Research Article

Oregano Leaf Meal as Phytogenic Feed Supplements: A Potential Antibiotic Alternative in Broiler Chicken Diets

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Abstract | Driven by the rising demand for animal protein, the use of synthetic antibiotics in broiler diets to accelerate growth has become a public health concern due to the potential spread of antibiotic-resistant bacteria. This study investigated the effectiveness of Oregano (*Origanum vulgare* L.) leaf meal (OLM) as a potential antibiotic alternative in enhancing broiler chicken growth performance. A completely randomized design was employed with 125 Cobb broiler chickens and five treatment groups. The diets included antibiotics (0.0025%) in T_1, and groups supplemented with varying OLM levels T_2 (1%), T_3 (3%), T_4 (5%), and T_5 receiving no antibiotics and OLM. OLM demonstrated a significant positive impact on growth performance ($P < 0.05$), with birds in the 3% OLM group achieving the highest live weight (1185.40 grams) and average daily gain (38.01 grams) by day 28. Notably, no significant differences were observed in feed conversion ratio, and groups with 3% and 5% OLM supplementation displayed no mortality. Additionally, OLM did not induce gut inflammation or the presence of undigested particles in the colon. Interestingly, the 3% OLM group also exhibited a significantly higher dressing percentage (68%), suggesting improved carcass yield. These findings indicate that OLM, rich in phenolic and flavonoid compounds, has the potential to be a safe and effective alternative to antibiotic growth promoters in broiler chickens, warranting further investigation into the mechanisms underlying its beneficial effects.

Keywords | *Origanum vulgare*, Antimicrobial alternatives, Phenolic compounds, Flavonoid compounds, Gut health, Mortality

Received | March 20, 2024; **Accepted** | May 02, 2024; **Published** | May 27, 2024
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Citation | Ampode KMB (2024). Oregano leaf meal as phytogeenic feed supplements: A potential antibiotic alternative in broiler chicken diets. Adv. Anim. Vet. Sci., 12(7):1362-1370.
DOI | https://dx.doi.org/10.17582/journal.aavs/2024/12.7.1362.1370
ISSN (Online) | 2307-8316

INTRODUCTION

Livestock and poultry are the primary sources of protein consumed globally. The performance of these animals in producing protein can vary due to multiple factors, including management, breed, and nutrition. These factors ultimately impact animal productivity and the quality of the meat they produce. The quest for increased protein production has driven technical specialists and farmers to refine their operations continually. This includes selecting breeds best suited to the local environment (Mashayekhi *et al*., 2018), upgrading conventional poultry houses to tunnel-ventilated structures (Hamrita and Comway, 2017), and manipulating diets through the inclusion of antibiotics (Tallentire *et al*., 2016). Antimicrobials have been used in livestock production since 1910, when workers across America staged riots and demonstrations over a shortage of animal meat products (Ogle, 2013). At that time, the scientific community began exploring ways to produce more meat for a relatively cheaper cost, which led to the introduction of antibiotics and other antimicrobial agents (Dibner and Richard, 2005).

The inclusion of antibiotics in animal feed, water, or at sub-therapeutic doses can be a significant factor in improved animal performance and production (Kumar *et al*., 2018). Specifically, in the poultry sector, farmers use antibiotics to improve production by obtaining a kilogram of meat in a shorter period, improving the feed conversion ratio, and enhancing disease prevention (Mehdi *et al*., 2018). However, the inclusion of antibiotics as antimicrobial growth promoters (AGPs) raises a primary concern: Antimicrobial resistance (AMR) (Nazeer *et al*., 2021). The global impact of AMR is the emergence of drug-resistant superbugs, rendering existing antibiotics ineffective against human and animal diseases (Salam *et al*., 2023). The antimicrobial-resistant pathogens in poultry will result in treatment failure and economic losses and could risk human health (Nhung *et al*., 2017). Several strategies have been practiced mitigating AMR using alternative approaches, such as phytogenic feed additives from various plant species with antimicrobial and antioxidant properties.

