

Evaluation of Oregano (*Origanum vulgare*) Leaf Powder on Performance Indices of Finisher Broiler Chickens in Sokoto, Nigeria

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Abstract: The study was conducted to evaluate the effects of graded levels of Oregano leaf powder on growth performance of broiler chickens in Sokoto, Northwestern Nigeria. Using Completely Randomised Design (CRD), a total of 300-day old broiler chicks were randomly allocated to four treatment groups consisting of 75 birds in each group. Each treatment was then sub-divided into 5 replicates consisting of 15 birds per replicate. T1, (15g Oregano), T2 (20g Oregano) T3 (25g Oregano) and T4 (0g Oregano) served as the control. The experiment lasted for 49 days. The air-dried Oregano leaves were processed into powder and its qualitative phytochemical composition was determined. Analysis the presence of Flavonoids and saponins in concentrated amounts, Tannins, Glycosides, Cardiac glycosides, Steroids, Saponin glycosides and Balsams in moderate amounts while Alkaloids and Volatile oils are in trace amounts. Anthraquinones were however not detected. Feed intake (FI), Body weight (BW), Body weight gain (BWG), Feed conversion ratio (FCR) and Mortality (M) were monitored. Results showed that FI, BW and BWG were significantly ($p < 0.05$) influenced by inclusion level of Oregano powder among treatments compared with the control during all the experimental periods. Both during the starter (0-4weeks) and the finisher phase (5-7weeks) the inclusion of Oregano powder significantly ($p > 0.05$) improved feed conversion ratio. The inclusion of 20g Oregano powder significantly ($p > 0.05$) improved the LW, KW, PW and DW of the experimental broiler chickens. Primal cut and organs were also significantly ($p > 0.05$) influenced by treatment levels and was better in T2. Oregano powder supplementation at 20g/100kg diets improved performance and its therefore recommended that, farmers should produce their chickens without antibiotics by using Oregano powder.

Keywords: Evaluation, Oregano leaf powder, *Origanum vulgare*, performance, Broiler, Chickens

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INTRODUCTION

Poultry farming is the raising of domesticated birds such as chickens, ducks, turkeys, geese etc, for the purpose of farming meat or eggs for food. Poultry are raised in great numbers, with chickens being the most numerous and predominant (Deeb and Aman, 2002). Poultry production has been recognized as an important enterprise in economies of developing countries. Its role in improving the nutritional status and incomes of many small farmers and landless communities has been recognized by various scholars and rural development agencies (Bembridge, 1988; FAO, 2006). The poultry industry has assumed greater importance in providing employment opportunities and animal food production in Nigeria (Mbanasor, 2002).

In Nigeria, poultry industry is fast growing as the demand for chicken products is increasing. It was reported that about 10% of Nigerian population is engaged in poultry production of varying farm sizes and it is one of the avenues that can be explored for poverty alleviation and eradication (NCERD, 2000). In recent decades, there is a significant progress in genetic selection of fast-growing meat-type chickens (Abioja, 2010) which has led to the production of broiler chickens that will weigh over 2.0kg at six weeks of age with 3.5kg of a balanced diet compared with 2kg body weight in fourteen weeks of age with 10kg feed consumed in the 1930s (Abioja, 2010). Smith *et al.*, (2001) reported that, most of the present day improved strains of chickens were introduced from the temperate regions to the tropics.

Broiler chickens are raised annually as a source of food, for both their meat and their eggs (Deeb *et al.*, 2002). Broilers are a type of chicken (apart from cockerels and layers) kept for meat production and by implication a source of protein (FAO, 2006). They are young chickens suitable for broiling or roasting at about 6-7 weeks of age. Broiler production is carried out in all parts of the country, with no known religious, social or cultural inhibitions associated with their consumption. In Nigeria, poultry contributes about 15% of the total annual protein intake with approximately 1.3kg of poultry products consumed per head per annum (Ologbon and Ambali, 2012). Specifically, investment in broiler enterprises is attractive because the production cost per unit is low relative to other types of livestock. Poultry meat is very tender and commonly used in ceremonies compared to other birds and broiler enterprises have short production circle (FAO, 2006). Owing to these obvious advantages of broiler enterprises, large number of farmers, men and women go into their production, many of whom do so for income generation purposes (Nwajiuba and Nwoke, 2000). Besides meeting the protein needs of the household, the importance of poultry to national economy cannot be over emphasized as it has become popular for the small-holders that have contributed to the economy of the country (FAO, 2006).

Oregano (*Oreganum vulgare*) is a natural herb that has been cultivated for centuries in the Mediterranean region, although now it can be found in most continents (Kintzios, 2012). Oregano is natural herbs, less toxic, residue free feed supplement for poultry when compared to other synthetic ingredients. It contains key bioactive components that include carvacrol and thymol. Besides being used as condiments to flavor foods, oregano has been attributed to other properties such as antioxidant, anti-inflammatory, and antimicrobial. These properties are related to the presence of various types of phytochemicals such as phenolic compounds, flavonoids, and terpenoids among others (Baratta *et al.*, 1998; Loizzo *et al.*, 2009; Kogiannou *et al.*, 2013.).

Despite the many importance of broiler chicken, using antibiotics for prevention treatment of diseases remains a major problem, because of increasing concern regarding antibiotic-resistant bacteria. Their use in animal and poultry feed has been banned in several countries and is under significant public scrutiny in other countries. Consequently, the poultry industry may be adversely affected by disease challenge and loss of production as a result of those restrictions (Falco *et al.*, 2013). Presently, there is a greater concern in the accumulation of antibiotic residues in animal products and in the environment. This situation also required most countries in the world to ban or limit the use of antibiotics in poultry feeds and launched the "antibiotic-free" labeled feeds (Taha *et al.*, 2003; Lee *et al.*, 2004). Wierup, (2001), reported that, removal of antibiotics as growth promoters will lead to reduced growth performance and feed efficiency as well as increase the incidences of certain animal diseases. This negatively affects the poultry sector and feed industries. This drives to search for other alternatives.

