

Effect of Date Palm Pollen and Bee Pollen as Growth Promoters on the Performance of Saidi Rams

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Summary

The experiment was conducted at the Animal Experimental Farm, Animal Production Department, Faculty of Agriculture, Assiut University, Assiut, Egypt. The aim of this study was to determine body performance of rams drenched three times weekly for three months with: tap water (Control, C), date palm pollen (DPP) 30 gm, bee pollen (BP) 30 gm, and artificial bee bread (BB) 30 gm. All experimental supplements suspended in tap water.

Twenty Saidi rams were assigned randomly to four treatment groups (C, DPP, BP and BB) with an average initial body weight, 35.00, 36.24, 36.74 and 35.68 kg, respectively. Animals were fed roughage and concentrate diets *ad libitum* during the experimental period (three months). Feed consumption was determined, live weight gain and feed conversion were calculated. At the end of experimental period, the final body weight in C and DPP, BP and BB treated groups was 44.38, 52.75, 53.13, and 58.38 kg, respectively. Regarding body weight (BW) and average daily gain DPP, BP and BB showed significant increase ($P < 0.05$) than the control while BB significantly ($P < 0.05$) exceeded the other two treatments DPP and BP. No significant differences were detected between DPP and BP treated groups. All treated rams had higher ($P < 0.05$) total feed intake than the control. Feed conversion of DPP, BP and BB treated rams improved and was significantly lower ($P < 0.05$) than the control. While the BB treated rams group showed the lowest feed conservation rate.

Keywords: *Date palm pollen, bee pollen, bee bread, sheep.*

Introduction

The use of antibiotics in animal nutrition has been prohibited in the European Union since January 2006 (Oetztuerk and Sagmanligil 2009). This trend has powered interest in natural nutritional concepts. Phyto-genic feed additives may be included among supplements that are aimed to positively affect feed quality, health of animals as well as animal products by means of their specifically efficacious substances (Karásková *et al.* 2015).

The ancient Egyptians described pollen as "*a life-giving dust*". Pollen

of the date palm (DPP) has been used for thousands of years as a traditional Egyptian herbal medicine for improving male and female fertility (Soliman and Soliman, 1957 and Amin *et al.*, 1969). Phytochemical studies of DPP showed the presence of estrone, α -amirin, triterpenoidalsaponins, estradiol and estriol five flavonoids and a crude gonadotrophic substance (Mahran *et al.*, 1985 and Abbas and Ateya, 2011). In addition, palm pollen was found to strengthen and increase the resistance of different tissues to different harmful pathogens and toxicants due to their high pheno-

lic and flavonoid contents (Campos *et al.*, 1997).

Bee pollen (BP) is aggregate of flower pollen composed from several plant sources by honeybees by collecting millions of floral pollen grains and mixing it with plant nectar and bee saliva rich in enzymes thus altering its composition and improving its therapeutically potential (Leblanc *et al.*, 2009). It is a substantial source of proteins (25–30%), lipids, including fatty acids and sterols, rich source of free amino acids; more than 12 vitamins, 28 minerals, 59 trace elements, 11enzymes or coenzymes, carbohydrates (35–65%), which are chiefly glucose, fructose and sucrose, as well as antibiotic substances, antioxidant substances, carotenoids, polyphenolics such as flavonoids and carbohydrates (Xu *et al.*, 2009, Attia *et al.*, 2011b and Haščík, *et al.*, 2012). Furthermore, Hajkova, *et al.* (2013) indicated that bee pollen contains a noticeable source of compounds with health protective potential and antioxidant activity.

Correspondingly, amino acids, vitamins and trace elements of BP are nutritionally beneficial for improving intestinal absorption due the stimulation the development, proliferation and differentiation of intestinal cells and because they improve the environmental conditions for the intestinal microbial ecosystem. BP could also improve the cell immune response, the antibody production speed, and reinforce the immunological system (Song *et al.*, 2005). BP composition tend to be species-specific and has been related to the therapeutic properties (antibiotic, antifungal, antineoplastic, antidiarrhoeic

and antioxidant) of pollen (Almaraz-Abarca *et al.*, 2004 and Hajkova, *et al.*, 2013). Attia *et al.* (2011a and 2014a and Batta and El-Kholy 2014) reported that bee pollen increased body weight gain and survival rate and reduced feed intake and feed conversion ratio of offspring up to 12 weeks of age. Khojasteh and Shivazad (2006) and Wang *et al.* (2007) stated that BP contains digestive enzymes from the bees.

