COMPARATIVE STUDY FOR USING NATURAL FEED ADDITIVES ON PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER CHICKENS

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SUMMARY

A total number of 210 one-day old Cobb 500 broiler chicks, were reared up to 35 days of age, as they were distributed into factorial design of two natural feed additives the first one was bee propolis (BPr) while the second was bee pollen (BP) with three supplementation levels (0.05, 0.10 and 0.20%), as compared with control group (0.0% feed additives). The study aimed to examine these additives with different levels and their interaction on growth performance, carcass characteristics and carcass parts of broiler chickens. The results indicated that, natural feed additives (BPr and BP) did not significantly affect final live body weight (LBW), body weight gain (BWG), feed consumption (FC), feed conversion ratio (FCR), performance index (PI), European production efficiency factor (EPEF), energy conversion ratios (ECR) and protein conversion ratios (PCR). Wheaese, levels of supplementation and their interaction, significantly affected LBW, BWG, FCR, PI and EPEF. Concerning carcass characteristics % (carcass, giblets and total edible parts) and carcass parts % (breast, thigh, drumstick and wing) , data showed insignificant figures when chicks fed different feed additives with different levels and their interaction. Based on the experimental results, it is concluded that supplementing broiler chick diets with (BPr or BP) with different levels (0.05, 0.10 or 0.20%) could a good approach to improve production performance without negative effects on carcass characteristics or carcass parts percentages.

Keywords: *propolis, pollen, broiler, performance, carcass characteristics, carcass parts*.

INTRODUCTION

The use of antibiotics routinely as feed additives, has bean banned in many countries because of public concern over possible antibiotic residual effects and development of drug-resistant bacteria. Honey bee products have been introduced as an alternative to antibiotics, however their effects on broiler production are not consistent (Toghyani *et al.,* 2015; Abdel-Kareem and El-Sheikh, 2015). Bee products have a very rich history of use in traditional medicine in humans but recently, various products like honey, pollen, propolis, venom, royal jelly and beenwax, have revealed interesting bioactivities such as antibacterial (Orsi *et al.*, 2005), antiviral (Sforcin, 2007;Gekker *et al.*, 2005), antifungal (Sforcin, 2007), antiparasitic (Salomao *et al.*, 2004; Freitas *et al*., 2006), antiflammatory (Dobrowolski *et al*., 1991), immunomodulatory (Dimov *et al*., 1992) and antioxidative (Krol *et al*., 1990).

On the other hand, all bee products such as propolis and pollen, have been applied as nutritional supplementation to improve weight gain and feed conversion ratio for broiler chicks (Kazem *et al.,* 2017; Rabie *et al.,* 2018). Propolis and pollen which could be considered as alternatives to antibiotics, have a wide range of potential usage. Therefore, determinations of the effects of these products on broiler performance are of significant importance at present, due to their significance with safe feed formulations.

The objective of the present study, was to examine efficiency of bee propolis and bee pollen as feed additives in broiler diets and their associated effects on performance, carcass characteristics and carcass parts.

MATERIAL AND METHODS

This experiment was carried out in Poultry Production Experimental Unit, Faculty of Agriculture, Ain Shams University.

Experimental design, diets and management

Two hundrets and ten chicks were randomly assigned to seven dietary experimental group (7 treatments x 3 replicates x 10 chicks in each) and were housed in three-tiered batteries equipped with feeders and drinking nipples. Feed and water were supplied ad-ilibitum and chicks were kept under similar environmental and managerial conditions during the period 1-35 days of age.

During the experimental period chicks were fed the experimental diets (starter 1-14, grower 15-28 and finisher 29-35 days of age) as shown in Table (1). The nutrient requirements were based on the recommendations of Cobb broiler guide**.** The seven experimental diets were formulated as the first one was served as a control (Basal diets). The other six diets (T_{1-6}) were formulated by mixing experimental feed additives with propolis (BPr) or pollen (BP) over the basal diets at the rate of 500, 100 or 200 g/ton of BPr (T_{1-3}) or BP (T_{4-6}). Experimental feed additives; BPr or BP were obtained from the Honeybee Research Department, Faculty of Agriculture, Ain Shams University.

