Comparison between effect of adding propolis and antibiotic in in broiler chickens on productive performance and carcass traits

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Abstract: This study was conducted to Compare effect between addition of propolis and antibiotic in performance and carcass traits of broiler from 07/02/2018 until 20/03/2018. 135 one day old unsexed chicks (Ross, 308) were reared for 42 day, they distributed to three treatments, three replicates per treatment (15 birds in replicate). First treatment was control, the second treatment was adding 0.5 g antibiotic (Oxytetracyclin 20%)/ 1 kg feed, and the third treatment was adding 1 g propolis/ 1 kg feed. The results were showed no significant differences in all broiler performance characteristics. While, the propolis treatment was high significantly (P≤0.05) in the relative weight of bursa and gallbladder. Whereas, the relative weight of neck and wings was increased significantly (P≤0.05) in the antibiotic treatment. On the other hand, other carcass traits and relative weights for internal organs were not differed among treatments.

1. Introduction

Propolis is a natural product derived from plant resins collected by honeybees from trees, especially willow buds, poplar and wild chestnut trees. It is used as an insulating material in beehives building and glue to fill the cracks and gaps in the beehive. Most of all, bees prevent by the use of propolis the decay of any foreign organism that enters the hive after killing it and the bees cannot carry it out [1; 2; 3]. The chemical composition of propolis is very complex and consists of more than 300 chemical compounds such as polyphenols, phenol aldehydes, aromatic compounds, steroids, a number of fatty acids, some enzymes, as well as minerals and vitamins such as magnesium, calcium, potassium, sodium, iodine, copper, zinc, manganese, iron, and vitamins B1, B2, B6, C and E. The contents of propolis depend on the collection location, collection time and plant source [2]. Propolis has antibacterial and antifungal properties, and it is used as an alternative treatment in case of infection. The wide range of action of propolis on various microorganisms is the result of the joint activities of flavonoids and aromatic compounds within propolis [4;5]. Propolis is used for medical purposes including remedy of cancer, cardiovascular, respiratory and digestive disorders, skin diseases, liver protection, immune system stimulation, enzyme secretion and cell metabolism. Most of these effects are due to the antioxidant properties of propolis and the removal of free radicals. Flavonoids are known for their strong effect of removing free radicals by binding with heavy metal ions that stimulate many of the processes that lead to free radical formation [6].
Because propolis is anti-bacterial, viruses, parasites, fungi and tumors, stimulates the immune system, protects liver cells and antioxidant [7; 8; 9] It has been used in different levels in broiler diets as alternative growth promoters to antibiotics by many researchers to demonstrate its effect in the productive performance and physiological characteristics of broiler. [10] found a significant increase in body weight and feed consumption, a significant improvement in the feed conversion ratio, and a significant decrease in mortality in the chicks, which were added the propolis to their diet by (50, 100, 150, 200, 250) mg/kg feed. The same applies to the chicks whose propolis was added to their diets (200, 400) mg/kg feed in other study, there was a significant increase in body weight, daily growth rate and feed consumption, a significant improvement in feed conversion ratio, and a significant increase in dressing percentage and relative weights of the thigh, liver and heart [11]. [12] indicated that the addition of (500 and 2000) ppm of propolis to the diet resulted in a significant increase in body weight and feed consumption. Also, [13] found a significant increase in feed consumption, weight gain and production efficiency factor in the chicks, which were added to their diet (1000) ppm of propolis. They also found a significant increase in the relative weights of ileum and liver in propolis treatment. Therefore, this study was carried out to compare the effect of propolis and antibiotics on the productive performance and carcass traits of broilers.

2. Materials & Methods

2.1. Husbandry & experimental design

This study was conducted in Anbar Governorate – Hit for 42 days, 135 one day old unsexed broiler chickens (Ross, 308) were used in this study, with an average weight of 36 g/chick, obtained from the local Euphrates hatchery in Hit. The chicks were reared on the floor in a 5 x 5 m room with a door and window, equipped with a small air puller, and randomly distributed to three treatments, three replicate pen for each treatment (15 bird per pen). The replicates were divided by plastic mesh barriers, and the dimensions of one replicate was 100 × 140 cm. The 1st treatment was control. The 2nd treatment was supplementation 0.5g antibiotic (Oxytetracyclin 20%)/1 kg feed to the end of experiment. While, the 3rd treatment was supplementation 1g propolis/1 kg feed to the end of experiment. A gas incubator was used to warm the chicks in the first three weeks of their life because of the low temperatures in that period. The chicks had ad libitum access to starter diet from 1-10 days, the grower diet from 11-24 days, and then the finisher diet from 25-42 days. Table (1) shows the chemical composition of the diets calculated by the manufacturer company and mentioned on the feed bags. Feed was provided in plastic circular feeders, and water was provided by nipple drinkers, in each replicate 3 nipples (five birds per nipple)

