 2467.03 g respectively; (Table 2). Before slaughtering, broiler chickens were starved for 12 hours and slaughtered via neck slit and then allowed to bleed. Cut-up parts and organs were weighed using sensitive scale and expressed as percentage of the liveweight. Meat was excised from the breast region, placed in a polythene bag and labelled accordingly for laboratory analysis.

A sensory panel consisting of 7 assessors was set up. Samples of meat were excised from two birds from each replicate, cut into cubes and tagged for identification. The samples were put in labelled polythene bag and cooked in a water bath at 70°C for 20 minutes. The meat was allowed to cool down at room temperature. A seven (7) member judge were educated on the assessment procedure and were subsequently required to masticate on each sample from each replicate and evaluate some of the sensory characteristics such as colour, juiciness, meaty flavour, tenderness, saltiness, overall flavour and overall acceptability using a nine-point hedonic scale (Peryam and Girardot, 1952). Like extremely =9, like very much =8, like moderately =7, slightly like =6, neither like nor dislike =5, dislike slightly =4, dislike moderately =3, dislike very much =2, dislike extremely =1.

The muscle colour was determined by taking a sample of sliced meat from the posterior part of the breast muscle obtained from broiler after slaughter and viewed using a Colorimeter (chroma meter CR- 410, Japan). The meat samples were placed in a Petri dish and the colorimeter was placed over the meat and the values displayed were recorded. The values of L*, a* and b* colorimetric coordinates were determined. L*= corresponds to lightness, a*= corresponds to redness, b*= corresponds to yellowness.

The water-holding capacity (WHC) of meat samples excised from the breast were determined using a centrifugation technique (Hamm, 1960).. Triplicate 15 g samples of meat were slurred using mortar and pestle and placed in centrifuge tubes, 22.5 ml of 0.6 M saline solution was added and the contents stirred for 1 min with a glass rod. After stirring**,** the sample was refrigerator for 15 mins. The meat slurry was stirred again for 1 min and immediately centrifuged at 2000 rpm (Merlin 503, Spectral scientific Ltd, Great Britain) for 15 mins. The supernatant layer was decanted and the volume recorded. The amount of added solution retained by the meat was reported as the water holding capacity in ml per 100 g meat.

$$\textbf{Water-Holding Capacity (\%)} = \frac{Before\ centrifuge - After\ centrifuge}{Before\ centrifuge} \times 100$$

Before Centrifuge = Amount of saline solution added, After Centrifuge = Amount of solution decanted

A modified centrifugation method (Arganosa *et al.,* 1991) was used to determine the water absorption capacity (WAC) of the breast samples. Triplicate Five grams (5 g) of sample was blended (KenWood Processor) with 10 mls of distilled water for 1 min. The homogenized mixture was poured and rinsed with 10 mls of distilled water into

a pre-weighed centrifuge tube. The mixture was centrifuged (Merlin 503, Spectral scientific Ltd, Great Britain) at 2000 rpm for 25 mins. The remaining unabsorbed water was decanted after centrifugation and the water absorbed by meat was calculated.

$$\textbf{Water Absorption Capacity (\%)} = \frac{\textbf{gram of water absorbed}}{gram of meat} \times 100$$

Gram of Water Absorbed = Weight of meat with centrifuge tube before centrifugation – weight of meat with centrifuge tube after centrifugation, Gram of Meat = gram of meat sample

The proximate composition of the replicate meat samples was carried according to AOAC International (2005) to determine crude protein, ether extract and ash content.

Data were arranged in a one-way analysis of variance and analysed using the GLM procedure of the SAS/STAT module (SAS, 2003). Significant differences between means were separated using Tukey HSD test at $p>0.05$. Data are presented as means and pooled standard error of means.