Phytogenic feed additives in poultry production have been extensively studied to determine their effects on gastrointestinal health and function and their implications on better production performance, food safety, and environmental impact. These plant-based feed additives, which are made up of herbs, spices, fruit, and other plant components, include a wide range of bioactive compounds (Abdelli *et al*., 2021) and have drawn a lot of interest due to their possible use as antibiotic growth promoter alternatives (Mandey and Sompie, 2021). These plant secondary compounds were categorized based on their composition, processing, and botanical source. For instance, phytogenic feed additives with medicinal properties include herbs and non-woody flowering plants; spices, which are aromatic herbs with a strong smell or flavor and are frequently added to human food; essential oils, which are aromatic oily liquids made from plant materials like flowers, leaves, fruits, and roots; and oleoresins, which are extracts made from plant material using non-aqueous solvents (Mandey and Sompie, 2021).

Herbs and plant extracts used as feed additives contain a variety of bioactive ingredients, including alkaloids, bitters, flavonoids,glycosides,mucilage,saponins,tannins,phenolics, polyphenols, terpenoids, polypeptides, thymol, cineole, linalool, anethole, allicin, capsaicin, allylisothiocyanate, and piperine (Al-Yasiry and Kiczorowska, 2016). The effectiveness of phytogenic feed additives varies depending on the source and the time of collection. Factors such as plant components, genetics, age and time of harvest, and the extraction method can all affect the potency of a phytogenic substance (Yang *et al*., 2018). Moreover, numerous studies have reported the beneficial effects of incorporating phytogenic feed additives, such as oil and powder forms like oregano, in poultry nutrition. These advantages encompass increased feed intake, stimulation of digestion, enhanced growth performance, reduced illness occurrence, improved reproductive parameters, and enhanced feed efficiency (Mandey and Sompie, 2021). Thus, this study investigates the influence of oregano leaf meals on production performance and potential alternatives to antimicrobials in broiler production.

MATERIALS AND METHODS

Preparation of oregano leaf meal (OLM)

Samples were oven-dried at 40°C for 72 hours, then ground into a fine powder using an Oster blender. The powdered samples were transferred to clean, dry, resealable plastic bags and stored at room temperature, following the method outlined by Barbosa and Nueva (2019). Subsequently, 120 grams of the oven-dried Oregano leaves were macerated in 600 ml of absolute methanol at room temperature for 72 hours, with intermittent stirring. The extraction solution was filtered and kept at 4°C, and the solvent was removed from the filtrate using a rotary evaporator (Scilogex RE100-Pro) at 40°C and 80 rpm. The concentrated extracts were stored in glass vials covered with aluminum foil and stored at 4°C.

Determination of total phenolic content and preparation of standards and samples

A stock solution of gallic acid with a concentration of 100 mg/L was prepared by dissolving 0.0055 g of the standard gallic acid monohydrate in absolute methanol. The resulting solution was diluted to 50 ml. Different concentrations of 0, 20, 40, 60, 80, 120, 140, and 160 mg/L were prepared as working standards for the calibration curve. The stock sample solution with a concentration of 1000 mg/L was prepared by dissolving 0.1000 g of the extract in absolute methanol. The solution was diluted to make a total volume of 100 mL (Barbosa and Nueva, 2019).

In a microtube, 200 ml of 1000 ppm extract was added with 200 µL of Folin Ciocalteu Reagent, and the mixtures were set aside for 5 minutes. Eight hundred µL of 10% sodium carbonate was also added to the mixtures and incubated for 90 minutes at room temperature in the dark. The same method was applied to the working standards. In a 96-well plate, 200 µL of each mixture was loaded, and the absorbance at 750 nm was measured using Spectramax 250. TPC is expressed as mg of gallic acid equivalents per gram of dry weight (mg GAE/g DW).