2.2. Measured parameters

The growth performance characters of each pen were calculated (except body weight calculated per bird) in periods (1-21), (22-42) and (1-42) days, which were as follows:

- Body weight
- Weight gain
- Feed intake
- Feed conversion = \( \frac{\text{Feed intake}}{\text{weight gain}} \)
- Mortality [14]
- Relative growth rate = \( \frac{(\text{Body weight at the end} - \text{Body weight at the beginning})}{0.5 \times (\text{Body weight at the end} + \text{Body weight at the beginning})} \times 100 \) [15]
- Production efficiency factor = \( \frac{\text{No.of rearing days} \times \text{feed conversion}}{\text{body weight} \times \text{liveability}} \) \times 100 [16]

While, the relative weights of the internal organs and carcass pieces were calculated at the end of the study [17].

2.3. Statistical analysis
Data were analyzed through one way analysis of variance using the general linear model (GLM) procedures of SAS [18]. The significant differences between the means were tested by Duncan's multiple range test at probability value (P≤0.05) [19].

Table 1. Chemical composition of basal diets

| Calculated Nutrients | Starter Diet | Grower Diet | Finisher Diet |
|----------------------|--------------|-------------|---------------|
| Metabolizable Energy (kcal kg) | 2800 - 3000 | 2900 - 3100 | 2900 - 3100 |
| Crude Protein%        | 21.5 – 23    | 20 - 21.5   | 18 - 20       |
| Lysine%               | 1.04 – 1.13  | 1.2         | 1 – 1.04      |
| Methionine%           | 0.46         | 0.42        | 0.4           |
| (Methionine + Cysteine)% | 0.82 – 0.84 | 0.7 – 0.8   | 0.78 – 0.83   |
| Calcium%              | 0.87         | 0.87        | 0.8           |
| Available Phosphorus% | 0.4          | 0.4         | 0.4           |

The chemical analysis was performed according to NRC [20].

3. Results and Discussion

3.1. Growth performance

The results of the study described in Table (2) showed that there were no significant differences (P≤0.05) among the experiment treatments in the characteristics of productive performance, which included body weight at 3 and 6 weeks of age, weight gain, feed intake, feed conversion ratio, mortality, relative growth rate for periods (1-21), (22-42) and (1-42) days, and production efficiency factor which calculated for the period (1-42) days.

The characteristics of the productive performance of this study, which were not significantly affected by the addition of propolis to the diets, were in agreement with what [21] found when they compared the effect of adding (50, 100, 200, 300) ppm of propolis with antibiotics, from the absence of Significant differences in productive performance traits. This was confirmed by [22] as they did not find significant differences in productive performance of the chicks that were added to their diets (1000, 2000, 3000, 4000, 5000) ppm of propolis. Also, [23] did not find any significant effect of propolis on body weight, daily weight gain, feed consumption and feed conversion ratio when added (40, 70, 100, 400, 700, 1000) mg/ kg Feed. When comparing propolis extract in ethanol alcohol (220 ml/ 200 kg feed) with control, antibiotics (Avilamycin) and flaxseed oil treatments, there were no significant differences in body weight, weight gain, feed intake and feed conversion ratio at 28 days of age [24]. These non-significant results and their difference with the significant results of previous studies may be due to the type of propolis, the amount added to the diet, and the diversity of geographical location from which the propolis was collected.

On the other hand, the results of the production performance of this study differed with the results of many researchers who confirmed that there is a significant effect of propolis on the productive performance of broiler, [25] found a significant increase in body weight for broilers when they added propolis to the diet by (150 and 450) mg/ kg feed. As well as, for the results of [26] who observed a significant effect of propolis when added to the broiler diet of 1 g/ kg feed during heat stress. [27] also noted that the addition of propolis (100, 150, 200, 250) mg/ kg feed resulted in significant increase in body weight, weight gain, feed consumption and significant improvement in feed conversion ratio.

Most of the results of propolis, which showed a significant effect on the production performance of broiler, were attributed to the propolis content of flavonoids [10], which has anti-bacterial, viral and fungal growth, anti-oxidant and inflammatory effect, where flavonoids work clearance the body of free radicals, it has also protective effect on liver cells [9]. It reduces the process of lipid oxidation that leads to the production of free radicals in the body [28], propolis improves metabolism and absorption, increases blood circulation efficiency, and improves the enzymatic system [11]. Reducing the number of pathogenic bacteria, resulting in microbial balance in the gastrointestinal tract. This will result in improved digestion efficiency, and thus improved feed conversion ratio [13]. Also, phenols in propolis kill pathogenic bacteria by lowering pH, damaging the walls of bacterial cells and increasing the
permeability of these walls, this leads to the release of bacterial cell fluids outside and changes the osmotic pressure, and consequently cell death [29].