RESULTS AND DISCUSSION

All carcass characteristics parameters measured were not significantly influenced except live-weight, dressing percentage, thigh, drumstick and breast (Table 2). Live-weight and dressing percentage values were higher in the birds fed extra supplementation of VE+Se compared to the control, but was significantly highest from the 400 mg VE+ 0.2 mg Se diet. This is in contrast to the report of Tayeb and Qader (2012) who observed no differences in the in weight and dressing percentages of birds at 42 (74.70%) and 49 (75.48 %) days of age, with values obtained in the current study (76.54%) higher than the previous. This observed positive effect in the study is a direct result of the improved and better performance indices resulting in the higher live weight of birds, thereby affirming the role of vitamin E and selenium in growth and protection of the biological system (Cheng *et al.,* 2017) -as there exists a positive relationship between vitamin E and Se. Thigh, drumstick and breast values were lowest from the control (11.23, 9.80, 21.41) and 100 – 300 mg VE+Se diets, with the best prime cut-up value obtained from 400 mg VE + 0.2 mg Se group (12.26, 11.24, 25.19). This is not consistent with the reports of Habibian *et al.* (2016), Leonel *et al.* (2007) and Choct and Naylor (2004) who observed no differences in performance, carcass, breast, thigh, drumstick and abdominal fat yield percentages. The organs (liver and spleen) were statistically similar in all groups (Table 2), this is contrary to the report of Singh *et al.* (2006) who observed a synergistic effect resulting in a significantly higher bursal and spleen weight when birds were fed extra supplementation of 200 mg VE+ 0.2 mg Se but in agreement with Niu *et al.* (2009a, b) who stated no impact on weights of lymphoid organs with similar VE+Se supplementations**.** The non-significant scenario in organs, especially the spleen, reveals no extreme stressors on birds or indicative of no stress as reduced spleen weight is suggestive of physiological stress experienced by birds (Puvadolpirod and

Thaxton, 2000). Although incremental use of VE has been reported to increase relative weight of liver (Akbari *et al.,* 2008), current study with a higher supplementation in addition with Se however did not reveal any such influence on its weight as reported by Özkan et al., (2007) and Habibian *et al*., (2014).

Table 2: Effect of Dietary Vitamin E on Carcass Characteristics of Broiler chicken

Parameter	Control	100mg VE+0.05 mg Se	200mg VE+0.1 mg Se	300mg VE+0.15 mg Se	400mg VE+0.2 mg Se	SEM	P-Value
*Final weight (g)	2066.87[b]	2136.38[b]	2175.09[b]	2220.20[b]	2467.03[a]	40.28	0.0010
Live-weight (g)	2071.67[b]	2200.00[b]	2283.33[b]	2300.00[a]	2416.67[a]	36.84	0.0130
Dressing (%)	65.48[c]	66.77[c]	69.61[b]	71.28[b]	76.54[a]	1.13	<0.0001
Cut up part (%)							
Head	2.37	2.16	2.31	2.24	2.12	0.04	0.2720
Neck	3.72	3.43	3.16	3.46	3.43	0.11	0.7010
Thigh	11.23[b]	10.88[b]	11.56[b]	11.42[b]	12.26[a]	0.15	0.0320
Drumstick	9.80[b]	10.83[b]	10.59[b]	10.87[b]	11.24[a]	0.19	0.0049
Shank	4.61	4.32	4.27	4.52	4.30	0.18	0.6080
Back	11.74	12.51	13.66	12.23	12.72	0.26	0.1770
Wings	6.34	6.27	6.44	6.78	6.94	0.09	0.0730
Breast	21.41[b]	21.40[b]	22.80[b]	24.43[a]	25.19[a]	0.55	0.0049
Organs (%)							
Liver	2.09	1.96	2.07	2.40	1.83	0.08	0.2420
Spleen	0.11	0.11	0.10	0.14	0.09	0.12	0.7730
Empty gizzard	1.66	1.69	1.52	1.66	1.67	0.04	0.7360
Lungs	0.59	0.61	0.62	0.69	0.53	0.03	0.6710
Heart	0.51	0.46	0.49	0.52	0.44	0.01	0.4230

