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Original Research

The Effect of Chinese Propolis Supplementation on Ross Broiler Performance and Carcass Characteristics

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Abstract

The experiment was conducted to investigate the effects of Ether Extract of Propolis (EEP) on Ross (308) broiler performance and carcass characteristics. This experiment was carried out in a completely randomized design with 5 treatments (different levels of propolis including 0, 100, 250, 500 and 750 mg/kg diet) for 6 weeks. The mean weight gain, feed consumption and feed conversion ratio were recorded weekly. In addition At 42 days old the total body weight, total body weight gain, carcass and some internal organs relative weights were recorded. The results clarified that, the weight gain was significantly reduced in the 4th and 6th week ($P<0.05$), while the feed consumption, feed efficiency were non significantly ($P>0.05$) reduced for propolis fed birds in comparison to those fed control diet, Furthermore, inclusion of 100, 250, 500 and 750 mg/kg diet Propolis significantly reduced body weight at 42 days old and total body weight gain in comparison to control diet ($P < 0.05$). Under the condition of this experiment, prolonged use of propolis had adverse effect on performance of broilers. Also, all doses of propolis had non-significant negative effect on liver, heart, gizzard and carcass relative weight. In conclusion, EEP has no beneficial effect on performance and Carcass characteristics of Broilers.

Keywords: Propolis; Broiler; Internal organs weight; Performance

Introduction

In recent years, due to the limitations regarding the use of synthetic hormones and antibiotics in dietary rations, research has been carried out to investigate alternative food supplements, in order to increase the benefits of the feed, keep the animals healthy, and eventually decrease the cost of the animal products. Thus, the search for alternative substances that are economically feasible to control microorganism growth has an important role in the production of organic foods.

Recently, propolis has been attracting the attention of researchers due to various biological activities mainly antibacterial activity and therapeutic properties. For the last 30 years propolis has become the subject of intense chemical and pharmacological studies So much useful knowledge has been gathered.

Literature survey revealed that aromatic acids, diterpenic acids, flavonoids and phenolic compounds appear to be the principal components responsible for the biological activities of propolis samples (Haile *et al*., 2012). The collecting location, time and plant source affects contents of propolis (Greenaway *et al*., 1991; Markham *et al*., 1996). Propolis has antioxidant, antimicrobial, immunomodulatory and anti-inflammatory properties (Dobrowolski *et al*. 1991; Bankova, 2005 and Daneshmand *et al*., 2012).

Many authors recorded the beneficial effect of propolis on growth performance and immune response in poultry. They observed that weight gain, feed intake and feed efficiency were significantly increased when propolis fed in fattening quails (Denli *et al*., 2004), broilers (Biavatti, *et al*., 2003; Ziaran *et al*., 2005; Shalmany and Shivazad, 2006; Hassan and Abdulla, 2011 and Daneshmand *et al*., 2012) laying hens-and egg production was increased (Tatli Seven, 2008 and Galal *et al*., 2008).

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Shalmany and Shivazad (2006) indicated that, average weight gain and feed consumption, were significantly higher for 50, 100, 150, 200 and 250 mg propolis /kg diet fed birds and inclusion of Propolis also reduced mortality rate in comparison to control diet. While, Silici *et al*. (2007) reported that, propolis had no detrimental effect on the health but did not improve the performance parameters of quails in first 35 days. Seven *et al*., (2008) mentioned that, using high doses of propolis and vitamin C supplementation in broiler diets may overcome the depression in performance and carcass quality caused by heat stress. Hassan and Abdulla (2011) showed that using propolis at 400 mg/kg in the diet lead to significant increase ($P<0.05$) in eighth-week body weight, feed consumption, maximum daily growth rate of 55.52 g was obtained from the treatment of 400 mg/kg. Also propolis lead to improve feed conversion efficiency in the second, third and fourth week of age for broilers supplemented with 400 mg/kg propolis (1.35, 1.59, 1.95 respectively). Average of proportional weights for each of the liver, heart, thighs, and dressing percentage (74.0%) were improved among birds of this treatment, too. Daneshmand *et al*. (2012) clarified that, the combination of garlic (30 g/kg), oyster mushroom (2 g/kg) and propolis extract (0.2 g/kg) decreased bird's body weight and weight gain.

