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The Effect of Adding Different Levels of Cinnamon Oil in The media On Some Types of Intestinal Bacteria and Meat Quality of Chickens, Rose 308

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Abstract

This experiment was conducted in the poultry fields of the Department of Animal Production - College of Agriculture - University of Kirkuk for the period from 4/10/2020 to 8/11/2020 for a period of 35 days (field work) with the aim of studying the effect of adding different levels of cinnamon oil on the productive performance of chickens. Meat Rose 308. In this study, 250 unsexed Rose 308 broiler chicks, one day old, were used. The initial average per chick was 42 grams. The nutritional treatments were as follows: first treatment, T1: control (comparison) diet free of any additives. second treatment, T2: Adding 0.5 g/kg of cinnamon oil to the basic diet. third treatment, T3: Adding 1 g/kg of cinnamon oil to the basic diet. Fourth treatment, T4: Adding 1.5 g/kg of cinnamon oil to the basic diet. Fifth treatment T5: Adding 2 g/kg of cinnamon oil feed to the basic diet. Bacterial levels showed a meaningful decrease according to the research that conducted through T5 group testing and revealed 43×10^4 CFU/g bacterial amounts which were lower than T1 controls measuring 189×10^4 CFU/g. The counts of beneficial Lactobacillus bacteria rose throughout the entire cinnamon oil treatment regimen. Animals that received cinnamon oil consumption demonstrated better physicochemical qualities in breast and thigh meat samples. The lowest pH reading together with TBA and TVN values in T5 sample demonstrated both excellent spoilage resistance and better lipid stability. The most significant improvements occurred in T5 whereas this treatment also achieved superior water-holding capacity and increased shelf life in relation to the control group.

Introduction

The global market relies on poultry meat to provide high-quality animal protein since it combines nutritious content with low cost and convenient cooking methods. It provides low-fat nutritional content with essential fatty acids as well as digestible amino acids that support human health functions [1]. Researchers currently examine plant-based compounds as natural feed additives to enhance poultry health and performance because antibiotics have lost popularity [2,3]. Research reveals that antimicrobial and antioxidant and growth-promoting capabilities make essential oil compounds extracted from aromatic plants beneficial for poultry nutritional management [4]. Researchers extensively study cinnamon

(Cinnamomum zeylanicum) as it contains bioactive components that include cinnamaldehyde and eugenol and cinnamyl acetate and carvacrol which exhibit antimicrobial and antifungal and antiparasitic activity [5–12]. The scientific research indicates that cinnamon powder combined with cinnamon oil enhances growth performance and gut morphology and microbial balance in poultry systems. The work of Vidyanand [13] demonstrated better effects of cinnamon oil over cinnamon powder when applied to broiler meat quality and intestinal health assessment. Intestinal tests performed on quails that received cinnamon oil showed better ileum tissue structure and reduced levels of detrimental bacteria according to Wasman and Mustafa [14]. Carcass quality and antioxidant parameters of Rose 308 broilers received significant enhancement when fed with cinnamon oil according to Brakhas et al. [16].

Essential oils could alter the microbial balance in the gut and absorption of nutrients [17], whereas Al Hanna [15] construed herbal additives as beneficial to meat and immune system quality in broilers.Microencapsulation of essential oils with basil and cinnamon has been suggested as a new delivery technique to boost the stability and bioavailability levels in poultry feed [18]. This research examined the effects of various dietary cinnamon oil inclusions on both E. coli counts and breast and thigh quality of Rose 308 broiler chickens. The research evaluates cinnamon oil's capability as a natural replacement to enhance poultry output and meat preservation methods.

This study aimed to determine the effect of adding cinnamon oil to the feed on some types of bacteria in the intestines and the physicochemical characteristics of breast and thigh meat of broiler chickens.

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Materials and Method:

This study was conducted in the poultry field of the Department of Animal Production at the College of Agriculture / University of Kirkuk for the period from 10/4/2020 to 11/8/2020 for a period of 35 days (5 weeks of field work). This experiment used 250 unsexed chicks of the (Rose 308) breed, one-day old, with a starting weight of 42 gm/chick. The chicks were prepared from one of the private hatcheries in Kirkuk Governorate (Riva Community). The chicks were raised in a ground-based manner in a closed hall using 25 pens with dimensions of 60 x 150 cm on a mattress of sawdust with a thickness of 3-5 cm. Sugar was added to the drinking water during the first day at a concentration of 50 grams. / liter of water for 12 hours in order to provide it with a quick source of energy and clean the digestive tract, the chicks were randomly distributed among five treatments. Each treatment included five replicates, with 10 birds per replicate.