[a,b,c] :values in same row not sharing a common superscript are significant different ($p<0.005$)
SEM: Standard Error of Mean *: Average final treatment weight of birds at 7 weeks of age

All sensorial parameters of meat excised from broiler chicken were significantly influenced by VE+Se supplementation except colour, saltiness and overall acceptability profile of the meat (Table 3). Juiciness was lowest in 100 mg VE + 0.05 mg Se diet with increase as the level of supplementation increased. Meaty flavour and tenderness (6.71, 7.05) was highest from meat sampled from birds fed diet containing the highest supplementation of VE+Se while overall flavour was lowest from diets of 100 mg Ve + 0.05mg Se and 200mg VE+ 0.10mg Se. The result of the current study affirms the report of Zdanowska-Sasiadek *et al.* (2016) that the addition of dietary vitamin E resulted in high pH, low cooking loss and better sensory quality of fresh breast meat. Therefore, the ability of both vitamin E and selenium in inhibiting oxidative processes will cause a reduction in the degree of oxidation products generated which is capable of

deteriorating the quality of meat by imposing negative effects on sensory attributes (Kennedy *et al*., 2005) of meat. Juiciness is an important contributor to eating-quality of meat (Lyon *et al*., 2004) and it is influenced by the WHC of such meat sample. The numerical increase in the WHC in the VE+Se fed birds may account for the perception of the meat samples by assessors. Water-holding capacity (WHC) and water absorption capacity (WAC) were not influenced by dietary supplementation of VE+Se. However, WHC values in the VE+Se supplemented groups were numerically higher compared to the control group with the highest value of WHC (35.11%) recorded in meat excised from birds fed diet supplemented with 400 mg VE+0.2 mg Se. A similar trend was observed in WAC with numerically least value observed from the control group (Table 3). Water holding capacity reveals the extent of drip loss in meat. A low water holding capacity in muscles can increase the liquid outflow and lead to loss of soluble nutrients and flavour (Otto *et al*., 2004) and inadvertently resulting in depression in quality of meat. The water holding capacity, therefore determines the quality of meat perceived by a consumer by affecting the sensory quality and influencing its usability for processing. In this study, higher water holding capacity recorded was due to the concentrations of VE+Se. The higher concentration of VE+Se in diet could result in higher deposition of VE and Se in meat, protecting the integrity of cell membranes by reducing the oxidative changes in the membrane lipids (Li *et al.,* 2009). As a result, membranes remain intact longer, reducing the leakage of sarcoplasmic fluid into the extracellular spaces and maintaining cell integrity, thereby improving water holding capacity of meat in chicken. The numerically higher WHC of the meat in VE+Se supplemented group is a good indicator that the meat has high juiciness as observed in the sensorial analysis. This research is suggestive that VE+Se supplementation has a beneficial effect on the quality of meat (Juiciness, meaty flavour, overall flavour) and in combination with selenium, may be more effective in improving the antioxidative defence system of cells and tissues, as the protective effect of *a*-tocopherol against oxidation and its concomitant influence on sensory attributes of the meat is dependent on the dietary level added into the diet.

Table 3: Effects of VE+Se on Sensorial profile, WHC and WAC of meat

Parameter	Control (0mg)	100mg VE+0.05 mg Se	200mg VE+0.1 mg Se	300mg VE+0.15 mg Se	400mg VE+0.2 mg Se	SEM	P-Value
Colour	6.05	5.62	5.90	6.00	6.14	0.10	0.5600
Juiciness	6.48^{a}	5.05^{c}	5.52^{b}	6.29^{a}	6.95^{a}	0.17	0.0010
Meaty flavour	6.14^{b}	5.10^{c}	5.43^{c}	6.14^{b}	6.71^{a}	0.15	0.0060
Tenderness	6.71^{b}	5.71^{c}	5.76^{c}	6.52^{b}	7.05^{a}	0.13	0.0010
Saltiness	6.05	5.48	5.90	5.95	6.29	0.12	0.2990
Overall flavour	6.52^{a}	5.67^{b}	5.95^{b}	6.52^{a}	7.10^{a}	0.15	0.0270
Overall acceptability	6.61	5.56	6.61	6.50	6.78	0.16	0.1150
WHC	31.78	34.22	33.11	30.89	35.11	0.66	0.2520
WAC	44.04	45.92	62.43	47.11	54.59	2.99	0.2830