Table (1): Composition and calculated chemical analysis of the starter, grower and finisher experimental basal diets.

Ingredient %	Starter (1-14 days)	Grower (15-28 days)	Finisher (29-35 days)
Yellow Corn	57.72	61.50	64.01
Soybean meal (44%)	30.00	28.00	25.25
Corn Gluten meal (60%)	6.30	4.00	4.00
Soybean Oil	1.80	2.60	3.20
Mono calcium phosphate	1.60	1.50	1.35
Limestone	1.45	1.35	1.25
Lysine HCL	0.30	0.24	0.17
D-L Methionine	0.23	0.21	0.17
Salt (NaCl)	0.30	0.30	0.30
Vit. & Min. premix*	0.30	0.30	0.30
Total	100.00	100.00	100.00
Calculated chemical analysis**			
Crude protein %	22.01	20.03	19.03
ME (Kcal/kg)	3015	3090	3172
Calcium %	0.91	0.85	0.78
Available phosphorus %	0.45	0.43	0.39
Lysine %	1.33	1.19	1.06
Methionine%	0.61	0.55	0.50
Methionine + cysteine %	0.98	0.89	0.83

** Each 3 Kg of premix containing: 15000000 I.U.Vit A, 3000000 I.U Vit D, 50 g Vit E, 3000 mg Vit K3, 3000 mg Vit. B1, 8000 mg Vit B2, 4000 mg Vit B6, 20 mg Vit B12, 15000 mg pantothenic acid, 60000 mg niacin, 1500 mg folic acid, 200 mg biotin, 200000 mg Vit C, 700 g choline chloride, 80 g Mn, 80 gm Zn, 60 g Fe, 10 g Cu, 1 g I, and 0.2 g Se, where CaCo3 was taken as a carrier up to 3 kg, the inclusion rate was 3 Kg premix/ ton feed.*

*** Calculated analysis of the experimental diets were done according to (NRC, 1994).*

Productive performance

The performance parameters included live body weight (LBW), which was recorded at the start (at one-day of age) as initial weight and at the end of the experimental (at 35 - days of age) as final weight. All other parameters of performance such as feed consumption (FC), body weight gain (BWG), feed conversion ratio (FCR), performance index (PI), European production efficiency factor (EPEF), protein conversion ratios (PCR) and energy conversion ratios (ECR) were calculated during the experimental period (1-35 days of age).

Carcass characteristics and carcass parts percentages

At 35 days of age, four chickens from each treatment were randomly taken for slaughter which were weighed before and after slaughter until complete bleeding. After scalding, feather plucking and evisceration were performed and different body parts, organs and abdominal fat, were detached and weighed to determine the inedible parts % (blood, feathers, head and legs, viscera, abdominal fat) and edible parts % (carcass and giblets) and carcass parts % (breast, thighs, drumsticks and wings).

Statistical analysis

Data were subjected to a two-way analysis of variance concerning source and levels of growth promoters (BPr and BP) as main effects and their interaction by using the General Linear Models (GLM) procedure of SAS user's Guide (2001) according to the following model:

$$Y_{ijk} = M + S_i + L_j + SL_{ij} + e_{ijk}$$

Where:

Y_{ijk} = Observation of any measured trait

M = Overall mean

S_i = Effect of i th growth promoters sources i = 1, 2)

L_j = Effect of j th growth promoters levels + j 1, 2,3)

SL_{ij}= Two order interaction of sources by levels (2 x 3)

e_{ijk} = Random error

When significant differences were found within sources or levels, were detected, means were separated using Duncan's multiple range test (Duncan, 1955). Statistical significance was accepted at probability level of ($P \leq 0.05$).