**Table 2. Effect of propolis & antibiotic on growth performance of broiler**

| Period     | Traits                      | Control          | Antibiotic       | Propolis        | P-value   |
|------------|-----------------------------|------------------|------------------|-----------------|-----------|
| 1-21 days  | Body weight (g) at 21 days  | 615 ± 8.40       | 616 ± 8.96       | 622 ± 10.1      | N.S.**    |
|            | Weight gain (g)             | 579 ± 8.50       | 580 ± 9.27       | 586 ± 16.1      | N.S.      |
|            | Feed Consumption (g)        | 929 ± 1.44       | 949 ± 20.5       | 931 ± 0.192     | N.S.      |
|            | Feed conversion ratio (g/g) | 1.60 ± 0.021     | 1.63 ± 0.009     | 1.59 ± 0.044    | N.S.      |
|            | Mortality%                  | 0 ± 0            | 0 ± 0            | 0 ± 0           | N.S.      |
|            | Relative growth rate%       | 178.0 ± 0.288    | 178.0 ± 0.308    | 178.2 ± 0.539   | N.S.      |
| 22-42 days | Weight gain (g)             | 1430 ± 51.1      | 1438 ± 62.3      | 1458 ± 39.4     | N.S.      |
|            | Feed Consumption (g)        | 3071 ± 42.5      | 3110 ± 113       | 3113 ± 64.5     | N.S.      |
|            | Feed conversion ratio (g/g) | 2.15 ± 0.103     | 2.16 ± 0.095     | 2.14 ± 0.099    | N.S.      |
|            | Mortality%                  | 13.3 ± 0         | 15.8 ± 2.08      | 15.5 ± 4.44     | N.S.      |
|            | Relative growth rate%       | 107.4 ± 1.33     | 107.6 ± 1.44     | 107.9 ± 1.69    | N.S.      |
| 1-42 days  | Body weight (g) at 42 days  | 2045 ± 51.1      | 2052 ± 68.2      | 2084 ± 62.7     | N.S.      |
|            | Weight gain (g)             | 2009 ± 57.7      | 2019 ± 71.2      | 2044 ± 44.8     | N.S.      |
|            | Feed Consumption (g)        | 3980 ± 38.0      | 4032 ± 110       | 4016 ± 53.9     | N.S.      |
|            | Feed conversion ratio (g/g) | 1.98 ± 0.073     | 1.99 ± 0.059     | 1.96 ± 0.066    | N.S.      |
|            | Mortality%                  | 13.3 ± 0         | 15.8 ± 2.08      | 15.5 ± 4.44     | N.S.      |
|            | Relative growth rate%       | 193.1 ± 0.185    | 193.1 ± 0.228    | 193.2 ± 0.142   | N.S.      |
|            | Production efficiency factor%| 213 ± 14.4    | 206 ± 15.4       | 214 ± 23.5      | N.S.      |

* Means ± Standard Error.
** N.S.: Non-Significant.

3.2. Carcass traits
Table (3) showed that antibiotic treatment was significantly higher (P≤0.05) in relative weights of the neck and wings when compared with propolis treatment. While, the relative weight to bursa of fabricius increased significantly (P≤0.05) in propolis treatment in comparison with control treatment. In addition, the treatment of propolis was significantly higher (P≤0.05) in relative weight of gallbladder than the antibiotic treatment. However, the other carcass traits were not differed significantly among experiment treatments, which included the dressing percentage with giblet and without them and the relative weights of the breast, back, thigh, drumstick, liver, heart, gizzard,
proventriculus, pancreas, spleen, duodenum, jejunum and ileum, and relative lengths of the duodenum, jejunum and ileum.