$^{a, b, c;}$ Values in a row not sharing a common superscript are significantly different (P<0.05).
SEM: Standard Error of Mean.

The dietary supplementation of VE+Se was not significant ($p>0.05$) on all colour intensities of anterior section of meat (Table 4) except b* (yellowness). Yellow (b*) intensity was highest from 100 mg VE+0.05 mg Se and 400 mg VE+0.2 mg Se group. Although, the expression of yellowness did not follow any trend, it however agrees with Miezeliene *et al*., (2011) who noticed an upsurge in yellowness (b*) with increased supplementation of Se from 0.15 to 0.5 mg with basal VE of 40 mg, but divergent to Kim *et al* (2010). Using a lightness (L) value of 53 as a cut-off to make distinction between pale and normal poultry meat as Castromán *et al*., (2013) all samples in the current study were within normal range with values for 400 mg VE+0.2 mg Se group numerically lower compared to other groups (Table 4).

Values for L, a, b and L* intensities of breast meat were significantly influenced by the dietary supplementation of VE+Se in diets (Table 4). All significant parameters did not follow any particular pattern. Least values for L and L* (lightness) (49.38, 56.44) intensities were observed from the control group with meat from other VE+Se supplemented groups lighter in colour. A higher a (redness) intensity was observed in the control group while least and statistically similar intensities were observed in VE+Se treatment groups (Table 4). Meat colour is the foremost and primary criterion used to ascertain the quality and acceptability of meat by consumers (Mancini and Hunt, 2005). Poultry meat has been classified as white because of its pink colour, therefore the sorting of its colour parameter ratio to establish nicotinamide haemochrome (pink colour defect). Sole and combined usage of VE and Se by Kim *et al*. (2010) and Ryu *et al*. (2005) revealed no effect on meat surface colour; this is contrary to observations in the current study which resulted in increased lightness and decreased redness intensities. The observed changes in some colour intensities negates the report of Miezeliene *et al*., (2011) who detected a decreased lightness (L*), and increased redness (a*) and yellowness (b*) intensities as a direct consequence of supplementation with Se. The meat colour intensities observed may be due to the synergistic effect of both vitamin E and selenium as the supra-nutritional dietary levels of sole vitamin E has been revealed to improve and positively affect WHC and coloration of meat (Jensen *et al*., 1998). An increasing supplementation of vitamin E above recommended levels has been documented to improve the meat quality by decreasing the oxidation of lipids in the muscle resulting in the discoloration (lightness) of the meat by delaying the oxidation of myoglobin (Salami *et al.,*2015; Bellés *et al.,* 2018). The lightness range in the current study anterior (L: 49.73 - 53.65) and posterior (49.38-55.42) fell within the range (L=53-57) reported by Castromán *et al.* (2013) and lower than the Lightness limit (60) used by Van Laack *et al*., (2000) for pale poultry breast meat. Comparison between the colour intensity of the anterior to the posterior section of the meat shows a reduction in redness and yellowness in the latter in all groups, reduction in lightness in the control but with an increase in the VE+Se supplemented groups. Since most perception of appearance is based on the anterior, colour intensities observed will influence consumer preferences.