RESULTS AND DISCUSSION

Effect of dietary treatments on LBW, BWG, FC and FCR

The effect of natural growth promotors (BPr and BP) on productive performance of broiler chicks, would be presented as follows:

Source of natural feed additives (BPr and BP)

Results presented in Table (2) indicated that, there were no significant differences in initial body weight, final LBW (35 d), BWG, FC and FCR by feeding (BPr) diets compared with (BP) diets. This observation agreed with Tayeb and Sulaiman (2014) who found that propolis did not improve the performance parameters of quail within period of 1- 35 days of age.

Additionally, Mahmoud et al. (2013) found that inclusion of BPr (100, 250, 500 and 750 mg/kg) in broiler rations, did not improve the chicks performance. Moreover, Kleczek *et al.* (2012) concluded that final body weight of broiler chicks fed diets supplemented with antibiotic or propolis were equal to those fed the control diets. Also, Tayeb and Sulaiman (2014) concluded that feeding Japanese quail diets supplemented with bee pollen up to 20 g/ton, did not result in any significant improvement in growth performance or body components. On the other hand, these findings are in contrast with the results obtained by Attia et al. (2014) and Farag and El-Rayes (2016) who concluded that supplementing diets with (BPr or BP) resulted in a better LBW, BWG and FCR. In addition, according studies of Dos Santos *et al.* (2003) in broiler chicks; Kazem *et al.* (2017) in male broiler chicks and Kaya-Miyata *et al.* (2009) in mice,it is concluded that body weight and weight gain were significantly decreased by feeding diets containg propolis.

LBW and BWG

It worth to note that broiler chicks fed control diets during experimental period reflected the lowest significant (LBW and BWG) compared with different levels of (BPr or BP). In addition, chicks fed 0.2% gave higher BWG (1730.32 g) compared to diets containing lower levels of 0.05 or 0.10% being 1630.4

Table (2): Effect of dietary treatments on productive performance of broiler chicks.

Item	Additives		Levels				Interaction							S. D.
	BPr	BP	Control	0.05%	0.10%	0.20%	Control	T1	T2	T3	T4	T5	T6	
Initial Weight (g)														
1 day	36.03	35.78	36.06	36.00	35.92	35.67	36.06	36.30	35.97	35.80	35.70	35.80	35.50	0.68
Live body weight (g)														
35 days	1682.39	1665.65	1569.08^{c}	1665.67^{b}	1711.26^{b}	1765.98^{a}	1569.08^{d}	1661.63^{c}	1718.48^{abc}	1780.37^{a}	1669.00^{bc}	1704.00^{abc}	1751.60^{ab}	82.31
Body weight gain(g)														
1-35 days	1646.71	1637.87	1533.04^{c}	1630.47^{b}	1675.35^{b}	1730.32^{a}	1533.04^{d}	1626.75^{c}	1681.52^{abc}	1744.56^{a}	1633.31^{bc}	1668.18^{abc}	1716.07^{ab}	82.37
Feed consumption(g)														
1-35 days	2759.85	2796.09	2811.05	2706.90	2753.98	2838.25	2811.00	2649.30	2739.50	2839.76	2768.13	2768.46	283673	160.20
Feed conversion ratio														
1-35 days	1.67	1.71	1.83^{a}	1.66^{b}	1.64^{b}	1.64^{b}	1.83^{a}	1.63^{b}	1.63^{b}	1.63^{b}	1.69^{b}	1.66^{b}	1.65^{b}	0.05

a,b,c means in the same raw with different superscripts in the same raw are significantly (p≤ 0.05) different control: No additives, T1: BPr (Bee propolis) 0.05%, T2 : BPr 0.10%, T3: BPr 0.20%, T4: BP (Bee Pollen) 0.05%, T5: BP 0.10% and T6: BP 0.20%. S.D. Stander deviation.

and 1675.35 g, respectively. Similar observations were reported by other investigators: Klaric *et al.* (2018), in Ross 308 chicks; Sakine *et al.* (2016) in quail and El-Neney and El-Kholy *et al.* (2014) in rabbits. In addition, Attia *et al.* (2014) showed that continuous or intermittent supplementation of (BPr, BP or mannan oligosaccharides) , increased BWG of broiler chickens. Moreover, Fazayeli-Rad *et al.* (2015) reported that LBW and BWG were significantly increased with increasing BPr or BP levels.