Several studies have been reported on the use of oregano and other plant extracts in the diet of broiler chicken (Hashemi and Davoodi, 2010). Study by Taylor *et al.*, (2017) investigated effect of dietary supplementation of oregano on growth performance, antioxidant status and meat quality of broiler chicks. Studies by Ahmad *et al.*, (2010) worked on effect of inclusion levels and source of oregano leaf in starter diet for broiler chicks. Amir *et al.*, (2011) conducted their research on performance, cecal microflora and serum antioxidant activity of broiler chickens fed dietary oregano essential oil. Liliana and Michial (2014) work on effects of oreganum chemotypes on broiler intestinal bacteria. However, Antonia and Andrea (2007) conducted their research effect of oregano on *Staphylococcus aureus* and *Staphylococcus epidermis*.

Although oregano has shown high potential from its chemical nature to improve animal health and growth so far, there is dearth of information on the utilization of oregano as broiler feed additive in Nigeria. The findings of this research will serve as a base for other works on natural alternatives to antibiotics and research in Nigeria.

Consumers will have best poultry meat free from drug residues, bacteria causing food toxicity and contaminants, ensuring consumer high quality product. To the poultry farmers, the research could provide useful information on the use of natural alternatives as substitute to antibiotics.

The previous research mainly concentrated on effects of oregano powder on a few specific physiological parameters and few studies about meat quality have been conducted so far to decide on the commercial value of the meat production. Therefore, the present study will be conducted to examine the effects of different levels of oregano on growth and health performance of broiler chickens. The main aim of this research is to evaluate the effect of graded levels of Oregano on general performance of broiler chickens while the specific objectives are to evaluate effect of using graded levels of Oregano on the growth performance of broiler chickens in the finisher phase.

MATERIALS AND METHOD

Experimental Site

This study was conducted at the Poultry unit of the Teaching and Research Farm of the Department of Animal Science, Faculty of Agriculture, Usmanu Danfodiyo University, Sokoto, located at the Sokoto State Veterinary Clinic, along Aliyu Jedo Road, Sokoto.

Housing Preparation

The house was cleaned, washed and disinfected a week to the arrival of the birds. The birds were managed on deep litter in tropical house type, with open side walls and concrete floor. Litter materials (wood shavings and old newspaper) were spread on the floor, feeding trays and small drinkers were used for the first 0-4 weeks (starter phase), while conical feeders and plastic containers with wire guard were used at finishing phase. Heat sources were provided using charcoal. The floor spacing was maintained to accommodate the birds in each replicate to avoid variation in size and growth.

Experimental Design

Using completely randomized design (CRD), a total of 300 day-old broiler chicks purchased from a reputable hatchery for this experiment. The chicks were divided into 4 treatment groups consisting of 75 birds per treatment. Each treatment was replicated 5 times with 15 birds per replicate. Treatments 1, 2 and 3 were added Oregano leaf powder over the top at 15, 20, and 25g in every 100kg of the feed, while treatment 4 served as the control with 0g oregano leaf powder but on conventional antibiotics.

Experimental Birds and their Management

Sourcing of Experimental Birds

Day old chicks for this study were purchased from Agrited in Ibadan, Oyo State, Nigeria. The birds were transported to Sokoto under the cool hours of the evening through the night to arrive in the cool morning hours. Feed was given to the birds at free choice (ad libitum) on tray feeders for the first 4 days and the tray feeders were replaced with small conical feeders for proper feed management and efficiency. Fresh water was given to the birds every morning and evening in small drinkers. Their health care was ensured through strict hygiene and biosecurity. The floor spacing was maintained to accommodate the birds in each replicate to avoid variation in size and growth. (4/9ft) per replicate (Oluyemi and Roberts, 2000).

Experimental Diets Formulation

Sourcing and Processing of Oregano

Air dried Oregano leaves were purchased from Sokoto Central Market. The dried Oregano leaves was finely ground and sieved into fine powder under protected condition manually and stored in polythene bags until required for the formulation of experimental diets.

Phytochemical Analyses of Oregano

Sample of Oregano powder (20g) was taken to the research Laboratory of the Biochemistry Department, Faculty of Science, Usmanu Danfodyo University for phytochemical Analyses.

Sourcing and Processing of Feed Ingredients

Maize, wheat offal, bone meal, fish meal and salt were obtained from Sokoto Central Market. Soya bean meal, Groundnut cake, limestone and micro ingredients such as Premix, Lysine, Methionine were sourced from a Feed supply vendor called Alkanci Farm Ltd in Sokoto Metropolis. Feed ingredients such as Maize, Groundnut cake (GNC), Soya bean meal and Bone meal were milled to the particle size that will suit the birds. Other feed ingredients that are in most cases in powdery form were weighed and mixed with the crushed ones.

Experimental Diets Formulation

Using a computer application, finisher diets for this experiment targeting 2800Kcal/kgME and 19%CP was formulated for the finisher phase as specified in Table 1. All experimental diets were isonitrogenous and isocaloric varying only in graded levels of Oregano powder added over the top.

