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EFFECT OF GRADED LEVELS OF OREGANO POWDER (*Origanum Vulgare*) ON MEAT QUALITY OF BROILER CHICKENS

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ABSTRACT

This research evaluated the effect of feeding varying levels of Oregano powder (OP) (Origanum vulgare) on physico-chemical properties of broiler chicken meat. Two hundred broiler chicks (n=200) were allocated randomly to four (4) dietary treatments. The dried oregano leaves were ground into a fine form, milled and incorporated into the ration. Each treatment consisted of varying levels of OP as 0, 15, 20 and 25g/100kg representing treatments T1, T2, T3 and T4 respectively. Broiler chickens were fed the experimental feed for 49 days, at the end of which five (5) birds per replicate were sacrificed and evaluated for physico-chemical properties. The mean values of physico-chemical properties (cooking loss, drip loss, colour, pH and density) didn't vary significantly among all the treatments. It was concluded that Oregano powder inclusion at 0, 15, 20 and 25g/100kg in the diets of broiler chicken did not have any significant effects on meat quality evaluated.

Keywords: broiler chickens, chemical, physical, phytochemicals

INTRODUCTION

The place of poultry in the livestock sector cannot be underestimated in the socio-economic sectors of developing countries, Nigeria inclusive. Thus, for any nation to attain food security in relation to protein consumption, broiler birds are good converters of feed and reach marketable size within a short period of production cycle and the return to investment is considered good compared to other types of livestock (Ojo, 2003).

The use of antibiotics over the years as growth promoters in poultry production has been associated with the fast-growing nature and short generation interval of broiler chickens for the improvement of the final product (meat) (Puvača *et al.*, 2013). Generally, poultry farmers use antibiotics to protect the health of poultry birds and promote growth. Nevertheless, the appearance of the residue-resistant strain of bacteria has arisen into a controversial issue worldwide being a threat to consumers' health and wellbeing (Toghyani *et al.*, 2011). The misuse and overuse of antibiotics are accelerating this process; thus, the complete removal of the antibiotics would have a greater impact on the industry without replacing them with phytobiotic alternatives such as *Origanum vulgare* (Shareef *et al.*, 2009).

In recent years, researchers have demonstrated the application of *Origanum vulgare* as antioxidant, antiproliferative, antimicrobial, antispasmodic, anti-inflammatory, neuroprotective and antiviral (Zhang *et al.*, 2014; Goncearіuc *et al.*, 2015; Gîrd *et al.*, 2016; Elshafie *et al.*, 2017; Cheng *et al.*, 2018; Dutra *et al.*, 2019).

Consequently, there was global interest in this plant from nutritionists and scientists as a feed additive. Therefore, the present study investigates the effect of feeding varying levels of Oregano powder (OP) on physico-chemical properties (cooking loss, drip loss, colour, pH and density) of broiler chicken meat.

MATERIALS AND METHODS

The Study Area

The present study was conducted at the Department of Animal Science research farm, located at the Faculty of Agriculture, Usmanu Danfodiyo University, Sokoto, Nigeria. The research site is located between latitude 11^0 $30^{'}$ -13^0 $50^{'}$ N and longitude 4^0 $0^{'}$-6^0 $40^{'}$ E. Sokoto state lies at an altitude of 350m above sea level and rainfall of about 760mm per annum being in Sokoto is located in the semi-arid region of Nigeria. It has a temperature range of 35-40^{o}C and scanty vegetation (Mamman *et al.*, 2000).

Experimental Design

This study employed the use of a Completely Randomized Design (CRD), using two hundred (200) broiler chickens comprising four (4) treatments (50 birds per treatment), replicated five (5) times (10 birds/replicate). Treatment 1 (T1) contained 0g/100Kg of Oregano Powder (OP), while

treatment 2 (T2), treatment 3 (T3) and treatment 4 (T4) contained 15g/100Kg, 20g/100Kg, and 25g/100kg OP, respectively.

Experimental Birds and Their Management

The birds were sourced from a reputable company in Nigeria. Prior to the arrival of the birds, the house was cleaned, washed and disinfected according to the recommended practices. The experimental chickens were vaccinated against Gumboro and Newcastle diseases as when due. Similarly, adequate floor spacing and sanitation are maintained (Oluyemi and Roberts, 2000). The tropical house type (Deep litter) with open sidewalls and concrete floor was used to raise the birds. Feed and clean fresh water were given *ad libitum.*

Experimental Diets

Four (4) Iso-nitrogenous and Iso-caloric diets were formulated both at the starter phase and the finisher phase and fed to the experimental broiler chickens for seven (7) weeks (Table 1). However, Oregano powder was added over the top as an additive (above 100%) at 15g/100Kg OP, 20g/100Kg OP, and 25g/100Kg in treatments 2, 3 and 4 respectively while treatment 1 served as the control diet with no (0%) OP.