FC and FCR

The results in Table (2) showed insignificant decrease in FC for groups received (0.05 or 0.10%) feed additives in their diets as compared with other treatments (0.0% control or 0.20%). The reduction in these groups reached 3.71 and 2.03%, respectively compared with control group. However, the highest value of FC, was recorded with the group given (0.20%) feed additives as compared to other experimental groups. Regarding FCR, obtained data showed that there were significant differences among different levels of feed additives during the studied period (1-35 d). Chicks fed control diets recorded lower efficiency in converting their food into BWG compared with those fed different levels of feed additives. These results could be attributed to the presence of phenols and flavonoids found in (BPr and BP) supplementation which is responsible of their antimicrobial, antioxidant activity and, hence, better nutrient utilization (Tatli Seven *et al.,* 2009). These results agreed with those reported by Abou El-Naga (2014), Galal *et al.* (2008), Abdel-Kareem and El-Sheikh (2015) and Attia *et al.* (2014).

Interaction between sources and levels

Data concerning the interaction between feed additives (BPr and BP) and levels (0.05, 0.10 and 0.20%) for productive performance were showed in (Table 2). The corresponding values for BWG ranged between 1533.04 and 1744.56 g, while FCR ranged between 1.63 and 1.83, with significant differences within treatments. Broiler chicks fed T3 or T6 diets , gave the higher figures of BWG being 1744.56 and 1716.07 g, while, chicks fed control diets recorded the lowest figure (1533.04 g). In the same order, FCR figures showed the same trend, in which T_{1-3} presented better FCR.. These findings agreed with those obtained by **Fazayeli-Rad *et al.* (2015),** who reported that supplementing chick diets with different levels of propolis, improved growth performance, immunological, microbiological, anti-oxidant and physiological status.

Effect of dietary treatments on PI, EPEF, ECR and PCR

Source of natural feed additives (BPr and BP)

Data in Table (3) indicate that PI and EPEF, increased by feeding (BPr) diets compared with (BP) diets. The corresponding figures were 100.80 and 287.82 versus 98.39 and 280.89, without significant differences. Moreover, feeding diets containing (BPr) gave better ECR and PCR compared with (BP) diets, being 0.33 and 5.23 versus 0.34 and 5.32, respectively, with insignificant differences.

Level of natural feed additives (0.05, 0.10 or 0.20%)

PI and EPEF of chicks as affected by different levels of feed additives, is illustrated in Table (3). The obtained data showed that there was significant difference in PI and EPEF among different levels of feed additives. Chicks fed control diets presented the lowest values of PI (86.21%) and EPEF (244.64). While, chicks fed diets supplemented with 0.20% feed additives showed the highest PI (107.68) and EPEF (307.66).

The figures of ECR and PCR indicated insignificant differences between chicks fed diets containing different levels of feed additives compared with those fed control diets.

Interaction between sources and levels

Data in Table (3) indicated that there were significant differences in (PI and EPEF) among treatments during the studied period (1-35 d). Chicks fed control diets recorded lower values of PI and EPEF, compared with other treatments (T_{1-6}). However, higher PI and EPEF were detected for the chicks fed T_3 or T_6 diets.

Better values of ECR and PCR, were recorded with chicks fed T_{1-3} diets, while, worst ECR and PCR were recorded with chicks fed control or T_{4-6} diets, however, with insignificant differences.