Determination of total flavonoid content and preparation of standards and samples

A stock solution of quercetin with a concentration of 100 mg/L was prepared by dissolving 0.0050 g of the standard quercetin in absolute methanol. The resulting solution was

diluted to 50 ml. Different concentrations of 0, 20, 40, 60, 80, 100, 120, 140 160, 180, and 200 mg/L were prepared as working standards for the calibration curve. The stock sample solution with a concentration of 1000 mg/L was prepared by dissolving 0.100 g of the extract in absolute methanol. The solution was diluted to make a total volume of 100 ml (Barbosa and Nueva, 2019). In a microtube, 200 ml of 1000 ppm extract was added with 40 µL of 10% aluminum chloride, 520 µL of 96% ethanol, and 40 µL of sodium acetate. The mixtures were incubated at room temperature in the dark. The same method was applied to the working standards. In a 96-well plate, 150 µL of each mixture was loaded and the absorbance at 415 nm was measured using Spectramax 250. TFC was expressed in mg of quercetin equivalents per gram of dry weight (mg QE/g DW).

Animal welfare statement

Birds were housed in wooden cages equipped with screen floors and wire partitions to minimize contact and prevent potential cross-contamination (McNaughton et al., 2020). The housing and management conditions of the experimental birds were similar to those of a commercial facility, adhering to standard operational procedures. Daily observations were conducted to monitor health and well-being.

Diet and management

The feed was formulated using Hybrimin Futter 5 software to meet the nutritional requirements based on the physiological needs and age of the birds. The feeding program included three phases: Broiler booster (days 1-14) with a nutrient composition of 22.90% crude protein, 3.68% crude fiber, and 5.41% crude fat; Broiler grower (days 15-21) with 19.33% crude protein, 3.28% crude fiber, and 5.95% crude fat; and Broiler finisher (days 22-28) containing 18.15% crude protein, 3.19% crude fiber, and 4.19% crude fat. The experimental treatments were as follows: a formulated broiler diet with 0.0025% antibiotics but without Oregano Leaf Meal (OLM) (T_1); 1% OLM (T_2); 3% OLM (T_3); 5% OLM (T_4); and a diet without antibiotics and OLM (T_5). All broilers had *ad libitum* access to fresh, clean drinking water throughout the study.

Macroscopic intestinal scoring (Dysbacteriosis)

The scoring system employed in this study involved at least five samples collected from each of the five replicates across all five treatment groups. To reduce stress in the animals during processing, well-trained personnel handled the dressing of the experimental birds. Gut samples were macroscopically assessed for the presence of undigested particles and signs of inflammation. Each parameter was assigned a binary score of either 0 (absent) or 1 (present) (Van Meirhage, 2016).

Experimental design and analysis

A total of 125 mixed-sex Cobb broiler chickens were sourced from a local hatchery and randomly divided into five treatment groups, each with five replicates comprising five birds each. All data were analyzed using the Analysis of Variance (ANOVA) in a Completely Randomized Design (CRD). The graph was presented with the mean values showing the standard error of the mean using the Sigmaplot computer software version 21. The differences between treatment means were further compared using Tukey's Honestly Significant Difference Test at $p<0.05$ level.

RESULTS AND DISCUSSION

The total phenolic and flavonoid content of oregano

The evaluation of total phenolic content (TPC) and total flavonoid content (TFC) provides significant insights into the bioactive composition of the oregano leaf meal. Based on the results presented in Figure 1, TFC QE mg/g was 17.14 while TPC GAE mg/g was 4.21. Phenolic compounds are known for their antioxidant properties, which have the potential to improve growth performance and reduce mortality in farm animals (Christaki *et al.*, 2020) by inhibiting the growth of pathogenic bacteria in the gastrointestinal tract (Hashemi *et al.*, 2011).