Table 1: Gross and Calculated Chemical Composition of Experimental Broiler Finisher Diet

Ingredients	Treatment 1 Oreg. (15g)	Treatment 2 Oreg. (20g)	Treatment 3 Oreg. (25g)	Treatment 4 Control
Maize	50.5	50.5	50.5	50.5
Soya beans meal	15.0	15.0	15.0	15.0
Groundnut cake	13.0	13.0	13.0	13.0
Wheat offal	12.0	12.0	12.0	12.0
Limestone	5.40	5.40	5.40	5.40
Bone meal	3.0	3.0	3.0	3.0
Premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Lysine	0.30	0.30	0.30	0.30
Total	100	100	100	100
Cost of Oreg.(N)	30	40	50	00
Total cost (N)	17,566	17,576	17,586	17,536
Calculated chemical composition				
Energy (Kcal/kgME)	2800	2800	2800	2800
Protein (%)	19	19	19	19
Lysine	1.0	1.0	1.0	1.0
Methionine	0.5	0.5	0.5	0.5
Calcium	2.8	2.8	2.8	1.8
Phosphorus(Av.)	0.7	0.7	0.7	0.7
Fibre (cf)	5.5	5.5	5.5	5.5

Experimental Diets Compounding

The selected ingredients were weighed according to bulk, spread on a clean, plain floor, heaped and leveled. Ingredients of the little quantities such as lysine, methionine, salt, oregano etc were weighed and mix alongside other ingredients such as limestone, bone meal etc, then sprinkled on the leveled heap. After this, the heap was mixed severally, turning and heaping to another side until a thorough and uniform mixture is obtained. The feed mash was then packed into feed bags for feeding the experimental birds.

Data Collection

Instrumentation

Some of the instruments used in the process of collecting data were feeders and drinkers of various sizes, lighting materials, heating materials, shovels, floor scrapers, buckets, digital scale, face mask, record book and pencil, polythene bags etc.

Data Recording

The following parameters were monitored and data collected was sorted and statistically analysed.

- Feed Intake (FI) (g/kg) = Feed given – Feed leftover
- Body Weight (BW) (g) = Current/ Final weight – Initial/ Previous weight
- Body Weight Gain (BWG) (g/kg) = Current/ Final weight – Initial/ Previous weight
- Feed Conversion Ratio (g:g) = by dividing weight gain (g) by the feed intake (g), expressed using the formula below
 - $FCR = \frac{\text{feed intake}}{\text{body weight gain}}$
- Mortality (%) = recorded as it occurred and expressed as percent of the population.

Sample and Sampling Procedure

All living birds in every replication and treatment were sampled for every parameter monitored.

Data Analyses

Data obtained from feed intake, body weight, weight gain, feed conversion ratio and carcass evaluation was subjected to Analysis of Variance (ANOVA) using Stat View Analytical computer package version 9.2 (SAS, 2007). Least significant difference (LSD) was used to compare the means.

RESULTS AND DISCUSSION

Results on the Phytochemical constituents of oregano and general performance carcass characteristics of the experimental broiler birds are presented in Tables 2 and 3.

Phytochemical constituents of Oregano (*Origanum vulgare*)

Result on the phytochemical constituents of Oregano powder is presented in Table 2.

Table 2: Qualitative constituents of Oregano powder

Qualitative phyto-chemical	Results
Flavonoids	+++
Tannins	++
Saponins	+++
Glycosides	++
Alkaloids	+
Cardiac glycosides	++
Steroids,	++
Saponin glycosides,	++
Balsams	++
Volatile oil	+
Anthraquinones	ND

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

Qualitative constituents of oregano powder

Qualitative analysis of the test ingredients indicated the presence of Flavonoids, tannins, saponins, glycosides, alkaloids, cardiac glycosides, steroids, saponin glycosides, balsam and volatile oil. There was moderate presence of tannins, glycosides, cardiac glycosides, steroids, saponin glycosides and balsam, adequate presence of flavonoids and saponins, trace presence of alkanoids and volatile oil were found in *Origanum vulgare* used for this study.

The phytochemical composition of the oregano used in this study is similar to the report of Veni and Neeru (2013) who indicated the presence of glycosides, steroids, tannings and flavonoids from Oregano. A research by Prathyush *et al.*, (2009), indicated the presence of the following phytochemicals, Alkaloids,

Saponins, Glycosides, Flavonoids, Tannins and Steroids. This implies that oregano is a potential source of phytochemicals most of which have been reported to represents an efficient alternative as an antimicrobial agent (Chouhan *et al.*, 2017), antifungal activity (Khan *et al.*, 2019), antioxidant activity (Ha'c-Szyma'nczuk *et al.*, 2018), ant parasitic activity (Giannenas *et al.*, 2003), anti-inflammatory activity (Silva *et al.*, 2012), beneficial activity on skin disorders (Avola *et al.*, 2020) and effects on melanin production (Sarikurkcuc, *et al.*, 2015).

Performance Characteristics at Finisher Phase

Results on the general performance of experimental broiler birds at finisher phase (5th-7th weeks) is presented in Table 3.

Table 3: General performance of experimental broiler chickens in the finisher phase

Parameter	Treatment 1 (15g Oreg.)	Treatment 2 (20g Oreg.)	Treatment 3 (25g Oreg.)	Treatment 4 (Control)	SEM\
AFIB	836.23 ^b	867.17 ^a	849.83 ^{ab}	861.00 ^{ab}	2.056
AFIBD	119.46 ^b	123.88 ^a	121.41 ^{ab}	123.00 ^{ab}	0.293
ABWB	1583.94 ^{bc}	1608.21 ^b	1483.97 ^d	1689.00 ^a	9.918
ABWBD	226.24 ^{bc}	229.74 ^b	211.99 ^d	241.28 ^a	1.414
ABWGB	873.72 ^{bc}	876.44 ^b	856.06 ^d	941.25 ^a	2.735
ABWGBD	124.82 ^{bc}	125.21 ^b	122.29 ^d	134.46 ^a	0.391
FCR	0.97 ^b	0.94 ^{ab}	1.01 ^{cd}	1.020 ^d	0.011
MORT	00	0	0	0	

Means with different superscript across the row are significantly different (P<0.05) AFIB =Average feed intake per bird, AFIBD =Average feed intake per bird per day, ABWB =Average body weight per bird, ABWBD=Average body weight per bird per day, BWGB= Body weight gain per bird, BWGBD = Body weight gain per bird per day, FCR=feed conversion ratio, MORT= mortality

