Archives of Agriculture Sciences Journal
Print ISSN: 2535-1680
Online ISSN: 2535-1699

ARCHIVES OF AGRICULTURE SCIENCES JOURNAL

Volume 7, Issue 3, 2024, Pages 1–9

Available online at https://aasj.journals.ekb.eg

DOI: https://dx.doi.org/10.21608/aasj.2024.393199

Effect of date palm pollen as growth promoters on the performance of Ossimi lambs

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Abstract

This study was conducted to investigate the effects of adding different levels of date palm pollen (DPP) to the diets of Ossimi lambs on growth performance, nutrient digestibility, nutritional values, feed conversion ratio, and blood parameters. Twelve Ossimi male lambs aged 5–6 months with an average body weight of 24.00 kg ± 0.5 were allocated into three treatment groups of four. All lambs were fed on a basal diet consisting of a concentrate mixture and wheat straw at 2 and 1% of live body weight, respectively. Lambs in the first group were fed the basal diet without additives (control). While those in the second and third groups were fed the basal diet supplemented with doses of 15 or 30 g DPP/head per week, respectively. Blood samples were collected monthly over the three-month experimental period. At the end of the trial, a digestion experiment was conducted to estimate the digestibility coefficients and nutritional values of all treatments. The results indicated significant differences in total dry matter intake, daily growth rate, and total weight yield in favor of the third treatment followed by the second treatment compared to the control group, while the lowest cost/kg of growth was for the control group (63.0 L. E/kg growth), while it was 84.26 and 99.05 L. E/kg growth for the second and third groups, respectively. As for blood constituents, there were no significant differences between the groups for TP, AL, GL, A/G ratio, and cholesterol, while differences were significant in favor of the third treatment followed by the second compared to the control in the liver enzyme levels (ALT and AST), with no significant differences detected between the DPP-supplemented groups. The digestion trial showed significant differences in the digestion coefficients of OM, CP, and CF in favor of the second and third treatments compared to the control, with no significant differences found between the DPPG-supplemented groups. However, significant differences were observed between all three groups for DM, EE, and NFE in favor of the third group. These findings suggest that while DPP can enhance growth performance and nutrient utilization in lambs, its use may need to be evaluated against economic returns for practical applications.

Keywords: date palm pollen, growth promoters, Ossimi lambs, growth performance, nutrient digestibility.

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1. Introduction

Plant-based natural extracts have gained popularity due to their high effectiveness in supporting many biological processes, resulting from the protective properties of the plants to improve performances in livestock. In recent years, date palm pollen (DPP) has been categorized as an herbal remedy that contains high levels of antioxidants. It is the second highest of plant extractions that possess antioxidants (Bishr and Desoukey, 2012). DPP is a natural product produced from male date palm flowers and consists of 36% crude protein, 8.81% crude fiber, 11.80% crude fat, 9.26% ash, and 17.11% carbohydrate. Moreover, the mineral contents of Ca, K, Mg, Fe, Zn, and Mn are 530, 760, 310, 225, 125, and 310 mg/100 g, respectively (Saleh *et al*., 2021). Date palm (*Phoenix dactylifera* L.) belongs to the Aceraceae family, is widely cultivated in Egypt. The male reproductive cells of palm flowers are commonly used in the Middle East; the ancient Chinese and Egyptians used DPP as a medicinal agent. It is considered an effective natural and functional dietary food supplement due to its remarkable contents of protein, vitamins, minerals, trace elements, carbohydrates, lipids, organic acids, sterols, nucleic acids, enzymes, and cofactors. Besides bioactive volatile unsaturated fatty acids and phenolic components, such as flavonoids and phenolic acids, play a crucial role as strong antioxidants and anti-breast-cancer agents (El-Kholy *et al*., 2019). Approximately one thousand tons of DPP are produced every year by millions of palm trees grown in the Arabian region (El-Neweshy *et al*., 2013). The objectives of this study were to investigate the effects of supplementing Ossimi lamb's diets with different levels of DPP on growth performance, nutrient digestibility, nutritional values, feed conversion ratio, and some blood constituents.