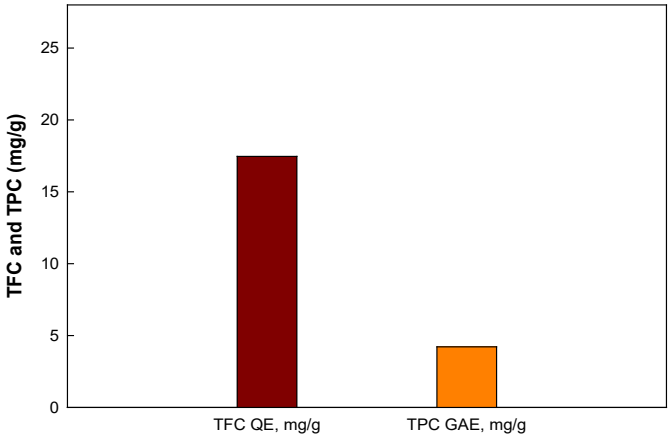

Figure 1: The total flavonoid content (TFC) quercetin equivalent (QE) milligram per gram and total phenolic content (TPC) gallic acid equivalent (GAE) milligram per gram.

Similarly, the analysis of oregano leaf meal's TFC yielded significant results. This compound has been found to possess bioactive properties including antioxidant, antimicrobial, and anti-inflammatory effects (Tan *et al.*, 2022). The levels of TPC and TFC observed in oregano leaf meals are consistent with previous studies, suggesting

their potential to enhance animal productivity without the need for growth-promoting antibiotics.

Mean of mortality

Mortality in the experimental birds was recorded from the beginning until the termination of the study. Based on the results, mortality in the broilers fed a diet with Oregano leaf meal showed no significant differences, although with a p-value of 0.068. This suggests the potential for improvement in reducing the mortality of broiler chickens. Table 1 reveals the comparison of the total bird mortality. It was observed that deaths only occurred in T_5 (without antibiotics and Oregano leaf meal), which accounted for the highest means of total deaths, followed by T_1 (0.00025% inclusion of antibiotic), and T_2, while both T_3 and T_4 had no recorded mortality. The sudden death of the broiler chicken in T_5 was mainly attributed to continuous diarrhea from day 3 until day 7. This result could be due to the non-inclusion of antibiotics and Oregano leaf meal.

Table 1: Mean of mortality of the experimental birds given oregano leaf meal, with and without antibiotics in the diet.

Parameter	T_1	T_2	T_3	T_4	T_5	SEM	P-value
Mortality	0.40	0.20	0.00	0.00	0.60	0.36	0.068

SEM: Standard error of the mean.

Since it contains a high amount of non–starch polysaccharides (NSPs), the digesta becomes more viscous. This viscosity reduces the feed passage rate and can lead to an overgrowth of bacteria, intestinal permeability, and inflammation (Vicuna *et al*., 2015). The imbalance of gut microbiota, including harmful and beneficial bacteria, can result in dysbiosis (Hooper and Macpherson, 2010). It is also crucial to maintain homeostasis by preventing the entry of harmful bacteria and preserving a balance between the existing commensals and the gut microbiota (Fathima *et al*., 2022).

However, dysbiosis in broiler production can be prevented by including antibiotic growth promoters (Yadav and Jha, 2019). On the other hand, sudden deaths of birds in T_1 and T_2 occur during bird maturity from day 23 until day 25, primarily due to heat stress and higher temperatures during the Day. It has been reported that heat stress leads to the production of stress hormones, which modify the neuroendocrine system in chickens by activating the hypothalamic-pituitary-adrenal axis and subsequently increasing plasma corticosterone concentrations (Quinteiro–Filno *et al*., 2012).

The breakdown of body protein concentration is correlated with corticosterone (Yunianto *et al*., 1997), which impacts the gastrointestinal tract, nutrient consumption, and digestibility (Olfati *et al*., 2018). When birds are in a state of heat stress, their intestinal barrier function is compromised, resulting in inflammation that affects performance (Liu *et al*., 2018) and increases intestinal permeability to endotoxins and salmonella, leading to higher mortality (Al-henaky *et al*., 2017). Furthermore, although the results show no statistically significant difference, broiler chickens in T_3 and T_4 show no mortality throughout the experimental period. This result suggests that the increase in concentrations of Oregano leaf meals prevents bird mortality by enhancing gut microbe diversity, specifically the beneficial bacteria, and decreasing the population of harmful bacteria.