Effect of dietary treatments on carcass characteristics % and parts %

Data in Table (4) show carcass characteristics at 35 days of age. It is clear that neither source of feed additives nor levels of supplementation had a significant effect on carcass, giblets % (liver + gizzard + heart) and total edible parts %. The corresponding values for carcass % ranged between 63.9 and 66.83, while the

Table (3): Effect of dietary treatments on performance index, european production efficiency factor, energy and protein conversion ratio of broiler chicks.

Item	Additive		Level				Interaction							S. D.
	BPr	BP	Control	0.05%	0.10%	0.20%	Control	T1	T2	T3	T4	T5	T6	
Performance index (PI)*														
	100.80	98.39	86.21^{b}	100.35^{a}	104.15^{a}	107.68^{a}	86.21^{b}	102. 80^{a}	105.54^{a}	109.38^{a}	98.62^{ab}	102.70^{a}	105.90^{a}	6.53
European Production Efficiency Factor (EPEF)**														
	287.82	280.89	244.64^{c}	286.24^{b}	297.60^{ab}	307.66^{a}	244.64^{c}	291.67^{ab}	301.55^{ab}	312.53^{a}	281.77^{b}	293.64^{ab}	302.78^{ab}	27.43
Energy conversion ratio (ECR)***														
	0.33	0.34	0.36	0.33	0.33	0.33	5.70	5.06	5.10	5.07	5.27	5.16	5.14	0.02
Protein conversion ratio (PCR)****														
	5.23	5.32	5.70	5.16	5.11	5.10	0.36	0.32	0.32	0.32	0.36	0.33	0.36	0.37

a,b,c means in the same raw with different superscripts in the same raw are significantly (p≤ 0.05) different control: No additives, T1: BPr (Bee propolis) 0.05%, T2 : BPr 0.10%, T3: BPr 0.20%, T4: BP (Bee Pollen) 0.05%, T5: BP 0.10% and T6: BP 0.20%. S.D. Stander deviation.

** calculated according to North (1981), ** calculated according to Emmert (2000),*** calculated as (kcal intake/ body weight gain (g)) and ****calculated as (g protein intake /body weight gain (g).*

Table (4): Effect of dietary treatments on carcass characteristics and parts % of broiler chicks.

Items %	Additives		Levels				Interaction						S. D.
	BPr	BP	Contز	0.05%	0.10%	0.20%	Contز	T1	T2	T3	T4	T5	T6	
Carcass characteristics %														
Carcass	65.51	66.07	63.92	67.37	65.88	66.01	63.92	65.83	65.45	66.83	64.84	64.95	65.17	2.01
Liver	2.64	2.38	2.31	2.50	2.70	2.51	2.31	2.69	2.86	2.72	2.35	2.52	2.30	0.37
Gizzard	1.48	1.49	1.49	1.53	1.54	1.36	1.49	1.52	1.61	1.31	1.53	1.50	1.43	0.22
Heart	0.50	0.49	0.47	0.55	0.49	0.47	0.47	0.52	0.49	0.48	0.57	0.51	0.46	0.06
Giblets*	4.61	4.38	4.27	4.60	4.75	4.36	4.27	4.74	4.95	4.51	4.27	4.55	4.21	0.13
Total edible prats**	70.12	70.44	68.19	71.97	70.61	70.36	68.19	70.57	70.4	71.34	69.11	69.5	69.38	0.80
Carcass parts %														
Breast	45.33	46.01	45.23	46.18	44.85	46.44	45.23	47.47	44.87	44.72	45.57	46.25	47.70	3.25
Thigh	28.64	28.36	27.20	27.80	28.83	28.50	27.20	27.57	29.10	28.64	27.91	27.79	27.84	2.07
Drumstick	15.18	15.26	15.51	14.94	15.52	14.91	15.51	14.17	15.28	15.13	15.16	15.36	14.47	1.43
Wing	11.28	10.98	11.95	11.10	10.81	10.64	11.95	10.77	10.75	11.50	11.35	10.59	9.78	1.23

control: No additives, T1: BPr (Bee propolis) 0.05%, T2 : BPr 0.10%, T3: BPr 0.20%, T4: BP (Bee Pollen) 0.05%, T5: BP 0.10% and T6: BP 0.20%.
*S.D. Stander deviation. *Giblets % = (liver + Gizzard + Heart) %, **Total Edible parts% = (Carcass + Giblets) %.*

percentages of giblets ranged between 4.21 and 4.95. Moreover, total edible parts ranged between 68.19 and 71.34, with insignificant differences within treatments.