2. Materials and methods

2.1 Animals, diets, and experimental design

Twelve male Ossimi lambs aged 5 to 6 months with an average body weight of 24.00 kg ± 0.5 were randomly assigned into three dietary treatment groups of 4 animals each. All experimental lambs were fed a basal ration consisting of concentrate feed mixture (CFM) and wheat straw (WS) at levels of 2 and 1% of live body weight, respectively. The diets were formulated to satisfy the nutrient requirements of rams according to the recommendations of the NRC (1985). Lambs in the first group were fed on the basal diet without additives (control group). Meanwhile, animals in the second and third treatment groups were fed the basal diet supplemented with 15 or 30 g /head/week of DPPG, respectively. The chemical composition analysis of CFM and WS and chemical analysis for palm pollen are presented in Tables (1 and 2), respectively.

2.2 Growth performance

The initial and final live body weights of lambs were taken before morning feeding and drinking. The weight gain was calculated as the difference between the

initial and final body weight. Feed conversion was calculated and expressed as kgs of dry matter (DM), total digestible nutrients (TDN), and digestible crude protein (DCP) per kg/kg body weight gain.

Table (1): Chemical composition of feedstuffs.

Item	DM	OM	CP	CF	EE	ASH	NFE
C.F.M	89.71	93.60	14.20	9.13	3.32	6.40	66.95
W. S	88.20	87.49	2.31	33.61	1.40	12.5	50.17
Control ration (calculated)	88.95	90.54	8.26	21.37	2.36	9.45	58.56

C.F.M: Concentrated feed mixture. W.S: Wheat Straw DM: dry matter OM: Organic matter CP: Crude protein CF: Crude fiber EE: Ether extract. NFE: Nitrogen free extract.

Table (2): Chemical analysis of date palm pollen.

Proximate chemical composition (g/100 g fresh weight)		Fatty acid composition (%)	
Moisture (%)	28.8	Capric acid (C10:0)	0.46
Ash (%)	4.57	Lauric acid (C12:0)	4.82
Crude fiber (%)	1.37	Myristic acid (C14:0)	13.33
Crude fat (%)	20.74	Palmitic acid (C16:0)	34.45
Crude protein (%)	31.11	Stearic acid (C18:0)	2.04
Carbohydrate (%)	13.41	Arachidic acid (C20:0)	7.32
Vitamin composition		Total SFA	62.42
A (IU/100g)	7708.33	Palmitoleic acid (C16:1n-7)	7.07
E (IU/100g)	3030.92	Oleic acid (C18:1n-9)	7.19
C (mg/100g)	89.09	Total MUFA	14.26
Mineral composition (g/100 g dry weight)		Linoleic acid (C18:2)	14.24
Boron (B)	309.4	-Linolenic acid (C18:3n-3)	0.79
Zinc (Zn)	281.0	-Linolenic acid (C18:3n-6)	1.27
Selenium (Se)	305.0	Arachidonic acid (C20:4n-6)	4.57
Iron (Fe)	241.0	Eicosapentaenoic acid (C20:5n-3)	0.52
Molybdenum (Mo)	302.2	Total PUFA	21.39
Copper (Cu)	319.6	Unidentified peak a	0.24
Manganese (Mn)	284.0	Unidentified peak b	0.25
Cobalt (Co)	305.4	Unidentified peak c	1.44
Nickel (Ni)	302.4	Total unidentified peaks	1.93

2.3 Digestion trail

At the end of the feeding experiment, three animals from each treatment group were selected for a digestion trial. During the three-day collection period of the trail, feces were collected directly from the rectum before feeding and drinking. Feces were stored at 40°C, and an approximate chemical analysis of the feed and feces was performed according to AOAC (2005). The apparent digestibility coefficients of nutrients and feeding values were calculated according to the method described by Yukio and Takahashi (1981).

2.4 Blood sampling and biochemical analysis

At the end of the experimental period, fasting blood samples were withdrawn from the jugular vein without

anticoagulant. Blood samples were centrifuged at 4000 rpm for 15 minutes. Subsequently, the separated serum was kept in a clean, dry glass vial and stored at -20 °C until analysis. Commercial kits (Diamond Diagnostics Co., Egypt) were used to determine total serum protein and glucose according to Armstrong and Carr (1964); serum albumin was determined according to Doumas *et al*. (1971). Serum globulin was obtained as the difference between the total protein and albumin concentration, and the Al/Gl ratio was the output of dividing the albumin value by its corresponding globulin value. Serum GOT (AST) and GPT (ALT) were determined according to Reitman and Frankel (1957). Serum cholesterol was obtained according to Watson (1960).

2.5 Statistical analysis

The data were statistically analyzed using the general linear model (GLM) procedure of SAS (2004) program, version 8.2. Differences among groups for feed intake, daily gain, feed conversion, blood parameters and nutrient digestibility were evaluated by one-way ANOVA. The significant differences between treatments means were tested by Duncan Multiple Range Test Snedecor and Cochran (1980).