Feed Intake (FI) (g)

Average feed intake per bird (AFIB) (g)

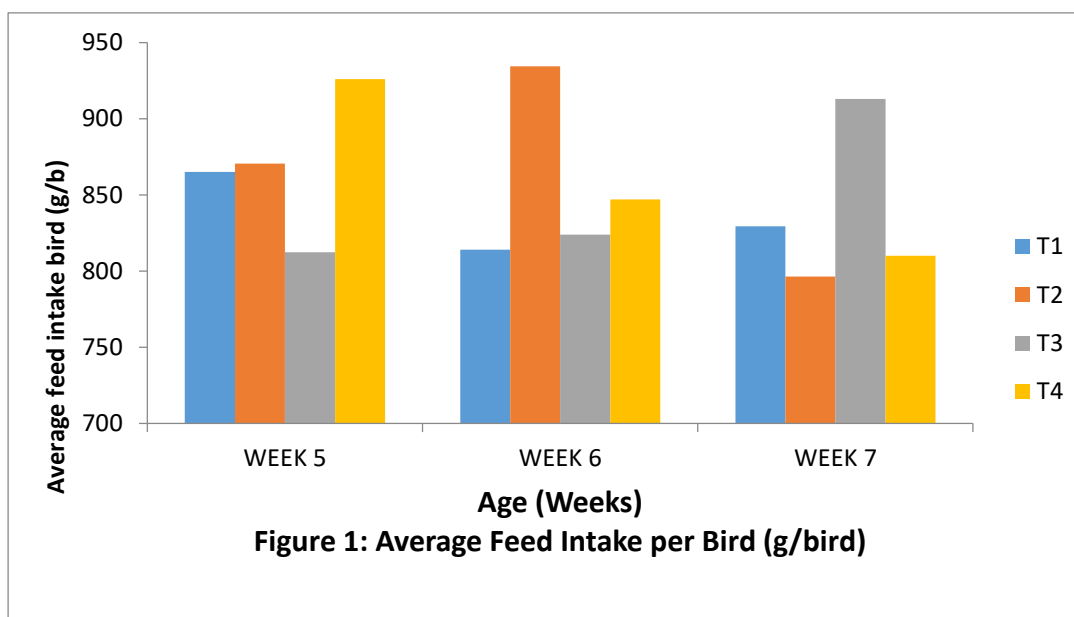
Results on the AFIB performance of experimental broiler birds in the finisher phase showed that AFIB value (836.23) was lowest in T1 (15g Oregano) and highest value (867.17) was in T2 (20g Oregano). Significant differences ($p < 0.05$) were observed on AFIB performance across the treatments in this trial.

AFIB trend was observed to increase and decrease with increase inclusion of Oregano among the treatments from 865.21 in T1 (15g Oregano) to 870.5 in T2 (20g Oregano) but the trend declined to 812.5 in T3 (25g Oregano). AFIB was better in the control treatment with recorded value of 926.0 in week 5. In week 7, AFIB showed an increase with increased inclusion of level of Oregano in the diets of experimental birds from 829.5 in T1 (15g) to 913.0 (better) in T3 (25g), though AFIB declined to 796.5 in T2 (20g). However, it was observed that control treatment has the value of 810 lower than T1 and T3 but higher than T2 respectively.

Weekly trend in the finisher phase showed that AFIB decreases (fluctuates) with increase in age of the

experimental broiler chickens from week 5-7 in T1, T2 and T4, where as in T3 AFIB increases with increase in age. For instance, in T1, AFIB was (865.21) in week 5th and decreased to (814) in week 6th and then tend to slightly increased to (829.5) in week 7, T2 was (870.5) in week 5 and then increased to (934) which was the highest value in week 6 but then declined to (796.5) in week 7 and it was the lowest value in that week among the treatment, T4 decreases with increase in age in week 5 – 7 from (926) in week 5 and decreased to (847) in week 6 and then declined to (810) in week 7 respectively, T3 increases with increase in age from 812.5 (lowest) in week 5 to 913 (highest) in week 7. Generally, AFIB fluctuates both between the ages (in weeks) and between the inclusion levels (among treatments).

Weekly trend on AFIB in the finisher phase is presented graphically in Figure 1.



The significant difference ($P > 0.05$) between means among all treatments on AFIB is in line with the findings of Ertas *et al.*, (2005) who noticed an increase in feed intake after three weeks when supplementing Oregano and Clove extract oil (EO) mixture at 200 and 400 mg/kg to the broiler diet. Ahmad (2019) and Abdurrahman (2019) reported AFIB mean values of 682.72 to 750.32 respectively, lower than the observed AFIB value of 836.23 to 867.67 in this experiment within same environment.

Average feed intake per bird per day (AFIBD) (g)