Table 1: Gross and Calculated Chemical Composition of Starter and Finisher Diets

Ingredients (Kg)	**STARTER**	**FINISHER**
Maize	53.5	50.5
SBM	14.0	15.0
GNC	15.0	13.0
Fish meal	2.0	2.0
Wheat Offal	11.0	12.0
Limestone	2.0	5.4
Bone meal	1.5	3.0
Minerals and Vitamins Premix	0.25	0.25
Salt	0.25	0.25
Methionine	0.25	0.25
Lysine	0.25	0.3
Total	**100Kg**	**100Kg**
Crude Protein	21 %	19 %
Energy (Kcal/Kg)	3000	2800
Methionine	0.5	0.5
Lysine	1.0	1.0
Calcium	1.3	2.8
Phosphorus (Available)	0.5	0.7
Crude Fibre (%)	5.3	5.5

* T1 = Diet + 0g Oregano Powder T2 = Diet + 15g Oregano Powder T3 = Diet + 20g Oregano Powder T4 = Diet + 25g Oregano Powder

SBM = Soya Bean Meal GNC= Ground Nut Cake

Sampling and sample size

A stratified sampling method was used to select five (5) birds per replicate, making 25 birds per treatment and a total of one hundred (100) birds from the four treatments. The sampled birds were left with drinking water but starved of feed for 8 hours to obtain fasted weight. Birds were weighed and slaughtered by severing the jugular vein closest to the head. The birds were hoisted for about 10 minutes to obtain the bled weight, defeathered and eviscerated. Samples from breast muscles were taken and stored at -18^{O}C for subsequent quality evaluation.

Data Collection

Data on meat quality parameters was collected at the end of the growth period (7 weeks) according to the treatment groups. The aqueous extracts of Oregano powder were analyzed qualitatively using standard procedures to identify the constituents according to El-Olemy *et al.* (1994).

Drip loss

Twenty (20) grams of fresh meat samples were collected from the breast muscle, weighed and sealed. The samples were kept for 24 hours at 4^{0}C. The paper towels were used to dry the samples and weighed. Drip loss was calculated using the below formula.

$$\text{Drip loss} = \frac{\text{weight of fresh sample} - \text{weight after chilling}}{\text{Weight of fresh sample}} \times 100$$

Cooking loss (%)

Twenty (20) grams of fresh meat samples were collected from the breast muscle. The samples were cooked in a water bath at 85^{0}C for 10 min using vacuum-packaged technology in non-permeable polyethylene bags. The samples resulted in a core temperature of about 75^{0}C, removed, and cooled for 15 minutes at room temperature. The samples were blotted dry using paper towels and weighed. The cooking loss was calculated using the below formula.

$$\text{Cooking loss} = \frac{Weight\ of\ uncooked\ sample - Weight\ of\ cooked\ sample}{weight\ of\ uncooked\ sample} \times 100$$

Colour

The colour of the meat was determined using U/V visible spectrophotometer at 500nm. The absorbance of the meat sample was used to measure the intensity of the redness.

Density

Density was determined as mass per unit volume of the samples. The volume of the 5g samples of meat was measured with a graduated test tube and the density was computed using a mathematical relationship; D=M/V
Where D= density
M= mass
V= volume

pH

The procedure described by Garba *et al.* (2019) was used to measure pH. Briefly, 20g of meat samples were blended with de-ionized water using an electric blender until an aqueous mixture was achieved. 20 ml of the mixture was measured in a graduated test tube and the electrode of the pH meter was immersed into the test tube for 5 minutes until a stable pH reading was achieved.

Data analysis

Data on meat quality parameters were analyzed using the General Linear Model procedure of the Statistical Analysis System (SAS, 2007) and the P-value was set at $p < 0.05$.

RESULTS AND DISCUSSION

Phytochemical Constituents of Oregano (*Oreganum vulgare*)

Analysis of Oregano indicated the presence of about 10 phytochemical constituents as shown in (Table 2). Phytochemical constituents are bioactive chemicals that are naturally present in plants and the most important property of phytochemicals is their role as antioxidants. The results of the present study are similar to those reported by Prathyusha *et al*. (2009) and Veni & Neeru (2013) who indicated the presence of the phytochemicals constituents found in this study. This, corroborates that Oregano is a potential source of phytochemicals and an efficient alternative to antibiotics (Giannenas *et al.,* 2003; Zhang *et al.,* 2014; Silva *et al.,* 2015; Dutra *et al.,* 2019; Khan *et al.,* 2019).