However, Rimpler (2003) hypothesized that BP was insufficiently digested and that cracking would improve the digestibility and bioavailability. Regarding to natural beebread (BB), to feed its larvae bees store pollen in the hive as beebread. Pollen is mixed with honey and bee secretions and stored in the combs. Bee bread undergoes a lactic acid fermentation and can be thus preserved. This improves the nutritional value of pollen grains. Beebread is an excellent source of otherwise scarcely available nutrients and produced in a very small amount (Krell, 1996). There is no information about the effect of DPP, BP and BB on body performance of ruminants especially in sheep. There are no previous reports dealing with artificial bee bread (BB) as growth promoter in farm animals or poultry. Therefore, the present study was aimed at elucidating the effects of supplementing DPP, BP and BB productive performance in Saidi rams.

Materials and Methods

The experiment was conducted at the Animal Experimental Farm, Animal Production Department, Faculty of Agriculture, Assiut University, Assiut, Egypt. Fresh commercial

date palm pollens (DPP) were bought at the season of date palm male tree flowering. Fresh commercial multi-floral bee pollens (BP) were used.

Artificial bee bread (BB) was prepared according to modified method after Dany, (1988). The natural bee bread was more or less simulated artificially using date palm pollen (DPP), honey, *Lactobacillus bulgaricus* and *Streptococcus thermophilus* (10 shares of pollen: 1.5 shares of honey: 2.5 shares of clean water, in shares by weight, and small quantity of lactic acid bacteria). The temperature for the first 2-3 days was between 32 and 34°C. After that, the temperature was lowered to 20 - 24°C for about one week.

Twenty Saidi rams of about 35-36 kg body weight were assigned randomly to four treatment groups (C, DPP, BP and BB) with an average body weight, 35.00, 36.24, 36.74 and 35.68 kg, respectively. The control group (C) was drenched tap water while DPP, BP and BB treated groups were drenched 30 g. of water-suspended date palm pollens (DPP), bee pollens (BP), or artificial bee bread (BB). Rams were drenched three times weekly for the three months of the experimental period.

Animals were fed roughage and concentrate diet *ad libitum* during the experimental period. Animals were weighed at the beginning of the experiment in the morning before feeding and biweekly thereafter to determine body weight. Feed consumption

was determined, live weight gain and feed conversion (kg feed / kg gain) were calculated.

Statistical analysis:

Data were statistically analyzed using general linear model (G.L.M.) procedure of SAS (2012). For growth performance, metabolite constituents, the following model was used:

$$Y_{ijk} = \mu + T_i + P_j + (TP)_{ij} + E_{ijk}$$

Where;

T_{ijk} = The observation

μ = general mean

T_i = Effect due to treatments

P_j = Effect due to period.

TP_{ij} = Effect due to interaction of treatment and period

E_{ijk} = The errors related to individual observation.

Results and Discussion

1-Body weight (BW)

The mean values and standard error of the effects of DPP, BP and BB on body weight are presented in Table 1. While, Table 4 shows the effects of supplementation with DPP, BP and BB on BW.

Mean values of body weight increased ($P < 0.05$) gradually during the three months of the experimental period among the four experimental groups. Mean values of DPP, BP and BB showed increase ($P < 0.05$) in BW than the control treatment while BB significantly ($P < 0.05$) exceeded the other two treatments (DPP and BP). No significant differences have been detected between DPP and BP treated groups (Table 1).

Table 1. Live body weight (Kg) of rams supplemented with DPP, BP and BB.

Treatments	Month			Mean
	1	2	3	
C	38.00 ±1.01	41.75 ±1.71	44.38±1.94	41.38 ^C ±1.10
DPP	41.75 ±0.75	48.00 ± 0.96	52.75±2.04	47.50 ^B ±1.41
BP	40.55 ± 0.88	46.50 ±1.06	53.13±2.19	46.71 ^B ±1.59
BB	43.50 ±0.96	51.25±0.46	58.38±0.66	51.04 ^A ±1.67
Mean	40.94 ^c ±0.62	46.88 ^b ±0.94	52.16 ^a ±1.42	
L.S.D. _{0.05}	1.66			L.S.D. _{0.05} 1.92

^{a,b,c} Means in row with no common superscript differ significantly (P< 0.05).