The experimental transactions included the following:

- The first treatment, T1: The control (comparison) diet free of any additives.
- The second treatment, T2: Adding 0.5 g/kg of cinnamon oil to the basic diet.
- The third treatment, T3: Adding 1 g/kg of cinnamon oil to the basic diet.
- Fourth treatment, T4: Adding 1.5 g/kg of cinnamon oil to the basic diet.
- Fifth treatment T5: Adding 2 g/kg of cinnamon oil feed to the basic diet. From day 1 through day 21 the chicks received a starter diet containing 22.45% crude protein with 2962 kcal/kg metabolizable energy and they progressed to the grower diet between day 22 and day 35 containing 19.61% crude protein and 3174 kcal/kg metabolizable energy.

Table 1 shows the details about the chemical makeup of the diets.Tabl 2 show cinnamon oil improves the microbial balance in the intestine.

Microbiological and Meat Quality Analysis

Five randomly selected birds from each treatment group underwent sampling at the conclusion of the study period (day 35). A microbiological analysis was performed on aseptically collected cecal contents. A laboratory procedure for E. coli required MacConkey agar plates while Lactobacillus spp. required MRS agar under anaerobic incubation at 37°C for 48 hours. The microorganisms cultivated through MRS agar incubation at anaerobic conditions at 37°C for 48 hours under anaerobic conditions. Results were expressed in CFU/g.

Breast and thigh muscles were collected for pH measurement with a pH meter and laboratory procedures determined TBA, FFA and TVN values (mg N/100g) and WHC through filter press analysis.

Table 1: Presents the chemical breakdown of starter and grower diets.

Nutrient Component	Starter Diet (1–21 days)	Grower Diet (22–35 days)
Crude Protein (%)	22.45	19.61
Metabolizable Energy (kcal/kg)	2962	3174
Crude Fat (%)	4.50	5.20
Crude Fiber (%)	3.80	4.00
Ash (%)	6.20	5.90
Calcium (%)	1.10	0.90
Available Phosphorus (%)	0.45	0.38
Lysine (%)	1.20	1.05
Methionine (%)	0.48	0.40

The feed materials were prepared. From local markets in Kirkuk, it was crushed in a private laboratory, and its components were mixed using a blender belonging to the Department of Animal Production - College of Agriculture - University of Kirkuk, as shown in Tables (3 and 4) and according to the recommendations of the Breeding Manual for Broilers, Rose 308.

Statistical Analysis:

The experimental data was analyzed through SAS (Statistical Analysis System) version 9.4. This study employed a Completely Randomized Design to assess dietary treatments' effects. We utilized Duncan's multiple range test (Duncan, 1955) for mean comparisons at $P \leq 0.05$ significance. The statistical analysis followed the model:

$Yij = \mu + Ti + eij$

Where:

Yij = observation of the jth replicate in the ith treatment,

μ *= overall mean,*

Ti = effect of the ith treatment,

The random error term follows a normal distribution with zero mean and constant variance.

$Yij = u + Ti + eij$

Since:

Yij = the value of the jth view belonging to transaction i.

u = the general average of the studied trait.

Ti = effect of treatment i.

eij = random error, which is assumed to be normally distributed and independent, with a mean of zero and an equal variance of 2eσ.

Results and Discussion

Effect of Cinnamon Oil on Intestinal Microbial Population

Broiler dietary inclusion of cinnamon oil led to reduced levels ($P \leq 0.05$) of intestinal bacteria count and Escherichia coli numbers when compared to the T1 control diet group. The addition of cinnamon oil at 2 g/kg in group T5 (2 g/kg) led to the lowest E. coli count being $1.22 \pm 43\times10^4$ CFU/g after increasing to $4.16 \pm 189\times10^4$ CFU/g in the control group. The analyzed groups showed that cinnamon oil administration led to elevated Lactobacillus levels resulting in microbial gut balance. The research team led by Chang et al. Research by Wenk [21] revealed that particular herbs sustain digestive health by supporting Lactobacillus bacterial development in poultry. Chang et al. Chang et al investigated the antimicrobial properties of essential oils extracted from Cinnamomum osmophloeum for gastrointestinal pathogens. [20]. Wenk [21] showed selected herb supplementation through supportive actions helped increase Lactobacillus bacterial numbers in poultry (Table 2).