Based on these findings, it can be proposed that Propolis could be of particular benefit and be useful as growth promoting factor for broilers. Therefore the present study was carried out to study the effects of different levels of propolis extract on the performance of broiler chickens and carcass characteristics

Materials and methods

Propolis

Commercial propolis produced by Dalian Tianshan Industrial Co., Ltd. Changjiang Road, Dalian, Liaoning, China.

Experiment design and treatments

The experiment was in accordance with animal welfare, and was conducted under protocols by Faculty of Veterinary medicine, Assiut, Egypt. A total of 80 one day–old commercial broiler chicks (Ross 308), were weighted individually and randomly allocated to dietary treatments so that each experimental unit had equal average weight and weight distribution. Feed and water were available at libitum. Wood shavings were used as litter. Experiment was carried out in a completely randomized design with 5 treatments each treatment includes 16 birds.

Chicks were randomly divided into one control and four treatment groups. Maize and soybean meal-based diets were formulated according to the requirements proposed by the NRC (1994).Diets were formulated as starter and finishing diets (Table1).

Table 1. Composition of the experimental diets (g/kg)

Ingredients	Starter	Finisher diet
Corn	50.5	60.05
Fish meal	3.5	3.0
SBM	36.75	29
Sunflower oil	6.0	4.7
Dicalciumphoshate	1.5	1.5
Ground lime stone	1.0	1.0
Salt	0.3	0.3
Lysine	0.1	0.1
Methionine	0.1	0.1
Premix	0.25	0.25
Calculated nutrient content		
E (Kcal/kg)	3202.47	3208.05
CP (%)	22.98	20.04

The experimental groups were as follows; group I (control) were fed with a basal diet, group II was fed with basal diet supplemented with100mg propolis /kg diet, group III was fed with basal diet supplemented with 250 mg propolis /kg diet, group IV was fed with basal diet supplemented with 500mg propolis /kg diet. Group V was fed with basal diet supplemented with 750 mg propolis /kg diet. Small amounts of the Basal diet were first mixed with the respective a mounts of propolis as a small batch, and then with a larger amount of the basal diet until the total amount of the respective diets were homogeneously mixed. The birds were fed with starter diet until 21days of age, followed by finishing diet until 42 days of age.

Lighting

Continuous lighting program (23 hours lightning: 1 hour darkness) was used. 60 watt bulb was suspended 2.20 m at head height of the birds. Light in-

tensity at the level of the birds was approximately 2.66lux/m^2/second (Measured by the digital lux meter at the bird head level).

Temperature

Ambient temperature was determined by maximum and minimum thermometer, where the readings were taken every day and the average of weekly and monthly readings were calculated. Heat was provided by using electrical heater.

Groups	Min.	Max.	Mean temperature
1st week	33.71±0.78	34.59±.0.76	34.17±0.89
2nd week	29.20±0.87	29.75±0.79	29.47±0.87
3rd to 6 week	26.03±.0.87	26.77±0.94	26.4±.0.97

Humidity

Indoor Relative humidity was measured by using wall mount thermo hygrometer. Mean relative humidity ranged between 40 to 60 %.

Vaccination Program

Lives Newcastle Disease Virus (NDV)-vaccine was administered in drinking water at 6, 14, 21 and 32 days of age, while the live Infectious Bursal Disease Virus vaccine was given in drinking water at 10, 18 and 25 days of age.

Broiler performance

Live body weight (LBW)

Chicks were individually weighed every week throughout the experimental period from 1 to 42 days of age (using Sartorius balance produced by Sartorius– universal, made in Germany). Individual live body weights were totaled and divided by the number of experimented chicks to obtain the average live body weight (LBW).