3. Results and Discussion

3.1 Apparent digestibility coefficients and nutritional values

The results in Table (3) indicate that lambs in the second and third treatment groups, supplemented with DPP, exhibited significantly higher apparent digestibility coefficients. Notable improvements were observed in OM, CP, and CF digestibility in the DPP-supplemented groups compared to the control group, which showed the lowest digestibility values. Although no significant differences were observed between the two DPP-supplemented groups, lambs receiving 30 g of DPP had the highest DM and NFE digestibility coefficients, followed by the 15 g DPP group.

Table (3): Effect of palm pollen feeding on digestibility coefficients of Ossimi lambs.

Digestion coefficients (%)	Treatments			Sig.
	Control	T1	T2	
Dry matter	52.30±0.27^{c}	55.60±0.16^{b}	56.80±0.35^{a}	<.0001
Organic matter	55.00±0.15^{b}	58.50±0.36^{a}	58.50±0.36^{a}	<.0001
Crude protein	58.20±0.45^{b}	60.50±0.20^{a}	61.13±0.22^{a}	0.0002
Crude fiber	67.51±0.38^{b}	70.20±0.44^{a}	71.00±0.74^{a}	0.0035
Ether Extract	65.40±0.29^{c}	68.90±0.73^{a}	67.10±0.19^{b}	0.0016
Nitrogen free extract	52.80±0.31^{c}	54.20±0.40^{b}	55.40±0.29^{a}	0.0014

$^{a, b \text{ and } c}$ Means within the same row with different superscripts differ($P<0.05$) and ($P<0.01$). Control = CFM + WS, (T1) = CFM + WS+ 15 g DPP / h / w, (T2) = CFM + WS + 30g DPP/ h /w.

These findings are consistent with Raghda (2017), who attributed enhanced crude protein digestibility to the antibacterial and antioxidant properties of flavonoids in date palm pollen. Improvements in body weight and weight gain may also be linked to a healthier gut environment, facilitating nutrient absorption and utilization. Similarly, Tu *et al*. (2015) demonstrated that supplementing pre-ruminant calves with bee pollen or bee pollen polysaccharides improved nutrient digestibility.

3.2 Blood biochemical variables

The results shown in Table (4) revealed that supplementing lamb diets with DPP at 15 or 30 g/head/week had no effect on the serum concentrations of total protein, albumin, globulin, and cholesterol. However, ALT levels were significantly reduced in lambs in the second and third treatment groups compared to the control group, with values of 12.43, 12.70, and 14.04 IU/L, respectively. Similarly, AST showed a significant reduction in the second and third treatments compared to the control, with values of 10.56, 9.99, and 12.42 IU/L, respectively. These results were consistent with the findings of Raghda (2017), who found that supplementing diets with DPP and bee bread significantly ($P < 0.05$) increased the serum concentration of total albumin and glucose over three months of the experimental period compared to the control. However, the dietary supplementation of DPP, bee pollen or bee bread significantly reduced the serum concentrations of cholesterol, AST, and ALT relative to the control. There was no significant difference in globulin concentration across dietary treatments.

Table (4): Effect of palm pollen feeding on some blood parameters of Ossimi lambs.

Items	Experimental treatments			*p*-value
	Control	T1	T2	
T protein (g/dl)	7.31±0.04	7.36±0.02	7.37±0.03	0.4480
Albumin (g/dl)	3.44±0.06	3.42±0.05	3.44±0.03	0.9628
Globulin (g/dl)	3.87±0.05	3.96±0.05	3.93±0.05	0.5137
A /G ratio	0.89±0.03	0.87±0.02	0.87±0.02	0.7062
Glucose (mg/dl)	57.28±1.69^{b}	60.93±1.58^{ab}	65.21±1.21^{a}	0.0276
Cholesterol (mg/dl)	109.18±4.10	114.91±1.95	118.94±2.84	0.1609
ALT (IU/L)	14.04±0.49^{a}	12.43±0.41^{b}	12.70±0.10^{b}	0.0449
AST (IU/L)	12.42±0.39^{a}	10.56±0.11^{b}	9.99±0.07^{b}	0.0009

$^{a, b, and\ c}$ Means within the same row with different superscripts differ(P<0.05) and (P<0.01). Control = CFM + WS, (T1) = CFM + WS+ 15 g DPP / h / w, (T2) = CFM + WS + 30g DPP/ h /w.