^{ABC} Means in column with no common superscript differ significantly (P< 0.05).

2- Daily weight gain:

The mean values and standard error of the effects of the growth promoters (DPP, BP and BB) on body weight gain (g/day) are presented in Table 2. While, Table 4 shows the effects of supplementation with DPP, BP and BB on daily weight gain. Significant differences (P<0.05) in mean values of BW among the four experimental groups were observed (103.11, 182.33±, 179.84, and 259.11 g/day for the con-

trol, DPP, BP and BB treatments, respectively). Mean values of DPP, BP and BB showed significant (P<0.05) increase than the control one, while the BB group significantly (P<0.05) exceeded the other two treatments DPP and BP. No significant differences have been detected between DPP and BP groups (Table2). Insignificant differences were detected among the three months of the experimental period, over all the four treatments (Table 2).

Table 2. Daily weight gain (g/d) of rams supplemented with DPP, BP and BB.

Treatments	Month			Mean
	1	2	3	
C	90.00±16.33	131.34±19.11	114.67±13.69	103.11 ^C ±11.37
DPP	177.34±10.92	205.33±8.60	164.67±17.50	182.33 ^B ±12.66
PB	160.67±28.90	173.34±19.44	206.67±43.01	179.84 ^B ±24.92
BB	284.00±32.07	253.34±22.61	236.67±25.49	259.11 ^A ±15.78
Mean	173.25±19.29	197.50±13.31	172.54±6.78	
L.S.D. _{0.05}	41.78			L.S.D. _{0.05} 48.24

^{ABC} Means in column with no common superscript differ significantly(P<0.05).

The present study showed that rams fed diets with DPP, BP and BB at 30 g/day three times/weekly had improved live body weight and daily gain. Our findings are in agreement with those of previous reports with other farm animals. For example, Dietary pollen improved growth performance, survival rate, egg productivity, feed utilization efficiency, immunity, and resistance to diseases in

chickens. Similar effects were also observed in pigs, as supplementary BP stimulated growth rates of swine (Huai *et al.* 2005).

The positive effect of DPP, BP and BB administration on BW and BWG can be attributed to the presence of a lot of nutrient factors (as antioxidants, vitamins, mineral, essential fatty acids, vitamins, amino acids, enzymes etc.) and protective

agents, such as flavonoids, carotenoids, and phenolic constituents in the BP which can improve nutrient value of the feed as well as feed digestibility and absorption (Leja *et al.*, 2007; Saric *et al.*, 2009). Wang and Cheng (2005) assessed the presence of BP (1, 2, 3, 4 and 5%) in diets for growing and finishing pigs and reported that the 4 and 5% levels improved the daily weight gain of the animals. Similarly, the improvement of intestinal mucosa morphology in rabbits supplemented by BP may be partially responsible for the higher growth rate obtained in the current study. However, pollen feeding in mammals increased the intestinal absorptive capacity through the longer and thicker villi (Wang *et al.*, 2007).

Bee pollen comprises high concentrations of reducing sugars, essential amino acids and unsaturated/saturated fatty acids about half of them are the unsaturated acids oleic, linoleic (omega-6) and linolenic (omega-3), minerals as Zn, Cu, Fe, Se and high K/Na ratio. Significant quantities of several vitamins in bee pollen: provitamin A, B complex, A, C, D, K3, E (tocopherol), vitamin B2 (riboflavin), niacin, thiamine, folic acid was observed and biotin has an important role in metabolism of proteins, fats and carbohydrates and has participation in vitamins B6, B9 and B12 metabolism which reflected in an enhanced animal performance. It is also a potential source of polyphenols and other healthy compounds (Santos Pereira, *et al.*, 2010, Campos, *et al.*, 2010 and Attia *et al.* (2014 a).

The effects of BP can be also attributed to the fact that BP is an energy enhancer, a growth promoter,

and a potential antibiotic (Almaraz-Abarca *et al.* 2004). The nourishing and medical beneficial of BP as an antioxidant, anti-aging substance, and a supplement to improve immune function and growth in animals have been widely appreciated (Almaraz-Abarca *et al.* 2004 and Batta and El-Kholy 2014).