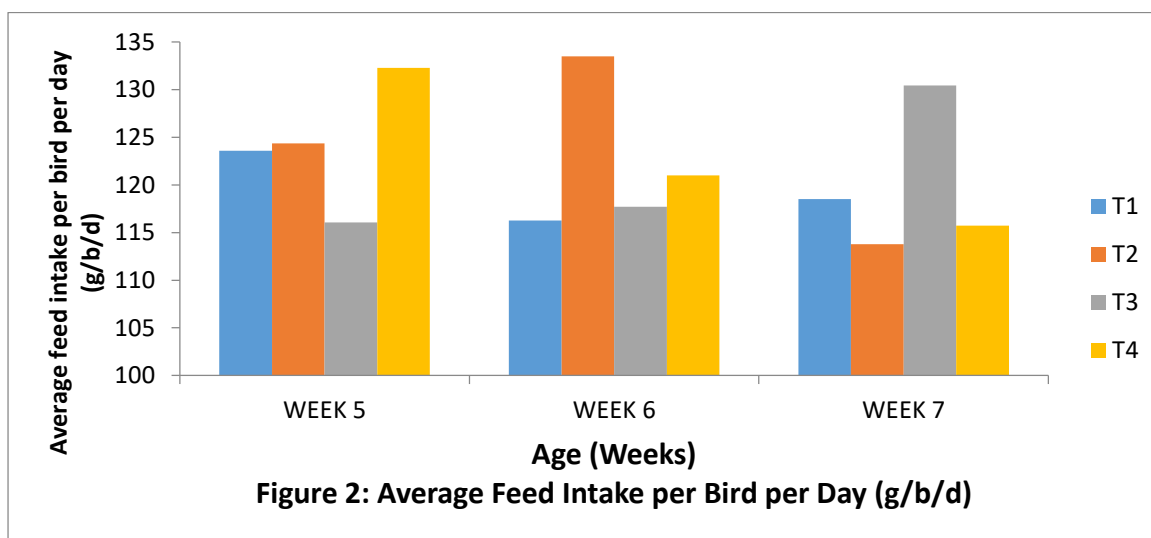
Results in the finisher phase showed that AFIBD was lowest (119.23) in T1 (15g Oregano) and highest (123.88) in T2 (20g Oregano). Significant differences ($p < 0.05$) exist between means among all treatments. Recorded AFIBD values were observed to increase and decrease with increase inclusion of Oregano in diets of experimental birds from 123.6 in T1 (15g Oregano) to 124.36 in T2 (20g Oregano) but fluctuated to 116.07 in T3 (25g Oregano) across the treatments. AFIBD value of

132.28 was better in the control treatment in week 5. At week 7, AFIBD increase with increased inclusion of level of Oregano from 118.5 in T1 (15g) to 130 (best) in T3 (25g) but the trend fluctuated to 113.78 in T2 (20g). Similarly, it was observed that control treatment has AFIBD value of 115.72, lower than T1 and T3.

Weekly trend in AFIBD in the finisher phase showed that AFIBD decreases with increase in age of the experimental broiler chickens in T1 and T4 but in T2 and T3, AFIBD increases with increase in age from week 5-6 weeks and then declined by fluctuating across the weeks from 6-7 weeks. For instance, in T2 AFIBD was lower

(116.07) in week 5 and progressively increased to (133.5) in week 6 and then declined to (113.78) in week 7. T4 was 132.28 in week 5 and then decreased with increase in age to 121 in week 6 but then declined to (115.72) in week 7. T1 AFIBD value was 123.6 in week 5 which then decreased with increase in age to (116.28) in week 6 and a little increase of 118.5 was observed in week 7. AFIBD in T3 was lower (116.07) in week 5 and progressively increase (117.71) in week 6 and then increase again (130) highest in week 7 respectively.

Weekly trend on AFIBD in the finisher phase is presented graphically as Figure 2



Significant difference ($p < 0.05$) exist between means of T1 and T2 whereas T3 and T4 are statistically the same on AFIBD. This in line with the research findings of Ulfah (2006) who noticed an increased average daily feed intake after feeding a diet containing 18mg/kg of Oregano.

Statistically, AFIBD mean values of 119.46 to 123.88 were noticed in this trial. Similarly, AFIBD mean values of 97.53 to 107.18 were reported by Muhammad (2019) and were lower than the reported mean values in this trial in Sokoto Nigeria.

Body weight (BW) (g)

Result on the performance of the experimental broiler birds on total body weight in the finisher phase (5-7 weeks) is presented in Table 3.

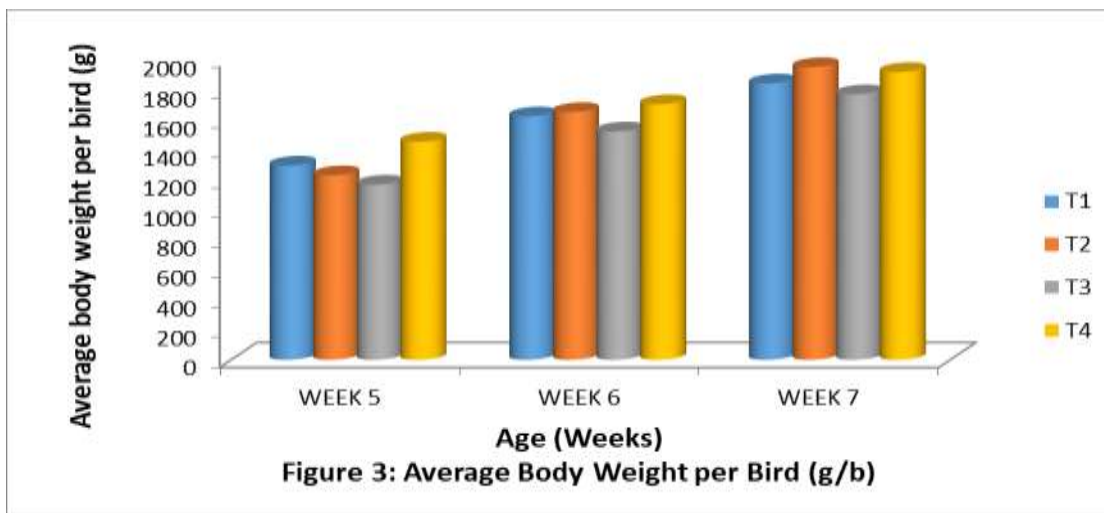
Average body weight per bird (ABWB) (g)

Results on the ABWB showed that ABWB was lowest (1483.97) in T3 (25g Oregano) and highest

(1689.00) in T4 (control). Significant difference ($p < 0.05$) exist between means of ABWB among all the treatments. Results on ABWB of the experimental birds was shown to fluctuate with increase in Oregano inclusion in the diets of birds in week 5 from 1292.89 (better) in T1 (15g) to 1165.50 (lowest) in T3 (25g) among the treatment. Thus, highest ABWB value of 1451.0 was recorded in control treatment (0g Oregano). At week 7, ABWB was observed to increase with increase in the inclusion of Oregano in the diet of birds from 1839.08 in T1 (15g) to 1948.0 (better) in T2 (20g). There was however observed a decline in T3 (25g) with ABWB of 1767.02. ABWB value of 1915.02 in T4 (control) was observed to be better than T1 (15g) and T3 (25g).