According to reports, Oregano has antimicrobial and bactericidal effects. Its active compounds, carvacrol, and thymol have antibacterial effects primarily by breaking down and coagulating the proteins that make up bacterial cell walls. This alters the permeability of the cytoplasmic membrane to K+ and H+, causing interaction with the phenolic substances. As a result, cell components leak, become unbalanced, and cause bacterial death (Zhao *et al*., 2021).

Average live weight (7th day old)

The experimental birds' average live weight (ALW) was measured on the 7th Day to evaluate their growth performance. Evaluating their live weight during this period was crucial as it is their most challenging growth phase. Data indicated that the ALW of the experimental broiler chickens showed highly significant differences (P<0.01), as shown in Figure 2.

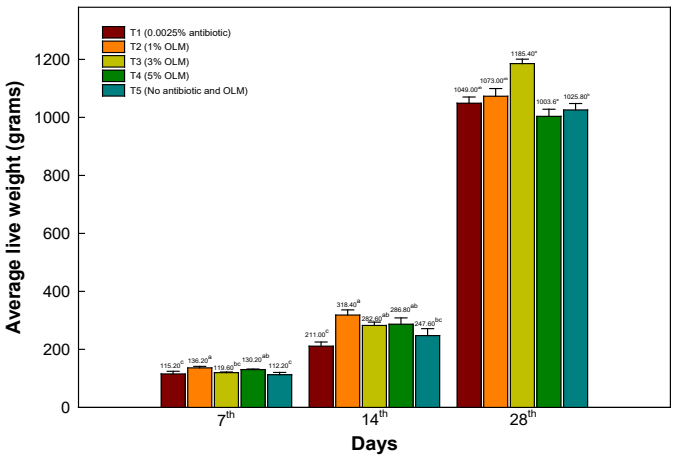

Figure 2: Average live weight (grams) of broiler chicken supplemented with different levels of OLM as alternative to antibiotics in broiler chicken diet.

The results demonstrated that the experimental birds in T_2 (1% Oregano leaf meal) had the highest ALW on the 7th day, weighing 136.20 grams compared to the rest of the treatments. Additionally, the broiler chickens in T_4 (5% Oregano leaf meal) had a lower ALW of 130.20 grams

compared to T_2, while broiler chickens in T_3 (3% Oregano leaf meal) had an ALW of 119.60 grams during the 7th day period. Broiler chickens fed with Oregano leaf meal positively affected growth performance compared to the experimental broiler chickens in T_1 (with antibiotics), which gained 115.20 grams. The lowest ALW was observed in T_5 (without antibiotics and OLM), with a weight of 112.40 grams.

The results of this study revealed that the inclusion of oregano in the diet during the early phase of rearing, particularly during the brooding period, led to a significant improvement in growth for the younger chicks. Previous studies have shown that dried Oregano leaf meal has the potential to enhance broiler chicken growth performance (Roofchaee *et al*., 2011), and this improvement can be attributed to the antimicrobial properties of Oregano (Ri *et al*., 2017). This improvement may also be linked to the phytogenic compounds of Oregano, such as phenols and flavonoids (Mahfuz *et al*., 2021).

It should be noted that the inclusion of antibiotics in the diet can improve broiler chicken growth performance (Diarra *et al*., 2007). However, based on this study, T_1 with the inclusion of antibiotics showed lower growth performance compared to the broiler chicken treated with Oregano. This recent finding supports a previous study that birds treated with Tiamulin in the broiler chicken diet did not enhance their body weight gain (Viera *et al*., 2010) due to the adverse effects of continuous application (Islam *et al*., 2009).

Average live weight (14th day old)

The experimental birds were evaluated on the 14th day of the growing phase and the last day of the brooding period. Monitoring their performance was vital because it would reflect their overall performance throughout the growth cycle. Based on the performance comparing the five treatment means, the findings demonstrated significant ($P<0.05$) (Figure 2).