| Carcass Parameters% | Treatments | Control | Antibiotic | Propolis | P-value |
|---------------------|------------|---------|------------|----------|---------|
| Dressing percentage with giblet | 72.3 ± 2.38*a | 74.4 ± 4.87 | 75.4 ± 1.67 | N.S. ** |
| Dressing percentage without giblet | 68.3 ± 2.65 | 70.8 ± 4.74 | 70.8 ± 1.63 | N.S. |
| Breast yield | 19.2 ± 0.873 | 20.0 ± 1.99 | 19.8 ± 2.64 | N.S. |
| Back yield | 6.65 ± 0.996 | 6.80 ± 1.02 | 5.99 ± 0.462 | N.S. |
| Neck yield | 4.54 ± 0.056ab | 5.28 ± 0.163a | 4.31 ± 0.363b | 0.05 |
| Wings yield | 7.87 ± 0.250ab | 8.32 ± 0.117a | 7.70 ± 0.098b | 0.05 |
| Thigh yield | 20.3 ± 0.840 | 21.0 ± 1.43 | 19.3 ± 0.891 | N.S. |
| Drumstick yield | 8.44 ± 0.651 | 7.85 ± 0.820 | 8.63 ± 0.279 | N.S. |
| Liver yield | 2.27 ± 0.224 | 1.94 ± 0.274 | 2.46 ± 0.203 | N.S. |
| Heart yield | 0.425 ± 0.066 | 0.499 ± 0.077 | 0.576 ± 0.045 | N.S. |
| Gizzard yield | 1.29 ± 0.131 | 1.17 ± 0.194 | 1.42 ± 0.055 | N.S. |
| Proventriculus yield | 0.347 ± 0.026 | 0.344 ± 0.082 | 0.430 ± 0.035 | N.S. |
| Pancreas yield | 0.136 ± 0.032 | 0.250 ± 0.041 | 0.229 ± 0.086 | N.S. |
| Spleen yield | 0.132 ± 0.047 | 0.089 ± 0.005 | 0.150 ± 0.003 | N.S. |
| bursa of fabricius yield | 0.091 ± 0.013b | 0.107 ± 0.009ab | 0.226 ± 0.083a | 0.05 |
| Gallbladder yield | 0.066 ± 0.010ab | 0.044 ± 0.001b | 0.102 ± 0.017a | 0.05 |
| Duodenum yield | 0.662 ± 0.094 | 0.400 ± 0.094 | 0.645 ± 0.092 | N.S. |
| Jejunum yield | 1.26 ± 0.208 | 1.11 ± 0.172 | 1.23 ± 0.111 | N.S. |
| Ileum yield | 1.07 ± 0.273 | 1.21 ± 0.272 | 1.29 ± 0.099 | N.S. |
| Duodenum length | 1.40 ± 0.695 | 1.68 ± 0.036 | 1.80 ± 0.193 | N.S. |
| Jejunum length | 4.23 ± 0.251 | 5.00 ± 0.235 | 4.65 ± 0.302 | N.S. |
| Ileum length | 4.87 ± 0.231 | 6.80 ± 1.96 | 4.82 ± 0.342 | N.S. |

* Means ± Standard Error.
** N.S.: Non-Significant.
a, b: means in the same Rows with different superscripts differ significantly at probability value (P≤0.05).

The results of carcass traits and internal organs that they were not affected by the addition of propolis implicitly agree with the results of [30] who did not find any significant effect to add (100, 250, 500, 750) mg/ kg of propolis to feed in dressing percentage and relative weights for the liver, heart and gizzard. The relative weights of the liver, heart, gizzard and small intestine were not significantly affected by adding (1,2,3,4,5) g/ kg of propolis to the diet [31]. However, some studies indicated that some of the carcass traits and internal organs were affected by the addition of propolis. It was observed that the addition of (400) mg/ kg of propolis to the feed resulted in a significant increase in the dressing percentage and relative weights of thigh, liver and heart [11]. As well as, [13] found that the addition of 1000 ppm of propolis to feed significantly increased the relative weight of the ileum and liver. The significant increase in the relative weight of bursa of fabricius in propolis treatment in this study may be due to that propolis stimulates the immune system, Which may be directly done by stimulating the lymphatic tissue in the digestive tract, or indirectly by changing of microbial communities and creating of microbial balance in the gastrointestinal tract. Propolis also increases the effectiveness of macrophage cells, and because the propolis is antioxidant and inflammatory, it inhibits the formation of prostaglandin, which is considered an anti-immune response, thus increasing humoral immunity [32]. Bursa of fabricius is one of the main organs for the production of antibodies that increase its production by adding propolis, where tissue sections of Bursa of fabricius showed a little increasing in the germinal center when the propolis was added by 1g/ kg feed.
to the broiler diets [23]. As for the increasing in the relative weight of gallbladder in propolis treatment, it may be attributed to the flavonoids because they have a hydroxyl group might be able to act as growth hormones where they increase cell metabolism in the body [23]. This will increase the efficiency of digestion and absorption in the gastrointestinal tract and stimulate the enzymatic system [33], Consequently, the increased need for secretion of enzymes increases the weight of gallbladder accordingly.

4. Conclusion

It can be concluded from this study that the addition of propolis in broiler diets had no effect on the characteristics of productive performance, while the addition of propolis in the diets increased the relative weight of the gallbladder and bursa of fabricius for broiler.

5. Acknowledgement

The authors are grateful to the College of applied sciences - Hit, University of Anbar, for the support provided to complete this study.

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