Body weight gain (BWG)

The average live body weight gain was calculated weekly by subtracting the individual initial live weight from the final one every week. Individual live Weight gains were totaled and divided by the number of experimented chicks to obtain the average live body weight gain (BWG).

Feed intake (FI)

Chicks in each replicate were provided with a certain amount of feed every week. The residuals were obtained at the end of the same week and the amount of feed consumed was calculated by differences. The following equation was applied to obtain the average amount of feed consumption.

$$\text{Feed intake (g/bird)/ week} = \frac{\text{Amount of feed consumed / week}}{\text{Number of chicks}}$$

Feed conversion (FC)

Feed conversion ratio (feed required to produce a unit of gain)was calculated for each age interval by dividing the average feed consumption per chick per week on average body weight gain per chick per week.

Carcass Characteristics and weight of Some Organs:

At the end of the growing period (42 days old), 5 birds from each treatment were randomly taken. Birds were individually weighed to the nearest gram and slaughtered by severing the carotid artery and jugular veins. After four minutes of bleeding, each bird was dipped in a water bath for two minutes and feathers were removed by hand. After the removal of head, carcasses were manually eviscerated to determine some carcass characteristics including carcass, gizzard, liver and heart weights

Statistical analysis

The results were expressed as the mean ± SEM. All data were analyzed using one way analysis of variances (ANOVA) followed by Duncan Test using SPSS11.0 statistical software (SPSS, Inc., Chicago, IL, 2001).

Results

Chicks showed no clinical signs indicative of harmful effects of the propolis supplementation throughout the experimental period. The effect of dietary propolis extract on body weight of Ross broiler chicks from 1 day old to 42 days of age are shown in Table (2). Initial weight was not different among treatments.

Table 2. Effect of diets containing different levels of propolis on body weight of the Ross broilers (gram).

	1 days old	7 days old	14 days old	21 days old	28 days old	35 days old	42 days old
Control	63.09±0.85	241.79±5.85	513.08±11.89	999.61±21.33	1345.46±35.94a	1717.92±52.14a	2085.00±69.01a
100 mg propolis	60.72±2.14	231.38±10.11	519.58±12.51	987.50±25.78	1295.42±36.38ab	1612.08±48.46ab	1896.67±48.92b
250 mg propolis	64.45±1.03	243.845±7.01	506.15±12.34	940.77±28.76	1235.38±38.40b	1572.92±53.24 b	1867.91±56.91b
500 mg proplis	61.42±1.09	246.25±6.575	515.00±9.432	975.94±21.23	1252.81±23.72b	1571.67±35.73 b	1880.83±48.06 b
750 mg propolis	62.76±1.29	252.50±5.934	524.38±12.60	969.38±24.16	1200.94±32.80b	1521.07±35.25 b	1876.92±35.05b

Means with different letters in the same column differ significantly ($p<0.05$)

Table 3. The effect of propolis supplementation on body weight gain/week.

	1st week	2nd week	3rd week	4th week	5th week	6th week
Control	178.69±5.46	270.00±6.93	486.54±12.05^{a}	345.85±18.47^{a}	359.92±30.79	367.08±34.52^{a}
100mg propolis	170.97±8.99	280.83±8.18	467.08±22.97^{ab}	308.75±13.98^{ab}	316.67±29.90	284.58±21.30^{b}
250mg propolis	179.39±7.31	262.31±8.54	434.62±20.53^{b}	294.62±12.97^{b}	342.92±24.34	278.33±25.65^{b}
500mg propolis	184.83±6.07	268.75±4.78	460.94±13.12^{ab}	276.88±10.10^{b}	342.92±38.45	275.83±19.81^{b}
750mg propolis	189.74±5.13	271.88±7.98	445.00±13.65^{ab}	231.56±12.99^{c}	356.79±16.45	267.30±16.41^{b}

Means with different letters in the same column differ significantly ($p<0.05$)

Nevertheless, it is important to note that from 14 to 21 days Body weight were slightly decreased in treatment groups comparing to control ($P>0.05$). However in other weeks the reductions in body weight become significant from 28 to 42 days old in 250, 500, 750 mg propolis treated groups comparing to non-treated group. While, the significant reduction in the body weight of chicks treated with 100 propolis mg/kg diets appeared only at 42 days of age ($P<0.05$).