Results revealed that T_2 significantly affected the broiler chicken's growth performance and gained the highest ALW of 318.40 grams while the lowest ALW was observed in T_1 with antibiotics which gained 211 grams. Generally, broiler chicken treated with varying concentrations of Oregano showed better ALW on the 14th Day, such as in T_4 (286.80 grams) and T_3 (282.60 grams). This result implies that the inclusion of varying levels of Oregano in the poultry diet could be an alternative to antibiotics for broiler chickens in the earlier stage.

In addition, a comparison of the findings between the birds in T_1 (211.00 grams) treated with antibiotics and the birds in T_5 without antibiotics and with Oregano (247.60 grams) revealed that the birds in T_1 were least productive in terms of their growth performance. This finding suggests, as demonstrated in T_5 that broiler chickens under normal conditions with proper care and management would achieve better production in terms of growth performance. Better production was also attained through the incorporation of feed enzymes in the diet that enhance the digestion of several dietary components (Ravindran, 2013) and nutrient absorption (Thacker, 2013).

Average live weight (ALW) on the 28th day

The data presented in Figure 2 clearly show that broiler chickens in T_3 gained the highest ALW (1185.40 grams), followed by T_2 (1073.00 grams), T_1 with antibiotics (1049.00 grams), T_5 (1025.00 grams), and the lowest was in T_4 (1003.60 grams). This present study reveals that experimental birds under T_3 have shown a significant difference ($P<0.05$) in growth performance.

This recent study established evidence that under field conditions, conventional environments, and the use of phytogenic feed additives, better growth performance was achieved in broiler chickens. Furthermore, the data implied that T_3 could be the best concentration for achieving good growth performance in the birds. However, based on the findings, the inclusion rate of phytogenic materials had no impact on animal performance. It has been observed that experimental birds with the highest dosage of 5% level of dried Oregano leaf meal (T_4) obtained the lowest AWL of 1003.60 grams which could be attributed to the occurrence of substantial portions of tannins in the diet (Dumaup and Ampode, 2020).

The higher levels of tannins could lead to poor absorption of some essential minerals required for metabolism, reducing growth (Alkassar and Al-Shukri, 2018). Moreover, some factors are linked to the efficacy of phytogenic feed additives such as naturally varied botanical compositions, diverse animal scenarios, environment, management, and health (Abdelli *et al*., 2021). In summary, when the birds reached maturity on day 28, T_3 attained the highest ALW due to improving feed acceptability by the birds. Phytogenic feed additives had a range of performance-related benefits. This may be caused by variations in the chemical makeup of the various phytogenic compounds, the quantity of the active components, and their biological activity (Amad *et al*., 2011).

Average daily gain (ADG)

Measurement of the average daily gain is essential for monitoring the influence of various treatments on the performance of experimental broiler chickens. The results presented in Figure 3 show that Oregano leaf meal had a significant effect ($P<0.05$) on the average daily gain of the broiler chickens, as observed in T_3. The findings

demonstrate that birds fed with varying inclusion rates of Oregano leaf meal showed different ADG treatment means. Broiler chickens in T_3 had the highest ADG of 38.01 grams, followed by T_2 with 34.27 ADG, while T_4 achieved the lowest ADG of 31.96 grams.

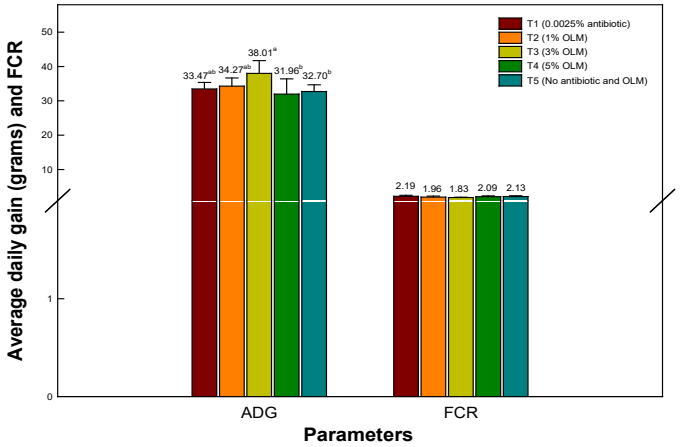

Figure 3: Average daily gain (grams) and feed conversion ratio (FCR) of broiler chicken supplemented with different levels of OLM as alternative to antibiotics in broiler chicken diet.