An earlier study proposed that supplementation BP at 1.5% of diet improved the organizational structure of the digestive tract of layer hens, thus enhancing digestion and absorption (Wang *et al.* 2006). Broiler diets supplemented with 1.5% BP promoted the early development of the intestine, enhanced the immune function, and promoted the development of the liver, pancreas, and small intestine which reflected in an enhanced animal performance. (Song *et al.* 2005).

It is important to point out that, the use of BB as an additive for rams or other species has not been reported. However, Rimpler (2003) hypothesized that BP was insufficiently digested and that cracking would improve the digestibility and bioavailability. Taking this hypothesis in consideration, in this investigation it may plausibly explain the superiority of artificial BB compared to both DPP and BP in increasing live body weight in the present research. Lactic acid fermentation of DPP by *Lactobacillus bulgaricus* and *Streptococcus thermophiles* which in the presence of honey produce lactic acid consequently it digests the pollen walls and release all component of the pollens. The rendered end product (BB) is more digestible and enriched with new nutrients. It is interesting to point out

that bees used BB alone to feed its larvae. Supplementary researches showed that BP improved the small intestine absorption areas, promoted the development of lymphoid tissue, and enhanced the digestion and immune function of piglets (Wang *et al.* 2004).

Also, the improvement of intestinal mucosa morphology in rabbits supplemented by BP may be partially responsible for the higher growth rate. However, pollen feeding in mammals increased the intestinal absorptive capacity through the longer and thicker villi (Wang *et al.*, 2007).

However, as this a pilot study dealing with the application of DPP and BP on sheep for the first time and the pioneer usage of artificial BB on either farm animals or poultry, additional studies should be conducted to precisely determinate the proper application, the level of the treatments, the proper animal age, the effects of the treatments on both sexes, the effects of treatments at maturity and its consequences on the progeny, the op-

timal supplementation level of the treatment etc. The lower dose may be insufficient, and over dose can exhibit adversative effects. Future researches are needed to clarify the effects of treatment with DPP, BP and BB or its polysaccharides on the organizational structure of the digestive tract of rams.

3-Total feed intake:

The mean values and standard error of the DPP, BP and BB on total feed intake in kg/day are presented in Table 3. While, Table 4 shows the effects of supplementation with DPP, BP and BB on daily feed intake.

During the experimental period, mean values of total feed intake increased significantly ($P<0.05$) in the 2nd and 3rd months than the 1st month. Total feed intake increased significantly ($P<0.05$) in the three groups of rams (DPP, BP, and BB) than the control group. Nonsignificant differences between the three DPP, BP, and BB supplemented groups as shown in Table (3).

Table 3. Total feed intake of rams supplemented with DPP, BP and BB.

Treatments	Month			Mean
	1	2	3	
C	0.99±0.02	1.1±0.02	0.89±0.02	0.99 ^D ±0.04
DPP	1.05±0.01	1.34±0.01	1.38±0.02	1.26 ^B ±0.04
BP	1.09±0.04	1.23±0.10	1.16±0.06	1.16 ^C ±0.06
BB	1.19±0.02	1.36±0.02	1.44±0.01	1.33 ^A ±0.04
Mean	1.08 ^c ±0.03	1.26 ^a ±0.04	1.21 ^b ±0.06	
L.S.D. _{.0.05}	0.09			L.S.D. _{.0.05} 0.11

^{a,b,c} Means in row with no common superscript differ significantly ($P<0.05$).

^{ABC} Means in column with no common superscript differ significantly ($P<0.05$).

Table 4. Daily feed intake (DFI), growth performance and feed conversion (FCR) of rams supplemented with DPP, BP and BB

ITEM	Growth Promoter			
	CONTROL	DPP	BP	BB
Total feed intake Kg/day	1.11 ^c ±0.05	1.32 ^b ±0.04	1.27 ^c ±0.05	1.38 ^a ±0.06
Growth performance:				
Initial body weight, Kg	35±1.5	36.24±2.01	35.74±1.15	35.68±1.22
Final body weight, Kg	44.38 ^c ±1.91	52.75 ^b ±2.04	53.13 ^b ±2.19	58.38 ^A ±0.66
Daily gain, g/day	103.11 ^b ±9.93	182.33 ^a ±7.39	179.84 ^a ±17.85	259.11 ^c ±15.36
FCR Kg feed/Kg gain	10.65 ^a ±0.82	7.20 ^b ±0.30	6.57 ^b ±0.49	5.47 ^c ±0.16

^{a,b,c,d} Means in row with no common superscript differ significantly (P< 0.05).