In the same order, the figures of carcass parts % indicated insignificant differences between chicks fed diets supplemented with (BPr or BP) in three levels (0.05, 0.10 or 0.20%) compared with control group. The corresponding values ranged between 45.23 and 47.70 for breast %, 27.20 and 22.10 for thigh % and 14.1 and 15.51 for drumstick %. These results are in agreement with those reported by many investigators (Hascik *et al.*, 2012; Adhikari *et al.*, 2017; Tatli Seven *et al.*, 2008 ; Mahmoud *et al.*, 2013). These authors concluded that addition of BPr or BP in broiler diets, had no effects on carcass traits compared with control group. On the other hand, the obtained data disagreed with those reported by Farag and El-Rayes (2016), Attia *et al.* (2014) and Peter Hascik (2012) who reported that BPr or BP supplementation have been shown to increase carcass weight, carcass yield and dressing percentages.

CONCLUSION

Bee propolis or bee pollen at different supplementation levels (0.05, 0.10 or 0.20%) could effectively be used as a natural feed additives in broiler chicks diet for improving BWG, FCR and PI without negative effects on carcass characteristics or carcass parts percentages.

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دراسة مقارنة للمستويات المختلفة لبعض إضافات الأعلاف الطبيعية على الأداء الإنتاجي وصفات الذبيحة لدجاج التسمين

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أجريت هذة الدراسة علي 210 كتكوت تسمين سلالة كب 500 عمر يوم حتى 35 يوم. حيث إستخدام في هذه الدراسة البروبوليس وحبوب اللقاح بثلاث مستويات مختلفة (0.05، 0.10، 0.20%) بالمقارنة بمجموعة كنترول (صفر% من إضافات الأعلاف طبيعية) لدراسة تأثير نوع الإضافة الطبيعية ومستويات الإستخدام والتداخل بينهما على الأداء الإنتاجي وصفات الذبيحة وقطعيات الذبيحة لدجاج التسمين. و قد أوضحت النتائج أن

- إضافة المواد الطبيعية (البروبوليس وحبوب اللقاح) لم يكن لها تأثير معنوي على الأداء الإنتاجي (الوزن الحي ومعدل النمو - استهلاك العلف - معامل تحويل الغذاء - دليل الأداء الإنتاجي ومعامل الإنتاج - معامل تحويل الطاقة أو البروتين)
- أثرت مستويات الإضافة والتداخل (إضافة × مستوى) معنوياً على وزن الجسم والنمو ، معامل تحويل غذائي ، دليل الأداء الإنتاجي ومعامل الإنتاج وقد سجلت مجموعة الكنترول أقل القيم بالمقارنة بالمعاملات الأخرى.
- لم تؤثر الإضافات الطبيعية ومستويات الإضافة والتداخل بينهما على صفات الذبيحة (% للذبيحة والأحشاء الداخلية (المأكولة والأجزاء الكلية المأكولة) أو قطعيات الذبيحة (% للصدر والفخذ والدبوس والجناح).

توصي نتائج الدراسة بامكانية إستخدام الإضافات الطبيعية (بروبوليس أو حبوب اللقاح) بمستويات (0.05 و1.10 و0.20%) طول الفترة الإنتاجية 35 يوم لتحسين الأداء الإنتاجي بدون تأثيرات سيئة على صفات الذبيحة أو قطعيات الذبيحة