As shown in Table (3) broilers supplemented with propolis exhibiting significantly ($P<0.05$) Lower average body weight gain / week at the 4th and 6th week of age and in Table (4) the final body weight gain was significantly reduced in the propolis treated groups compared to the Control group ($P<0.05$): The markedly lowest values ($P<0.05$) were observed in the 750 mg propolis treated group. In addition, broilers supplemented with propolis exhibiting non significantly ($P>0.05$) reduced feed intake than broilers non supplemented with propolis. Consequently, the food conversion ratio was not improved by addition of propolis to Ross broilers diet.

The measures for carcass weight and internal organ weights such as liver, gizzard and heart are given in Table 5. The relative Carcass weight was non significantly higher in broilers non fed with propolis. In addition, at the end of the study, the group receiving 100, 250, 500 and 750 mg /kg propolis in the diets showed lower liver, heart and gizzard relative weights than control group.

Discussion

Results obtained here indicated that addition of 100, 250, 500 or 750 mg/kg Propolis not improved broiler chick's performance or carcass characteristics. The addition of propolis in the diet significantly reduced body weight and growth parameters of Ross broiler chicks such as body weight gain and feed consumption and did not improved feed efficiency compared with control.

These results agree with the findings of Santos *et al*. (2003) who reported that Propolis decreased live weight gain at 42 days in growing broilers. Also, Acikgoz *et al*. (2005) indicated that, Supplementation of male chick's broilers with 4000 ppm propolis significantly decreased body weight. Moreover, Koya-Miyata *et al*. (2009) recorded that; Administration of 50 mg/kg propolis extract orally in mice significantly reduced the weight gain.

On contrary, many authors observed that weight gain was significantly increased. Haro *et al*. (2000) mentioned that, propolis increased the weight gain, this benefit could be attributed to the fact that digestive functions are favored by this dietary supplement also, Shalmany and Shivazad (2006) and Tekeli *et al*. (2011) approved that propolis significantly improved body weight gain of broilers.

Table 4. The effect of propolis supplementation on total body weight gain, feed consumption and feed conversion ratio.

	Total body weight gain (g)	Feed intake (g) for bird/ week	Feed conversion ratio/bird
Control	2021.78±68.89a	727.78±141.87	2.08±0.30
100 mg propolis	1836.12±48.01b	674.53±132.63	2.39±0.57
250 mg propolis	1787.02±43.516b	671.23±122.41	2.45±0.58
500 mg propolis	1786.47±45.67 b	683.29±128.81	2.45±0.57
750 mg propolis	1745.72±33.54b	699.38±129.67	2.64±0.65

Means with different letters in the same column differ significantly ($p<0.05$)

Table 5. Effect of diets containing different levels of propolis on carcass characteristics and internal organ weight in Ross broilers

	Live body weight at 42 days of age	Eviscerated Carcass (%)	Liver (%)	Heart (%)	Gizzard (%)
Control	2292.50±58.39a	75.37±0.57	1.75±0.02	0.55±0.02	2.64±0.12
100 mg propolis	1954.00±133.86b	76.16±0.88	1.68±0.08	0.52±0.04	2.52±0.14
250 mg propolis	1831.00±112.75b	76.11±0.82	1.78±0.16	0.50±0.05	2.41±0.10
500 mg propolis	1929.00±32.87b	74.44±0.72	1.97±0.11	0.49±0.02	2.34±0.06
750 mg propolis	1977.00±106.61b	75.36±0.60	1.96±0.09	0.48±0.02	2.36±0.10

Means with different letters in the same column differ significantly ($p<0.05$)