Moreover, T_1 with antibiotics in the diet gained 33.47 grams ADG, and T_5 gained 32.70 grams. The significant results of incorporating Oregano leaf meal into the diet on the ADG were associated with its inclusion rate and the secondary compounds of Oregano. These could be attributed to the compounds from Oregano, specifically carvacrol, which acts as a growth promotant that can improve digestion and maintain the balance of the gut microbiota ecosystem, thereby stimulating the endogenous secretion of digestive enzymes (Ocak *et al*., 2008). This present study confirms the findings of Hong *et al*. (2012) that Oregano could be a potential natural growth promoter due to its natural activity on the physiology and metabolism of broiler chickens.

Feed conversion ratio (FCR)

The results of the FCR indicate that including OLM, antibiotics, and no antibiotics in the broiler chicken diet had no significant difference among treatment means (P>0.05) throughout the experimental period (Figure 3). Although no significant difference was observed, T_3, which contained 3% OLM, had the lowest FCR (1.83) compared to T_1, where broiler chickens treated with antibiotics showed the highest FCR (2.19). The high FCR in T_1 could be associated with its mortality rates. Birds fed with OLM achieved better FCR than those treated with antibiotics and those without either additive, although these results were not statistically significant. This finding aligns with previous research by Karimi *et al*. (2010), which showed that the inclusion of 20 grams of Oregano leaf per kilogram in starter diets did not significantly affect the FCR of broiler chickens.

Inflammation of the Gut

The inclusion of Oregano leaf meal in the poultry diet did not result in significant differences in gut inflammation among treatment groups (P>0.05) (Table 2). Numerically, the lowest levels of gut inflammation were observed in T1 and T_3. Additionally, T_1 (treated with antibiotics) and T_4 had an inflamed gut score of 0.4, whereas the highest inflammation score of 1.8 was noted in T_5, which lacked both antibiotics and OLM. Although these results were not statistically significant, birds treated with varying levels of OLM appeared to exhibit a reduced risk of gut inflammation. This effect may be linked to the dietary feedstuff, as components high in fiber can enhance the intestinal barrier and increase the antioxidant capacity of the animals, thus reducing intestinal inflammation (Wang *et al*., 2017).

Table 2: Mean of mortality, gut inflammation, and undigested particles in the colon of the experimental birds given oregano leaf meal, with and without antibiotics in the diet.

Parameter	T_1	T_2	T_3	T_4	T_5	SEM	P-value
Mortality	0.40	0.20	0.00	0.00	0.60	0.36	0.068
Inflammation of the Gut	0.40	0.20	0.20	0.40	0.60	0.05	0.709
Undigested particles in the colon	0.60	0.40	0.20	0.20	0.80	0.05	0.265

Undigested particles in the colon

Several particles of undigested feed were observed in the colon, but the results were not statistically significant (Table 2). However, birds from T_3 and T_4 indicated the smallest amount of macroscopic undigested particles, each at 0.20, compared to T_2, which had 0.40. The highest number of undigested particles was recorded in T_5, at 0.80; T1, where broiler chickens were treated with antibiotics, showed 0.60.

The results of this study did not reveal a significant difference that could be attributed to Oregano leaf meal. However, a reduction of undigested particles was visible. These results explain that incorporating phytogenic feed additives can help stimulate appetite, saliva secretion, production of intestinal mucus, bile acid secretion, and activities of digestive enzymes such as amylase and trypsin. These factors influence the positive effect of the morphology of the intestine (Oso *et al*., 2019).