These results are in coinciding with those of Da Silva *et al.* (2014) who reported that the rams fed diets with crude propolis had higher feed intake than those fed diets containing monensin sodium. Also, Tuner *et al.* (2006) concluded that BP supplementation may help the horse to meet those needs through increased feed intake, and thereby increased nutrient retention.

In this context, BP is reported to evoke an increase in feed intake, Haščik *et al.* (2012) reported that bee-pollen increased feed intake of broiler chickens in comparison to the control group. Furthermore, Kazem *et al.* (2016) indicated that the highest body weight, average daily gain, average daily feed intake, carcass weight, and carcass yield were observed in broilers offered 800 mg kg⁻¹ of bee glue. In this approach, Hosseini *et al.* (2016) estimated that dietary BP and BG (bee glue) improved average daily gain and average daily feed intake of broilers particularly during the starter period. Similar conclusion was reported by Sakine *et al.* (2016) in mixed-sex Japanese

quail. In 2015 Valero *et al.* stated that feed intake was higher (P<0.05) for bulls fed on control (9.17 kg/day) and propolis (9.31 kg/day) diets than bulls fed on monensin.

Contrasting to this results Valero *et al.* (2014) found that the addition of propolis and essential oils in the diets of bulls finished in feedlot improve animal performance and carcass weight but the feed intake was unaffected by the additives addition. In rabbits, Attia *et al.* (2011a and 2015) demonstrated that feed intake linearly decreased with increasing bee pollen level up to 200 mg (p < 0.01). Further increase in bee pollen (300 mg/kg) significantly increased feed intake compared to 100 and 200 mg. The decrease of feed intake in rabbit fed bee pollen could be explained by the increase in nutrient supply: in fact, nutrients such as minerals and water-soluble vitamins could accelerate nutrients metabolism and increase energy digestibility this, negatively affects feed intake (Attia *et al.*, 2011a). While, Battaa and El-Kholy (2014) showed that treated growing male rabbits with

bee pollen (BP) caused to decrease in feed intake and improved in feed conversion compared with untreated during experimental period.

1- Feed conversion:

The mean values and standard error of the effects of control, DPP, BP and BB on feed conversion rate are presented in Table 5. The three experimental groups that received DPP, BP and BB had significantly ($P < 0.05$) improved lower FCR in

comparison with the control group. Meanwhile, the rams group that received BB showed significantly ($P < 0.05$) lower FCR than DPP and BP groups as shown in Table 5. Nonsignificant differences in FCR had been observed between DPP and BP treated groups. Similarly, insignificant differences in FCR had been detected between the three months of the experimental period (Table 5).

Table 5. feed conversion rate of rams supplemented with DPP, BP and BB.

Treatments	Month			Mean
	1	2	3	
C	16.74±2.09	16.48±4.92	15.116±4.44	10.65 ^A ±0.82
DPP	10.31±2.027	8.85±1.90	12.418±1.72	7.20 ^B ± 0.30
PB	11.19±3.32	11.83±3.76	6.09± 0.98	6.57 ^B ±0.49
BB	7.43±1.62	7.57±0.61	8.206±1.01	5.47 ^C ±0.16
Mean	7.52±0.53	7.43±0.61	7.46±0.71	
L.S.D _{0.05}	1.32			L.S.D _{0.05} 1.53

^{ABC} Means in column with no common superscript differ significantly.

Improving the FCR by treating with phytogetic growth regulators have been reported by several investigators, Zawadzki *et al.* (2011) studied the performance of feedlot-finished bulls, and reported that the addition of propolis extract to the diet increased weight gain and improved feed conversion. In rabbits, Attia *et al.* (2011a, 2011b and 2014a) stated that bee pollen at 200 mg/kg reduced feed conversion ratio of offspring up to 12 weeks of age. Growth and FCR of kits from the treated does during 4–8 weeks of age were significantly better than growth of kits from control. Bee pollen if in combination with propolis, could be used as a supplement in the growing rabbits with positive effects on growth rate and FCR. Batta and El-Kholy (2014)

showed that treated growing male rabbits with bee pollen (BP) caused to increase significantly in final body weight and weight gain and to decrease in feed intake and improved in FCR compared with the control.