The results of this study suggest that propolis is an inhibitor of weight gain. The reduced body weight and weight gain could be explained depending on the finding of Koya-Miyata *et al.* (2009) who suggested that the anti-obesity effects of propolis extract could be attributed to reduced expression of fatty acid synthesis genes in the liver. In addition, the inhibitory effect of propolis extract on the accumulation of visceral adipose tissue and hyperlipidemia was down-regulation of fatty acid synthesis. Also, Supplementation of propolis to the starter diet had adverse effect on digestibility of crude protein during the grower phase (Acikgoz *et al*., 2005). Moreover, Ethanolic extract of propolis supplementation affects the digestive process, decreasing the carbohydrate digestion by the disaccharidases in the small intestine due to the linear decreases in maltase activity in the duodenum at 7 d old, in the jejunum at 21 d old, in the ileum at 42 d old (Do Amaral Duarte *et al*., 2011).Bioactive phenolic compounds in Chinese propolis, namely caffeic acid, 3, 4-dimethoxycinnamic acid, isoferulic acid, pinobanksin 5-methyl ether, chrysin, pinocembrin, benzyl caffeate, and galangin (Sha *et al*., 2009). Plant polyphenols have ability to form complex with metal ions and this can reduce feed efficiency and weight gain (Dei *et al*., 2007).

Non-significant reduction in feed intake were observed in propolis treated groups, Also, feed conversion ratio of the control was non significantly better than the propolis treated groups. These findings were in agreement with the results of Sahin *et al.* (2003) who indicated that addition of propolis ethanolic extract to Japanese quail diets did not affect feed intake and feed conversion ratio. Acikgoz *et al.* (2005) observed that propolis supplementation at doses of 500 or 2000 ppm did not significantly increase body weight or feed intake of male broilers while, Silici *et al.* (2007) mentioned that, the feed intake was decreased 10 % at the group receiving the diet containing 5 ml propolis/ kg diet and feed conversion rate 14.43 % in this group when compared with the control group. Controversially,Shalmany and Shivazad (2006) suggested that, higher weight gain in Propolis fed chicks is probably associated with higher feed intake. Tekeli *et al.* (2011) recorded that 240 ppm Z. officinal, 1000 ppm propolis and combination of both had a positive effect on feed consumption. Denli *et al.* (2005) reported that the addition of 1 g/kg propolis to the diet of quail resulted in significantly better-feed efficiency as compared to control.

Non-significant reduction in feed intake in this study may be due to the characteristics of propolis, as it has a strict genuine odour, volatile compounds and a bitter taste, which may have caused the broilers to reject the diet or affect negatively their desire for the diet (Acikgoz *et al*., 2005).

In the present study, carcass, liver, heart and gizzard relative weights were non significantly influ-

enced by the treatments. Addition of 100, 250, 500, 750 mg propolis for the diet of broilers decreased carcass, liver, heart and gizzard weights. The negative effect of propolis on FI and FCR has decreased body weight and consequently it decreased the carcass weight and other internal organs. In agreement with these results, Silici *et al*. (2007) reported that supplementation of 0.5, 5, 10, 20, 40, 80 ml propolis/kg of diet to Japanese quail decreased carcass, liver and gizzard weights. on contrary, Hassan and Abdulla (2011) reported that, Average of proportional weights for each of the liver, heart, thighs, and dressing percentage (74.0%) were improved for the broilers fed diet with 400 mg propolis /kg diet. Furthermore, Seven *et al*., (2008) indicated that Carcass yield and breast meat contents rate of birds fed propolis were statistically higher than the control group and attributed that to The positive effect of propolis on FI and FCR .

Conclusion

Performance and carcass characteristics were negatively affected by Chinese propolis supplementation. propolis extract in amounts that used in present study decreased bird's final body weight and total weight gain significantly ,and reduced feed intake and not improved feed conversion ratio. In addition, it reduced carcass, liver, heart and gizzard weight. Overall, under the condition of the experiments Chinese propolis could not be recommended as a feed additive in broiler production. However, future investigations are required to better understand the bird's response to the propolis and its different constituents.

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