Weekly trend on ABWB in the finisher phase showed that ABWB increases with increase in age of the experimental broiler chickens from week 5 (1165.5) in T3 (25g Oregano) to week 7 (1948) in T2 (20g Oregano) in the 7 week. A similar trend was observed among all treatment groups in this research.

Weekly trend on ABWB in the finisher phase is presented graphically as Figure 3.



The reported significant difference ($p < 0.05$) agrees with research findings of Tiihonen *et al.*, (2010) who reported that, adding a mixture of 15 mg/kg Oregano and 5 mg/kg Cinnamaldehyde to a diet over a period of 42 days improved ABWB. They found that BW per bird was improved by approximately 5%. Within the same environment, recorded ABWB mean values of 1483.97 to 1689.00 in this experiment were within the ranges mean values of 1375.4 to 1843.5 reported by Samuel (2019) in the finisher phase.

Average body weight per day per day (ABWBD) (g)

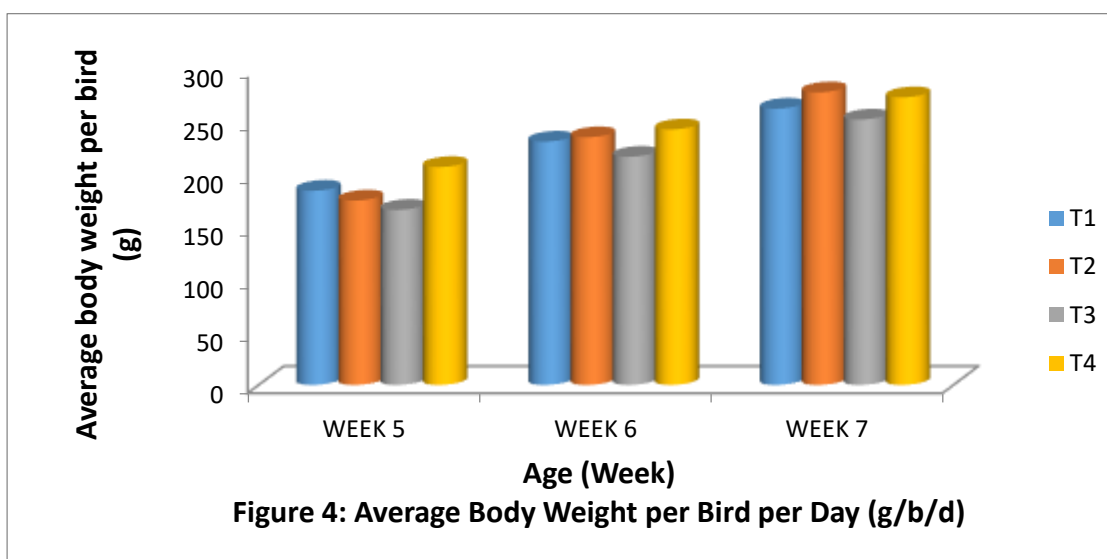
ABWBD performance in the finisher phase showed that ABWBD of 211.99 was lowest in T3 (25g Oregano) and 241.28 highest was in T4 (control). Significance differences ($p > 0.05$) were observed across the treatments.

ABWBD trend of the experimental birds in the finisher phase was shown to decline with increase in

inclusion level of Oregano in the diets of birds in week 5, ranging from 184.69 (better among the treatments) in T1 (15g) to 166.50 (lowest within the treatment) in T3 (25g). Thus ABWBD value of 145.10 (highest) was observed in control treatment (T4 0g Oregano). ABWBD was observed to increase with increase in the inclusion of Oregano in the diet of birds, At week 7, ABWBD was 262.73 in T1 (15g) to 278.28 (better) in T2 (20g). ABWBD trend declined in T3 (25g) with the value of 252.43. ABWBD value of 273.57 in control treatment was better than T1 (15g) and T3 (25g).

Weekly trend on ABWBD in the finisher phase showed that ABWBD increases with increase in age of the experimental broiler chickens from week 5 (166.5) in T3 (25g Oregano) to week 7 (273.57) in treatment 4 (control) in the 7th week. A similar trend in (ABWBD) was observed among all treatment groups in this research.

Weekly trend on ABWBD in the finisher phase is presented graphically in Figure 4.



Significant difference ($p < 0.05$) exist between means among all the treatments on ABWBD and is consistent with the research findings of Ertas *et al.*, (2005) who reported that increase in body weight by 16% was observed when 200mg/kg Oregano powder administer in broiler diet.

Body weight gain (BWG) (g)

Results on the performance of the experimental broiler birds on body weight gain in the finisher period (5-7 weeks) is presented in Table 3.

Average body weight gain per bird (ABWGB) (g)

ABWGB performance showed that ABWGB value was lowest (856.06) in T3 (25g Oregano) and highest (941.25) in T4 (control). Significant difference ($p < 0.05$) was observed between means among all the treatments. ABWGB increases and fluctuates with increase in Oregano inclusion in the diets of birds. ABWGB ranged

from 782.04 in T1 (15g Oregano) to 681.13 in T3 (25g Oregano) within the treatments but was best in control treatment with the value of 908.7 at week 5. Similarly, in week 7, ABWGB showed increase with different inclusions of Oregano between the treatments from 1001.16 in T1 (15g) to 1048.74 in T3 (25g) but was better in T4 (control) with a value of 1122.75.