Table 2: This experiment investigated the effects of cinnamon oil supplementations on intestinal microbial populations within experimental subjects (Table presents mean data with standard error levels).

Intestinal bacteria	Transactions				
	T1	T2	T3	T4	T5
Total number of bacteria	$12.35\pm213\times10^{6}$ A	$3.05\pm116\times10^{6}$ B	$1.56\pm93\times10^{6}$ c	$3.81\pm66\times10^{6}$ D	$1.16\pm41\times10^{6}$ E
number of Escherichia coli	$4.16\pm189\times10^{4}$ A	$5.49\pm99\times10^{4}$ B	$2.56\pm81\times10^{4}$ c	$0.91\pm53\times10^{4}$ D	$1.22\pm43\times10^{4}$ E
number of lactobacilli	$1.32\pm 36\times10^{2}$ E	$2.70\pm62\times10^{2}$ D	$2.31\pm128\times10^{2}$ c	$3.76\pm149\times10^{2}$ B	$1.16\pm157\times10^{2}$ A

- T1: control treatment without addition. T2, T3, T4, and T5 are added with cinnamon oil at a ratio of 0.5, 1, 1.5, and 2 g/kg feed, respectively.
- Different letters within one row indicate the presence of significant differences at a significant level ($P\leq 0.05$).

Effect on Physico-chemical Properties of Breast Meat

Table 3 revealed a significant ($P \leq 0.05$) decrease in breast meat pH for birds that received cinnamon oil particularly throughout treatments T2, T4, and T5 when compared to the control group. Breast meat containing all cinnamon oil doses showed reduced levels of TBA together with FFA and TVN. This represents three key spoilage markers.

Because of their phenolic and volatile constituents that prevent oxidative reactions in the meat, these effects are due to the action of antioxidant potentials of cinnamon oil. The results corroborate those of Brakhas et al. [16], who worked on the enhanced meat stability measure in broilers supplemented with cinnamon oil. There are other interesting findings as well supporting these results: Vidyanand [13] also established the positive effect of cinnamon oil on meat freshness and quality.

Table 3: Tests of breast meat's physico-chemical properties measured the effects of adding cinnamon oil (mean ± standard error).

Physico-chemical properties	Transactions				
	T1	T2	T3	T4	T5
PH	0.009 ± 6.13 A	0.008 ± 5.80 B	0.201 ± 5.94 ab	0.020 ± 5.74 B	0.003 ± 5.73 B
WHC %	0.551±53.49 A	0.016 ± 53.25 A	0.023 ±53.01 ab	1.095±51.38 b	0.008± 48.19 C
TBA mg/kg	0.015 ± 2.46 A	0.009 ± 2.08 B	0.003 ± 1.84 d	0.009 ± 1.85 d	0.008 ± 1.92 C
FFA %	0.020 ± 0.38 A	0.007 ± 0.33 B	0.030 ± 0.22 c	0.003 ± 0.18 C	0.002 ± 0.19 C
TVN mg/kg	0.002 ± 4.90 A	0.008 ± 4.83 B	0.006 ± 4.51 e	0.008 ± 4.68 D	0.005 ± 4.75 C

- T1: control treatment without addition. T2, T3, T4, and T5 are added with cinnamon oil at a ratio of 0.5, 1, 1.5, and 2 g/kg feed, respectively.
- water-carrying capacity (WHC), thiobutyric acid (TBA), free fatty acids (FFA), and total volatile nitrogen (TVN).
- Different letters within one row indicate the presence of significant differences at a significant level (P≤ 0.05).

Effect on Physico-chemical Properties of Thigh Meat

Research data in Table 4 shows thigh meat pH values were significantly lower (P ≤ 0.05) in all cinnamon oil treated groups compared to the control. Processed products contained reduced concentrations of TBA FFA and TVN indicating better resistance against oxidative damage and delayed product spoilage processes. Higher concentrations of oil in the samples (T4 and T5) caused a reduction in WHC values that potentially resulted from dense muscle fibers with modified water-binding abilities. Multiple studies by Salinas-Chavira and Barrios-García [17] alongside Brakhas et al. demonstrated how cinnamon oil extends meat shelf life by acting as an antimicrobial and antioxidant agent. [16].

Table 4: Tests of thigh meat's physico-chemical properties measured the effects of adding cinnamon oil (mean ± standard error).