Dressing percentage

Results from T_3 showed a significant difference in treatment means, with a dressing percentage of 68.14% (P<0.05), as indicated in Figure 4. In comparison, T_2

recorded a dressing percentage of 65.38%. Meanwhile, broiler chickens in T_1 had a lower dressing percentage of 65.2%, and the highest inclusion rate of Oregano leaf meal in T_4 resulted in a further reduction to 64.68%. This study demonstrates that the T_3 diet significantly improved carcass recovery percentages in broiler chickens. Supporting these findings, a previous study by Eler *et al*. (2019) reported that birds treated with 300 mg/kg of Oregano essential oil achieved a higher carcass recovery percentage of 70.16%, compared to those treated with higher dosages of 600 mg/kg and 900 mg/kg. This confirms the current findings that incorporating a higher concentration of Oregano in T_5 does not influence the carcass recovery rate of the broiler chickens.

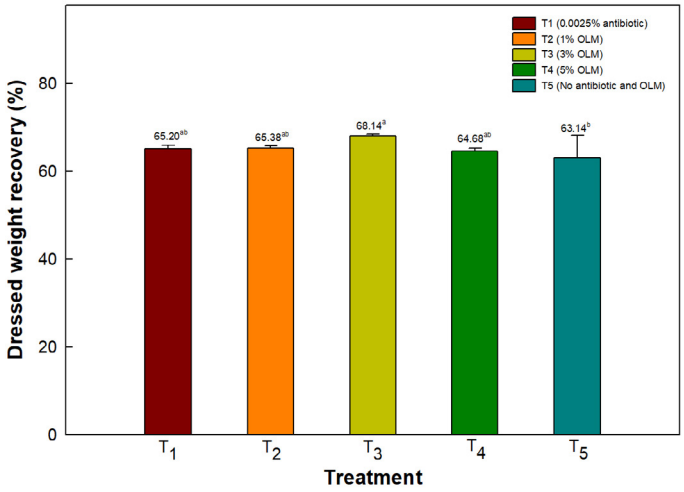

Figure 4: Dressed weight recovery (%) of broiler chicken supplemented with different levels of OLM as alternative to antibiotics in broiler chicken diet.

This could be explained by the fact that treating broiler chickens with higher levels of Oregano essential oil can lead to increased abdominal fat (Eler *et al*., 2019), which is undesirable since fat deposition in the abdomen significantly impacts carcass yield (Schumacher *et al*., 2022). To enhance carcass yield, reducing carcass fat, particularly the abdominal fat pad, is recommended (Foud and El-Senousey, 2014). The diet influences fat deposition, including the fatty acid content of the meat (Schumacher *et al*., 2022).

CONCLUSIONS AND RECOMMENDATION

The study demonstrates the significant impact of Oregano leaf meal (OLM) on broiler chicken performance, suggesting its potential as a substitute for antibiotics in poultry diets. Notably, both T_3 (3% OLM) and T_4 (5% OLM) treatments displayed improved performance with no observed mortality. Additionally, broilers fed OLM exhibited a significant increase in average daily gain (ADG), with T_3 achieving the highest value (38.01 grams) compared to the antibiotic control (T1). Furthermore, T_3 also displayed the highest average live weight (ALW) by day 28, indicating enhanced growth. Interestingly, the inclusion of OLM improved the feed conversion ratio (FCR), with T_3 exhibiting the lowest value. Macroscopic examination revealed positive effects on gut health, with reduced undigested particles and gut inflammation observed in OLM-fed broilers. Moreover, T_3 displayed a significantly higher dressing percentage than the antibiotic control. These findings suggest that incorporating 3% OLM in broiler diets has the potential to be a growth promoter, warranting further validation under commercial conditions.

ACKNOWLEDGEMENTS

The author expresses gratitude to the Natural Science Research Center for sample analysis, the College of Agriculture, Forestry, and Food Science at the University of Antique for their support, and Dr. Reynaldo Intong for his consultancy.

NOVELTY STATEMENT

This study presents a novel approach to investigating the effects of oregano leaf as a potential antimicrobial alternative in broiler chickens.

Conflict of interest

The author has declared no conflict of interest.

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