Weekly trend on ABWGB in the finisher phase showed that ABWGB increases with increase in age of the experimental broiler chickens from week 5 (666.33) lowest in T2 (20g Oregano) to week 6 (982.68) highest in same T2 (20g Oregano) and then slightly declined to (980.30) in the 7th week in T1 and T3. Weekly trend on ABWGB increases with increase in age of the experimental birds, but in T4 ABWGB means decrease with increase in age from 908.74 in week 5 to 792.26 in week 6 and increased to 1122.75 9 (highest) in week 7.

Weekly trend on ABWGB in the finisher phase is presented graphically as Figure 5.

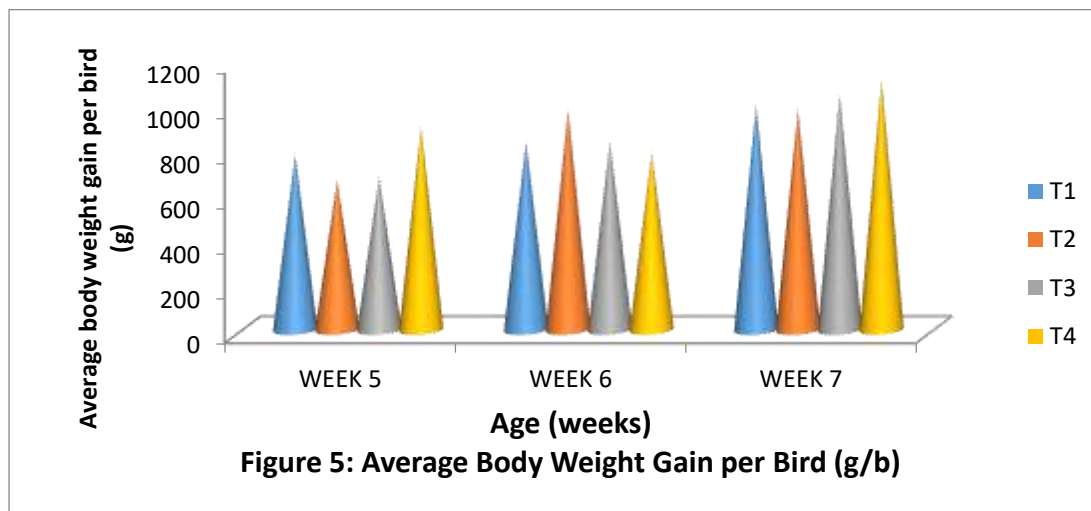


Figure 5: Average Body Weight Gain per Bird (g/b)

The observed significant difference ($p < 0.05$) between all the treatments contradicted the research findings of Lee *et al.*, (2003) who observed that addition of 100 mg/kg thymol, the major component Oregano, did not show any effects on BWG when compared to the control treatment.

Statistical mean values on ABWGB differ, ranges from 856.06-941.25 and are within the mean value range of 825.4 -1037.5 reported by Samuel (2019) in same environment.

Average body weight gain per bird per day (ABWGBD) (g)

Results on the ABWGBD performance showed that, the highest (134.46) ABWGBD was observed in T4

(control) and the lowest 122.29 in T3 (25g Oregano). Significant difference ($p < 0.05$) existed across the treatment means.

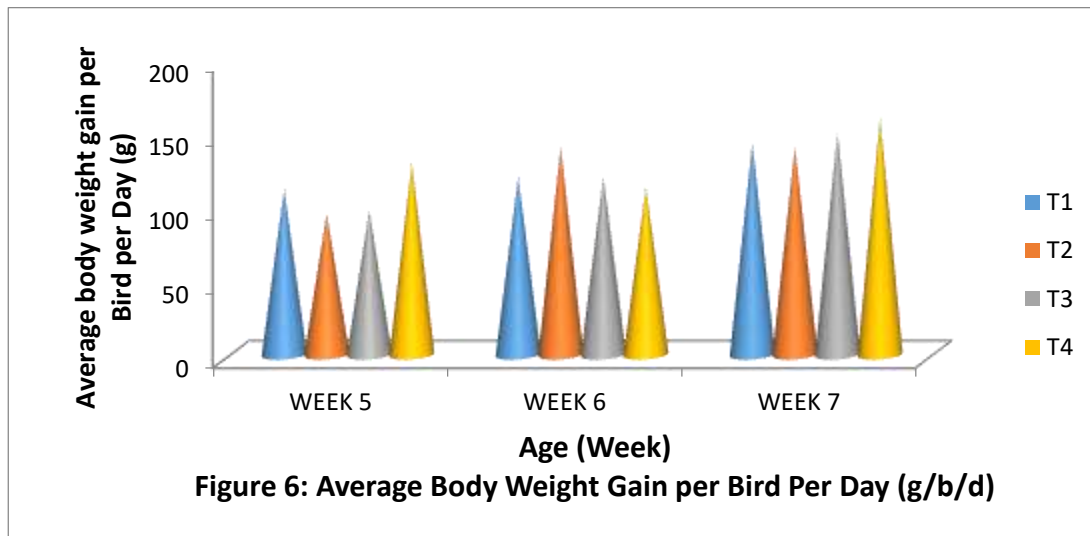
ABWGBD showed a fluctuating trend with increase in Oregano powder inclusion in the diets of experimental birds. The ABWGBD values of 111.72 in T1 (15g Oregano) but declined to 97.31 in T3 (25g Oregano) was observed between the treatments. Reported value of 129.82 (best) was observed in the control treatment at week 5 across the experimental treatments. Similarly, in week 7 reported ABWGBD shows increase in increase with different inclusion of Oregano from 143.02 in T1 (15g) to 149.83 in T3 (25g) but it was better in T4 (control) with a value of 160.39

Weekly trend on ABWGBD in the finisher phase showed that ABWGBD increases with increase in age of

the experimental broiler chickens from week 5 in T1 (111.72) to week 7 (143.02), T3 also shows similar trend, T2 was lowest (95.189) in week 5 but better in week 6 (140.38) and then a slight increase was observed in week

7 (149.83). T4 was 129.82 in week 5 and declined in week 6 (113.179) and then increased to 160.393 in week 7.