	Effect of adding cinnamon oil to the diet on the physico-chemical properties of thigh meat in broiler chickens (mean ± standard error)				
Treatment	T1	T2	T3	T4	T5
PH	0.034 ± 6.20 a	0.008 ± 6.06 B	0.018 ± 5.84 c	0.002 ± 5.76 d	0.004 ± 5.78 D
WHC %	0.630±53.67 A	0.003 ±52.55 A	1.840±51.55 b	0.247 ±53.83 C	0.007± 48.74 C
TBA mg/kg	0.002 ± 3.51 A	0.008 ± 2.95 B	0.004 ± 2.63 d	0.014 ± 2.64 d	0.012 ± 2.74 C
FFA %	0.020 ± 0.38 a	0.007 ± 0.33 B	0.030 ± 0.22 c	0.003 ± 0.18 C	0.002 ± 0.19 C
TVN mg/kg	0.005 ± 0.45 a	0.004 ± 0.39 B	0.004 ± 0.34 c	0.005 ± 0.32 d	0.005 ± 0.34 C

- T1: control treatment without addition. T2, T3, T4, and T5 are added with cinnamon oil at a ratio of 0.5, 1, 1.5, and 2 g/kg feed, respectively.
- water-carrying capacity (WHC), thiobutyric acid (TBA), free fatty acids (FFA), and total volatile nitrogen (TVN).
- Different letters within one row indicate the presence of significant differences at a significant level (P≤ 0.05).

Conclusions

The bioactive compounds within cinnamon oil act to decrease hazardous microorganisms and protect meat from oxidation and extend its lifetime and ensure safe food production and increases marketability. Research indicates cinnamon oil functions as a potential natural component for broiler animal production systems which enhances productivity and preserves

food quality. Research indicates that cinnamon oil proves effective as a natural enhancement tool and preservation method in broiler farming.

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تأثير إضافة مستويات مختلفة من زيت القرفة في العلف على بعض أنواع البكتيريا المعوية ونوعية لحم الدجاج، روز 308

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الخلاصة:
اجريت هذه التجربة في حقول الدواجن التابعة لقسم الانتاج الحيواني – كلية الزراعة – جامعة كركوك للمدة من 2020/10/4 ولغاية 2020/11/8 ولمدة 35 يوم (العمل الحقلي) بهدف دراسة تأثير إضافة مستويات مختلفة من زيت القرفة على الأداء الإنتاجي للدجاج. لحم روز 308. تم في هذه الدراسة استخدام 250 فرخ لحم روز 308 غير مجنس عمر يوم واحد. وكان المتوسط الأولي لكل كتكوت 42 جرامًا. وكانت العلاجات الغذائية على النحو التالي: المعاملة الأولى :T1 المراقبة (المقارنة) الغذائية الخالية من أي إضافات. المعاملة الثانية :T2 إضافة 0.5 جرام/كجم من زيت القرفة إلى النظام الغذائي الأساسي. المعاملة الثالثة :T3 إضافة 1 جرام/كجم من زيت القرفة إلى النظام الغذائي الأساسي. المعاملة الرابعة :T4إضافة 1.5 جرام/كجم من زيت القرفة إلى النظام الغذائي الأساسي. المعاملة الخامسة :T5 إضافة 2 جرام/كجم من علف زيت القرفة إلى النظام الغذائي الأساسي. أظهرت مستويات البكتيريا انخفاضًا ملحوظًا وفقًا للبحث الذي أُجري على مجموعة T5 ، حيث بلغت كمية البكتيريا 43×10^4 CFU/g، وهي أقل من تلك المسجلة في مجموعة الضبط T1 والتي بلغت 189×10^4 CFU/g. كما ارتفعت أعداد بكتيريا Lactobacillus النافعة في جميع المعالجات بزيت القرفة. وأظهرت الحيوانات التي تناولت زيت القرفة تحسنًا في الخصائص الفيزيائية والكيميائية لعينات لحم الصدر والفخذ. حيث سجّلت عينة T5 أدنى قراءة لمستوى الحموضة(pH) ، إلى جانب انخفاض قيم كل من TBA وTVN، مما يدل على مقاومة ممتازة للتلف وتحسّن في استقرار الدهون. وقد لوحظت التحسينات الأكثر أهمية في مجموعةT5 ، حيث حققت هذه المعالجة قدرة أعلى على الاحتفاظ بالماء، وزيادة في مدة صلاحية اللحم مقارنةً بمجموعة الضبط.