3.3 Growth performance and economic efficiency

Data in Table (5) shows that palm pollen significantly affected total weight gains with values of 13.25, 12.02 and 10.42 kg for the third, second, and control groups, respectively. The dietary treatments with DPP increased the average daily weight gain compared to the control group

(147.22g, 133.61g, and 115.83g) for T2, T1 and the control group, respectively. Additionally, lamb fed diets supplemented with 15 g DPP/head/week had the highest total dry matter intake (TDMI), total digestible nutrient intake (TDNI), and digestible crude protein intake (DCPI), with values of 921 g, 517.33 g, and 46.42 g per head per day, respectively. This was followed by lambs on a 15 g DPP/head/week regimen (889 g, 491.97 g, and 44.36 g/h/d), compared to the control group, which had the lowest values (808 g, 433.54 g, and 38.91 g/h/d).

Table (5): Effect of date palm pollen feeding on the productive performance of Osimi lambs.

Item	Treatments		
	Control	T1	T2
Duration day	90	90	90
No. of. Lambs	4	4	4
Initial weight, kg	24.50	24.375	24.25
Final weight, kg	34.675±0.67	36.400±3.14	37.500±2.24
Total gain, kg	10.425±0.44(b)	12.025±0.65(b)	13.250±0.44(a)
Av. daily gain, g	115.83±4.91(a)	133.61±4.83(a)	147.22±5.49(a)
Daily Feed DM Intake(g/h/d)			
C.F.M	509	559	580
Roughage	300	330	341
TDMI	809	889	921
TDN Intake	433.54	491.97	517.33
DCP Intake	38.91	44.36	46.42
Feed Conversion (Kg/Kg gain)			
DM	6.98	6.65	6.26
TDN	3.74	3.68	3.51
DCP	0.34	0.33	0.32
Cost/Kg gain	63.09	84.26	99.05
Economic efficiency	2.77	2.07	1.76

[a, b, and c] Means within the same row with different superscripts differ($P<0.05$) and ($P<0.01$). Control = CFM + WS, (T1) = CFM + WS+ 15 g DPP / h / w, (T2) = CFM + WS + 30g DPP/ h /w.

The improvement in weight gain can be attributed to the fact that increased protein intake increases feed intake, digestibility and hence growth rate (Khalid *et al*., 2011). In this regard, Gebregiorgis *et al*. (2012) reported that high-energy diets resulted in 18.8% greater weight gain in lambs. The supplementation with DPP enhance BWG as this growth promoters are rich in B-complex vitamins like B6, which plays an important role in protein and amino acid metabolism; B1, which is a cofactor for certain enzymes involved in carbohydrate and fat metabolism; and pantothenic acid, which is essential for energy metabolism, as reported by Cheeke *et al*. (1987). The positive effect of DPP administration on BW and BWG may also stem from the presence of numerous nutrient factors (such as antioxidants, vitamins, mineral, essential fatty acids, amino acids, enzymes, etc.) and protective agents, including flavonoids, carotenoids, and phenolic constituents. These components enhance the nutrient value of the feed as well as its

digestibility and absorption. Also, the presence of the zinc and selenium in DPP are essential in metabolism (Baylan *et al*., 2010; El-Neney and El- Kholy, 2014). These results agree with those of Soliman *et al*. (2016). Raghda (2017) reported that treatment of rams with the three plant growth promoters DPP, BP and BB significantly improved average daily body weight gain and feed conversion ratio. Improving the FCR by treating phytogenic growth promoters have been reported by several investigators. Refaie *et al*. (2019) reported that adding palm pollen either in powder form or extract form to rooster feed improves their productive performance (weight gain) and meat quality in addition to increasing economic profit. The increase in growth performance of poultry was attributed to the effectiveness of enhancing digestive enzymes and improving intestinal absorption of nutrients Salami et al., (2015). Our study results are also consistent with Zawadzki *et al*. (2011), who 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.

5. Conclusion

In conclusion, supplementing the diets of Ossimi lambs with date palm pollen (DPP) improved daily growth rates, nutrient digestibility, and certain blood parameters, especially at higher supplementation levels. However, the economic analysis revealed that the cost per kilogram of growth increased with DPP supplementation, making this strategy less cost-effective despite the observed performance benefits. These findings suggest that while DPP can enhance growth performance and nutrient utilization in lambs, its use may need to be evaluated against economic returns for practical applications.

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