Weekly trend on ABWGBD in the finisher phase is presented graphically as in Figure 6.



The significant difference ($p < 0.05$) on ABWGBD is in line with the findings of Cross *et al.*, (2007) who reported a significant improvement in BWG when supplementing Oregano powder in broiler diets. The mean values of 122.29-134.46 on ABWGBD in this experiment were within the ranges of 117.92-148.22 recorded by Samuel (2019).

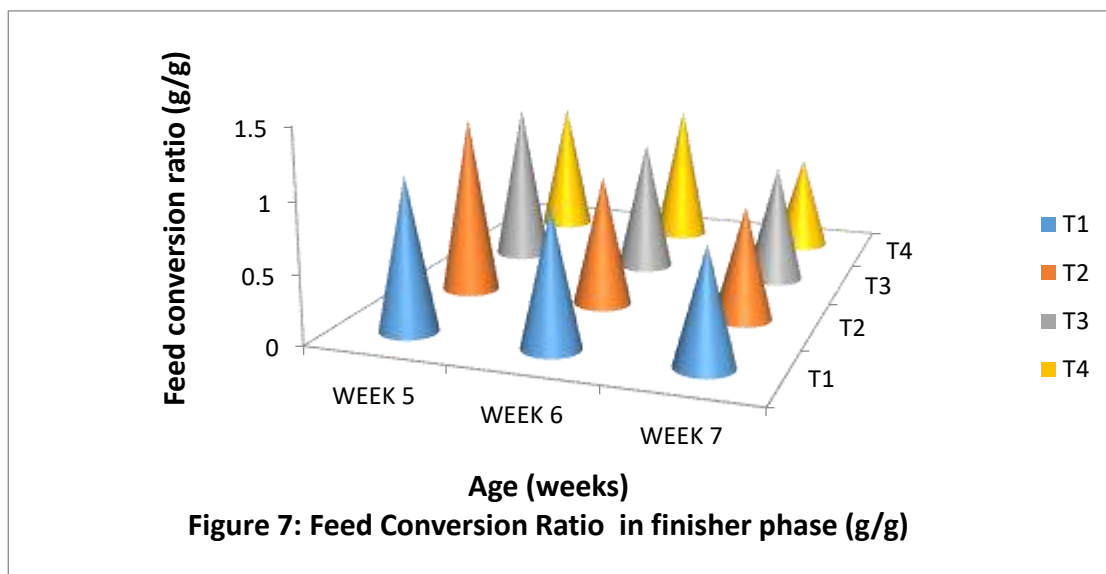
Feed conversion ratio (FCR) (g/g)

Results on the performance of the experimental broiler birds on feed conversion ratio in the finisher phase (5-7 weeks) is presented in Table 3.

Results showed that FCR was better (0.94) in T3 (25g Oregano) and poor (1.02) in T4 (control). Significant difference ($p < 0.05$) exist between means of T1, T2 with that of T3 and T4.

Result showed that T1 (15g Oregano) and T2 (20g Oregano) were statistically the same and significantly differ ($P < 0.05$) with T3 and T4 containing 25g graded level of Oregano and the control group. Similarly, T3 and T4 were also statistically the similar.

Weekly trend on FCR of the experimental broiler chickens at finisher phase is presented in Figure 7.



The improved FCR obtained in experimental broiler birds fed Oregano powder in this research was in agreement with the findings of Mohammed *et al.*, (2016) who reported that herbal powder improved feed conversion ratio at different inclusion level from 1-42days of age. Similarly, Soliman (2000); El-Gamry *et al.*, (2002); Tollba and Hassan (2003) and Ziton (2009) mentioned that, addition of garlic powder in broiler diets significantly improved the feed conversion ratio of the broilers. An increased nutrient digestibility is likely to be responsible for the improvement of FCR as it increased the digesta retention time in the gizzard (Gonzalez-Alvarado *et al.*, 2007).

Mortality (m) (%)

There were no significant differences ($P>0.05$), in mortality among the treatments during the finisher period. A similar observation was made by Durrani *et al.*, (2006), Abu-Dieyeh and Abu-Darwish (2008), who reported that supplementing diets with turmeric and black cumin at 1.25, 2.5 and 5% did not cause any mortality of broilers. This might be due to the antibacterial activities of herbal plants which might have helped in suppressing the pathogenic bacteria.

CONCLUSION AND RECOMMENDATIONS

This research work investigated the growth performance indices of broiler chickens fed dietary Oregano powder. The study showed that significant differences ($P<0.05$) existed in all the studied performance parameters among the treatments in the finisher stage. The effect of supplementing Oregano powder at 15g, 20g and 25g levels on the final FI, BW and BWG parameters of broiler chicks during the finisher phases showed significant differences ($P<0.05$) among the treatment groups, Significant ($p<0.05$) differences were observed in all performance parameters in the starter and finisher phases and it was better in T2 (20g Oregano) across the experimental treatment. Therefore, Oregano powder as phytobiotic additive in the diet of broiler can substitute commercial antibiotic growth promoters, as they are safe, effective, and economical efficient and above all, will help in the production of organic broilers and save the health of humankind from ill effects of residual of antibiotic in animal products.

Recommendations

1. Oregano powder at 20g inclusion levels can be used in broiler diets for improved performance and feed efficiency.
2. With good management and hygiene practice, broiler can be reared with Oregano as an alternative to synthetic antibiotics.

3. More detailed studies are still needed to determine the mode of action of the Oregano herb in achieving the optimal growth performance in broiler production and in different seasons in the study area.

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