Table 2: Qualitative constituents of oregano powder

Phyto-chemical	Result
Flavonoids	+++
Tannins	++
Saponins	+++
Glycosides	++
Alkalids	+
Cardiac glycosides	++
Steroids	++
Saponin glycosides	++
Balsams	++
Volatile oils	+
Anthraquinones	ND

Key: ND= Not detected; + = Trace; ++= Moderate; +++ = Concentrated

Physico-chemical Property

The Physico-chemical properties examined are pH, densiity, colour (absorbance), colour (concentration), drip loss and cooking loss and the results of this study indicated no significant difference in the meat quality parameters measured (Table 3).

Table 3**:** Physico-chemical characteristics of broiler chicken meat as affected by graded levels of Oregano powder.

	OP Inclusion level (g/100kg)				
Physico-chemical Property	**0**	**15**	**20**	**25**	**SEM**
Colour Absorbance (nm)	1.999	1.993	1.992	1.998	0.013
Colour Concentration (nm)	1999	1993	1992	1992	0.037
Cooking Loss (%)	6.36	5.54	5.96	5.90	0.191
Drip Loss (%)	0.83	0.73	1.03	1.27	0.115
Density (g/cm^3)	0.92	0.87	0.83	0.82	0.037
pH	5.27	5.40	5.20	5.37	0.084

Colour

The absence of difference in color absorbance and colour concentration, among the treatments might be attributed to similarity in factors (pH, muscle type, myoglobin pigment concentration, etc.) which were reported by earlier studies (Faustman & Cassens, 1990; Suman & Joseph, 2013; Calnan *et al.,* 2014). Similarly, the findings of Chang *et al.* (2017) indicated no dietary effect on the meat quality of broiler chicken fed Oregano powder.

Cooking loss

There was no significant difference ($p > 0.05$) in the cooking loss of broiler meat analysed. The cooking

yield of meat is dependent on its water-holding capacity which will determine the extent of cooking loss among other factors. The lower the cooking loss, the better when it comes to higher yield per unit cut. The findings of the present study showed that cooking loss was not influenced by the inclusion level of graded levels of Oregano powder and is consistent with the findings of Chang *et al.* (2017) where no dietary effect was observed on meat quality of broiler chicks fed Oregano powder.

Drip loss

The result of this study showed no significant difference ($p > 0.05$) in drip loss was recorded when Oregano powder was fed to a broiler. The significance of drip loss due to its economical can never be over-emphasized as meat with low water holding capacity results in higher drip loss and thereby reduces product yield (Lawrie, 1974). Thus, meat with higher drip loss decreases meat juiciness and tenderness. Consequently, decreasing consumers' demand for it. This is in agreement with the earlier findings of Chang *et al.* (2017) which observed no dietary effect on carcass yield and meat quality of broiler chicken meat fed Oregano powder.

pH

The pH values recorded in this study showed no significant differences were recorded between treatments ($p > 0.05$). The ultimate pH of the meat observed in this study ranged from 5.19 to 5.40. A decline in pH is one of the major postmortem changes that occur during the conversion of muscle to meat. The pH of meat influences the quality of the fresh meat and its products (Osório and Osório, 2000). In addition, various meat parameters (shear force, purge, cooking loss and tenderness) and sensory meat attributes (color, smell, taste, succulence and tenderness) (Bressan *et al.*, 2001).

The present findings are in disagreement with earlier findings of Puvača *et al.* (2015). However, it is consistent with the reports of Chang *et al.* (2017) where Oregano powder has no significant effects on pH of broiler chicks.

Density

Treatments did not differ on the density of the meat samples of broilers fed Oregano powder ($p > 0.05$). The density of the body only depends on its weight, amount of material accumulated and composition (Chiral *et al.*, 2007). Consequently, there were no significant differences between all the treatments in terms of density. This may imply that the sums of their respective components are similar in mass. Thus, this may be a result of non-significance differences among the treatments in terms of their water-holding capacity which is directly related to muscle fibre density of the meats.

CONCLUSIONS

In conclusion, the findings of the present study showed that the inclusion of graded levels (15g, 20g, and 25g per 100kg) of Oregano powder indicated that all physico-chemical meat properties were not adversely affected. Therefore, earlier studies and the present study suggested that Oregano powder inclusion in the diets of broiler chicken as phytobiotics did not have any effects on the meat quality of briler chickens.

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