Similar results were observed by El-Hanoun *et al.* (2007) who found that feed efficiency was improved of growing NZW rabbits supplemented with 250 and 500 mg BP per kg BW compared to the control group during winter and summer seasons from weaning till mature age. Wang and Cheng (2005) evaluated the inclusion of BP (1, 2, 3, 4 and 5%) in diets for growing and finishing pigs and reported that the 4 and 5% levels improved the FCR of the animals. In this regard Shewika (2009) and Attia, *et al.* (2014b) re-

ported that BP improved growth and FCR of rabbits. These improvements in FCR and lower feed intake may be attributed to BP in decreasing count of pathogenic bacteria and increasing digestion of all nutrients.

The enhancement in growth performance resulted from the addition of BP could be due to the better absorption of amino acids or/and due to antibacterial properties and enzymes or coenzymes of BP. Also, the improvement of digestive enzyme activity and intestinal mucosa morphology in rabbits supplemented by BP may be partially responsible for the higher growth rate obtained in the present study.

It appears from the present study that the addition of growth promoters (DPP, BP and BB) had improved life body weight, daily weight gain, feed intake and feed conversation. However, the treatment with BB was more effective than other treatments.

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تأثير حبوب لقاح النخيل وكتل حبوب اللقاح المجمعة بواسطة النحل كمحفز للنمو على أداء الحملان
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الملخص

اجريت التجربة في مزرعة بحوث قسم الإنتاج الحيواني، كلية الزراعة، جامعة أسيوط. الغرض من هذه التجربة هو تقدير كلاً من الأداء الإنتاجي في ذكور الاغنام كاستجابة للمعاملة بثلاث مُحفزات نمو نباتية وهي: حبوب لقاح النخيل (DPP)، كتل حبوب اللقاح التي يكونها نحل العسل (BP)، وخبز النحل الذي تم تصنيعه معملياً من حبوب لقاح النخيل (BB). استخدم في هذه الدراسة 20 من ذكور الاغنام. تم تقسيم الحيوانات عشوائياً إلى 4 مجموعات. تم تغذية مجاميع التجربة اثناء الدراسة على عليقة خشنة ومركزة حتى الشبع. التجربة استمرت 3 شهور. تم تجريع الكباش في المجموعات الأربع ثلاثة مرات أسبوعياً ولمدة ثلاثة أشهر كالاتي: المجموعة الأولى الضابطة (الكنترول) تم تجريعها بماء الصنبور. المجموعة الثانية وتم تجريعها ٣٠ جرام حبوب لقاح النخيل (DPP) في صورة معلق مائي. المجموعة الثالثة وتم تجريعها ٣٠ جرام كتل حبوب اللقاح التي يكونها نحل العسل (BP) في صورة معلق مائي. المجموعة الرابعة وتم تجريعها ٣٠ جرام من خبز النحل (BB) في صورة معلق مائي. وكان متوسط وزن الحيوانات في بداية التجربة (٣٥، ٣٦، ٢٤، ٣٦، ٧٤ و ٣٥، ٦٨) للمجموعات الأربعة على الترتيب.

تم وزن الحيوانات في بداية التجربة في الصباح وقبل تناول العليقة وبعد ذلك كل اسبوعين لتقدير وزن الجسم. تم تقدير كمية استهلاك العليقة الخشنة والمركزة والكلية. وتم حساب معدل النمو اليومي وكفاءة التحول الغذائي. كان متوسط الوزن في نهاية التجربة ٤٤، ٣٧، ٥٢، ٧٥، ٥٣، ١٣ و ٥٨، ٣٨ للمجموعات الأربعة على الترتيب. وقد أظهرت الدراسة النتائج الآتية:

زاد متوسط وزن الجسم ومعدل النمو اليومي واستهلاك العليقة في ذكور الاغنام المعاملة بمحفزات النمو (DPP, BP and BB) معنوياً ($P < 0.05$) مقارنة بالكنترول مع تفوق المجموعة المعاملة بخبز النحل (BB) معنوياً ($P < 0.05$) مقارنة بالمعاملتين (DPP and BP) على التوالي.

ومن ناحية أخرى أنخفض معدل التحويل الغذائي في المجموعات المعاملة معنوياً ($P < 0.05$) عن الكنترول وكانت المجموعة المعاملة بخبز النحل (BB) أفضل (أكثر انخفاضاً) من المجموعات الأخرى.