Table 4: Effect of Dietary Supplementation of Vitamin E on Colour of Breast Meat of Broiler Chicken

Parameter	Control (0mg)	100mg VE+0.05 mg Se	200mg VE+0.1 mg Se	300mg VE+0.15 mg Se	400mg VE+0.2m g Se	SEM	P-Value
Anterior Section							
L	50.69	53.65	50.12	52.29	49.73	0.65	0.30
a	13.42	13.96	13.47	10.53	11.26	0.52	0.12
b	7.39	10.02	8.04	6.96	9.69	0.43	0.06
L*	57.74	60.52	57.19	59.29	56.80	0.62	0.30
a*	15.28	15.62	15.39	11.99	12.99	0.57	0.14
b*	9.57^{c}	12.95^{a}	10.48^{b}	8.81^{c}	12.93^{a}	0.58	0.04
Posterior Section							
L	49.38^{c}	54.53^{ab}	50.26^{bc}	55.42^{a}	53.05^{abc}	0.71	0.0079
a	13.92^{a}	11.27^{b}	11.45^{b}	10.10^{b}	10.98^{b}	0.38	0.0080
b	6.68	5.87	5.51	6.97	5.80	0.25	0.3070
L*	56.44^{c}	61.42^{a}	57.33^{b}	62.26^{a}	60.01^{a}	0.68	0.0023
a*	15.92^{a}	12.66^{b}	13.16^{b}	11.33^{b}	12.44^{b}	0.57	0.0020
b*	8.76	7.22	6.98	8.39	7.20	0.34	0.3625

$^{a,\ b,c}$ Means not followed by the same superscript are significantly different ($P<0.05$) along the row
SEM: Standard Error of mean

The supplementation of VE+Se had no significant ($p>0.05$) effect on proximate composition of meat (Table 5). This result is consistent with Körösi-Molnar *et al.* (2004) who found no substantial impact of selenium or vitamin E on protein and ash content fractions. So also is Ševčikova *et al.*, (2006) on crude protein and fat when different selenium sources were fed in diets to broiler chickens. Tayeb and Qader (2012) reported a positive effect of combination of vitamin E and selenium on chemical composition in breast meat (protein percentage), however, the range of values obtained in the study except 300 mg VE+0.15 mg Se were within the range reported (22.18 - 23.44).

Table 5: Proximate composition of breast meat from broiler chickens fed diets containing supplemented with VE+Se

Parameter (%)	Control (0mg)	100mg VE+0.05mg Se	200mg VE+0.1mg Se	300mg VE+0.15mg Se	400mg VE+0.2mg Se	SEM	P-Value
Dry Matter	25.75	25.24	25.88	23.84	24.40	0.55	0.8240
Ether extract	2.55	2.44	2.50	2.28	2.40	0.06	0.7390
Ash	0.71	0.70	0.71	0.57	0.62	0.03	0.6940
Crude Protein	22.50	22.11	22.68	20.99	21.43	0.46	0.8400

SEM – Standard Error of Mean

CONCLUSION

In conclusion, supplementation of extra dietary vitamin E and selenium up to 400 mg Vitamin E+ 0.2 mg Selenium in poultry diets has been shown to improve prime cuts (thigh, breast and drumstick); improve consumer perception through improved sensorial attributes (juiciness, meaty flavour, tenderness, overall flavour) of meat and also influence meat colour intensity (L, a, L*, a*, b*) However, supplementation with VE+Se did not have additional effect on meat proximate composition.

AUTHORS CONTRIBUTION

This work was financed by all authors indicated. This study was concepted and carried out under the advice and guidance of Ekunseitan D.A. and Ekunseitan, O.F. The field-work was carried out by Alagbada I.M. Asa J.O. and Alao, O.A. (undergraduate students). Data compilation, statistical analysis and manuscript revision was done by Ekunseitan D.A., Ekunseitan O.F. and Adegun W.O. Laboratory analysis was conducted and supervised by Ekunseitan O.F. and Ekunseitan D.A. All authors read and approved the final manuscript.

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